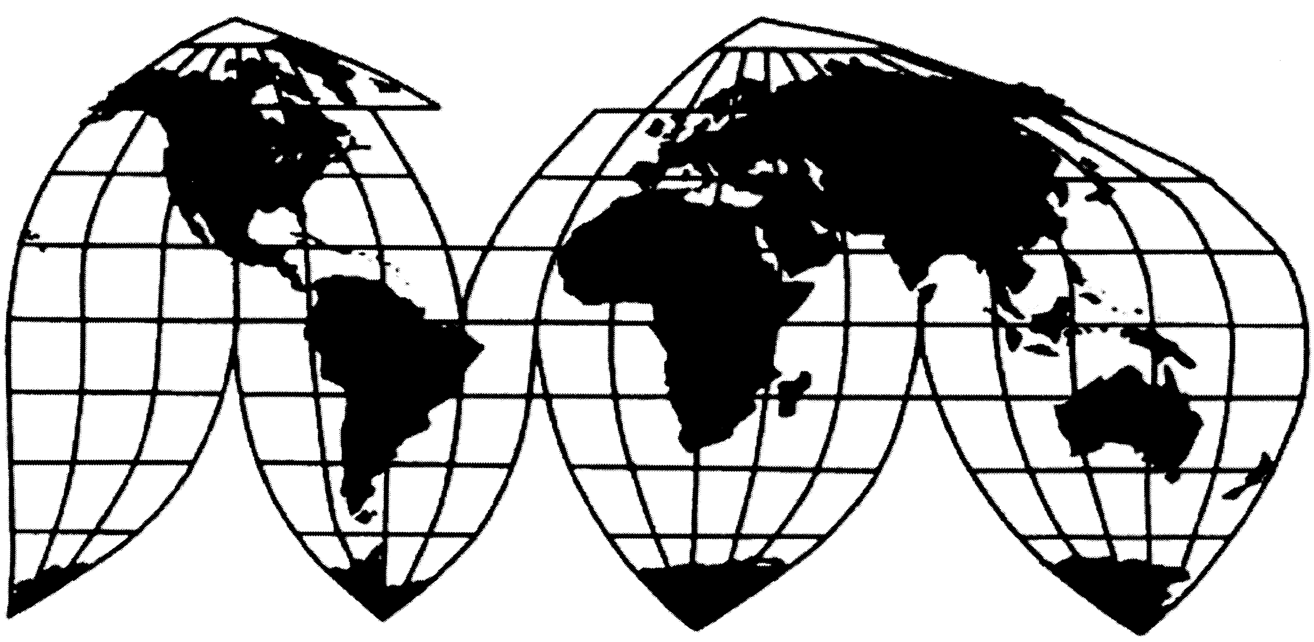
In the Matter of

Certain High-Brightness Light Emitting Diodes, and Products Containing Same

Investigation No. 337-TA-556

Publication 4011 June 2008

U.S. International Trade Commission



Washington, DC 20436

U.S. International Trade Commission

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*Commissioner Irving A. Williamson, whose term commenced on on February 7, 2007, participated in the decision to review certain portions of the Initial Determination and all subsequent phases of the investigation. Commissioner Dean A. Pinkert, whose term commenced on February 26, 2007, participated in all phases of the investigation following the decision to review certain portions of the Initial Determination. Commissioner Stephen Koplan, whose term ended on February 6, 2007, participated in the decision to institute the investigation. Commissioner Jennifer A. Hillman, whose term ended on February 23, 2007, participated in this investigation through the decision to review certain portions of the Initial Determination.

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In the Matter of

Certain High-Brightness Light Emitting Diodes, and Products Containing Same

Investigation No. 337-TA-556

Publication 4011 **June 2008**

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	))))))	**Inv. No. 337-TA-556**

ORDER

Upon consideration of the motion by Respondent Epistar Corp. for a stay of the Commission's limited exclusion order, and of the responses to this motion filed by Complainant Philips LLC and the Commission investigative attorney, the Commission hereby **ORDERS** that:

1. Respondent's Motion to Stay Enforcement of Exclusion Order Pending Appeal is denied.

2. The Secretary shall serve copies of this Order upon each party of record in this investigation.

By Order of the Commission.

William R. Bishop
Acting Secretary to the Commission

Issued: August 20, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT-EMITTING DIODES AND PRODUCTS CONTAINING SAME **337-TA-556**

CERTIFICATE OF SERVICE

I, Marilyn R. Abbott, hereby certify that the attached **ORDER** has been served by hand upon the Commission Investigative Attorney, Thomas S. Fusco, Esq., and the following parties as indicated, on August 21, 2007.

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PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	)	**Inv. No. 337-TA-556**

COMMISSION OPINION ON DENIAL OF MOTION FOR STAY

INTRODUCTION

On May 9, 2007, the Commission issued a limited exclusion order in the above-referenced section 337 investigation. The respondent subject to the Commission's order has moved for a stay of enforcement pending appeal to the U.S. Court of Appeals for the Federal Circuit.

PROCEDURAL HISTORY

The Commission instituted this investigation on December 8, 2005, based on a complaint filed by Lumileds Lighting U.S., LLC (originally "Lumileds", now "Philips") of San Jose, California on November 4, 2005. 70 *Fed. Reg.* 73026. The complaint, as amended and supplemented, alleged violations of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain high-brightness light emitting diodes ("LEDs") and products containing same by reason of infringement of claims 1 and 6 of U.S. Patent No. 5,008,718 ("the '718 patent"), claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580 ("the '580 patent"), and claims 12-16 of U.S. Patent No. 5,502,316 ("the '316 patent"). The Commission's notice of investigation named Epistar Corporation ("Epistar") of Hsinchu, Taiwan, and United Epitaxy Company ("UEC") of Hsinchu, Taiwan as respondents. The two respondents merged on December 30, 2005, shortly after institution of the investigation. Epistar is the surviving entity.

On May 15, 2006, the Commission published notice of its determination not to review an initial determination ("ID") (Order No. 14) from the presiding administrative law judge ("ALJ") granting Lumileds' motion for partial summary determination and dismissing Epistar's affirmative defense that the '718 patent claims are invalid. On November 13, 2006, the Commission published notice of its determination not to review an ID (Order No. 29) from the ALJ granting Lumileds' motion to amend the complaint to: 1) remove UEC as a named respondent, 2) change the complainant's full name from Lumileds Lighting U.S., LLC to Philips Lumileds Lighting Company LLC, and 3) identify additional Epistar LEDs (the MB II, GB I, GB II, OMA I, and OMA II products) alleged to infringe one or more patents-in-suit. 71 *Fed. Reg.* 66195.

On January 8, 2007, the ALJ issued his final ID, finding a violation of section 337 with respect to the '718 patent by certain of respondent's accused products (MB family of LEDs), but no violation with respect to the '316 and '580 patents as to any of respondent's products. On February 22, 2007, the Commission determined to review certain issues in the ID regarding claim construction of the asserted patents. 72 *Fed. Reg.* 9355-6 (Mar. 1, 2007). The Commission issued its determination on review on May 9, 2007, which reversed-in-part and modified-in-part the ALJ's final ID by modifying the construction of the claim limitations "substrate" and "semiconductor substrate", as well as other claim constructions, and finding infringement and thus a violation of section 337, with respect to the '718 patent for all of Epistar's accused LEDs. 72 *Fed. Reg.* 38101-2 (July 12, 2007). Accordingly, the Commission issued a limited exclusion order prohibiting the unlicensed entry of LEDs covered by claims 1 or 6 of the '718 patent, packaged LEDs including the infringing LEDs, and boards consisting primarily of an array of packaged, infringing LEDs, that are manufactured abroad or imported by or on behalf of respondent Epistar. The Commission's order does not cover any other downstream products.

The limited exclusion order became final on July 9, 2007, on the next business day after the 60-day period of presidential review expired without disapproval of the order. *See* 19 U.S.C. § 1337(j). On July 13, 2007, Epistar filed a motion with the Commission for stay of enforcement of the Commission's exclusion order pending appeal to the Federal Circuit. On the same day, Epistar filed a notice of appeal with the Federal Circuit and an expedited motion to stay the exclusion order pending appeal. On July 16, 2007, the court issued an order granting a temporary stay of the exclusion order pending its consideration of the motion papers. On July 23, 2007, Philips filed a motion to intervene at the Federal Circuit and a response in opposition to Epistar's motion. It also filed a response to the motion pending before the Commission.

On July 31, 2007, Epistar filed replies both at the Federal Circuit and the Commission. Epistar, however, failed to file a motion for leave to file a reply with the Commission, and its reply has been disregarded by the Commission.

RELEVANT PRIOR LITIGATION AND MERGER

From September 1999 through September 2001, Philips asserted the '718 patent against UEC in litigation before a federal district court. *See United Epitaxy Co., Ltd. v. Hewlett-Packard Co., Agilent Technologies, Inc., and Lumileds Lighting U.S., LLC*, No. C 00-2518 CW (PVT) (N.D. Cal. filed September 7, 1999). Specifically, Philips asserted the '718 patent against Epistar's absorbing-substrate LEDs (a type of LED having a substrate that absorbs some of the light emitted by the active layers). On August 30, 2001, Philips and UEC settled the litigation by negotiating and executing a [

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[

].

In addition, from January 2003 through July 2004, Philips asserted the '718 patent against Epistar in federal district court. *See Lumileds Lighting U.S., LLC v. Epistar Corp.*, No. C 02-5077 CW (PVT) (N.D. Cal.). In this litigation, Philips also specifically asserted the '718 patent against Epistar's absorbing-substrate LEDs. On approximately July 12, 2004, Philips and Epistar settled the litigation by negotiating and executing [

].

On December 30, 2005, UEC and Epistar completed a merger of the two companies. As part of the merger agreement, Epistar, as the surviving company, assumed "all assets, debts, rights, and obligations" previously held by UEC as of the date of the merger where these rights and obligations include those relating to patents and contracts, as well as UEC's status as a party to this investigation. *See* Exh. 3 of Complainant's Motion for Partial Summary Determination to Dismiss Epistar's Affirmative Defense that the '718 Patent Claims are Invalid.

[

] the ALJ granted Philips' motion for partial summary determination to dismiss Epistar's Affirmative Defense that the '718 patent claims are invalid. *See* Order No. 14. He later granted complainant's motion to amend the complaint to add additional allegations of infringement by Epistar. *See* Order 29.

DISCUSSION

Respondent Epistar's Motion for Stay

A. Legal Standard for Determining Whether to Stay an Order Pending Appeal

The Commission has previously held that section 705 of the Administrative Procedure Act ("APA") (5 U.S.C. § 705) provides the requisite authority to stay the effective date of its orders. *Certain Agricultural Tractors Under 50 Power Take-Off Horsepower* ("*Tractors*"), Inv. No. 337-TA-380, Comm'n Opinion at 9-10 (Apr. 24, 1997). In determining whether to grant a motion for stay under section 705 of the APA, the Commission has applied the four-prong test used by courts to determine whether to grant a preliminary injunction. *Id.*; *Certain EPROM, EEPROM, Flash Memory, and Flash Microcontroller Semiconductor Devices and Products Containing Same* ("*EPROMs*"), Inv. No. 337-TA-395, Comm'n Opinion at 88-90, USITC Pub. No. 3392 (February 2001); *see Cuomo v. U.S. Nuclear Regulatory Comm'n*, 772 F.2d 972 (D.C. Cir. 1985); *Washington Metro. Area Transit Comm'n v. Holiday Tours, Inc.*, 559 F.2d 841 (D.C. Cir 1977); *Virginia Petrol. Jobbers Ass'n v. FPC*, 259 F.2d 921 (D.C. Cir. 1958).

The four-prong test is also applied by the Federal Circuit in considering whether to issue a stay pending appeal and requires that the movant demonstrate: (1) a likelihood of success on the merits of the appeal; (2) irreparable harm to the movant absent a stay; (3) that issuance of a stay would not substantially harm other parties; and (4) that the public interest favors a stay. *See Standard Havens Prods. Inc. v. Gencor Indus. Inc.*, 897 F.2d 511, 512 (Fed. Cir. 1990); *Holiday Tours*, 559 F.2d at 843. However, the Commission need not conclude that its own determination is likely to be overturned on appeal, but may find the first prong satisfied if the Commission has ruled on "an admittedly difficult legal question." *Tractors* at 10; *citing Holiday Tours*, 559 F.2d at 844-45.

We address each of the four stay factors below.

B. Likelihood of Success on the Merits

We determine that Epistar has not made a showing of likelihood of success on the merits on the issues it raises, nor has it demonstrated "an admittedly difficult legal question."

Epistar contends that the Commission erroneously precluded respondent, based on the Epistar-UEC merger agreement, from contesting the validity of the '718 patent with respect to the "Epistar products" (*e.g.*, MB II, GB II, and OMA family of LEDs) when it denied Epistar's petition for review of Order No. 14. Epistar br. at 4-6, 9-13. Particularly, Epistar contends that the ALJ erred in Order No. 14 by barring Epistar from asserting that the '718 patent was invalid in litigation against all Epistar products, rather than only against the "UEC products" (*e.g.*, MB I, GB I) now made by Epistar. Epistar contends that in declining to review the ID the Commission [

]. *Id.* Also, Epistar cites to ambiguous statements from the presiding ALJ to support its contention that the ALJ recognized he had made an "error" or "mistake" in Order No. 14. *Id.* at 5-6, *see* Pretrial Hearing transcript at 60-63.

Epistar's argument concerning whether it was improperly prevented from raising invalidity against the '718 patent was considered and ruled on by the Commission. *See* Commission Notice to Not Review Order No. 14. Thus, regardless of whether the ALJ fully considered the Epistar license in making his ruling, the Commission fully considered the arguments Epistar raised in its petition for review of Order No. 14 when it determined not to review the ALJ's ID.

Further, as correctly noted by Philips, the cases cited by Epistar to support its argument that the Commission erroneously prevented respondent from asserting invalidity are clearly distinguishable based on the particular facts of this investigation. The cases cited by Epistar relate to a licensee attempting to enforce a license agreement as to different patents owned by a third-party who happens to later acquire the licensor's patents. *See, e.g., Medtronic AVE, Inc. v. Advanced Cardiovascular Sys.*, 247 F.3d 44 (3rd Cir. 2001); *Spindelfabrik Suessen-Schurr, Stachlecker & Grill GmbH v. Schubert & Salzer Maschinenfabrik Aktiengesellschaft*, 829 F.2d 1075 (Fed. Cir. 1987); *ZapatA Indus., Inc. v. W.R. Grace & Co.-Conn.*, 51 U.S.P.Q.2d 1619 (S.D. Fla. Feb. 4, 1999). However, in contrast, this investigation concerns a successor-in-interest to a licensee that is attempting to avoid a license agreement as to the same patent owned by the same licensor. As the facts are wholly distinguishable in this investigation, the case law cited by Epistar provides no guidance.

Also, Epistar relies on quotes from the ALJ that are presented out of order and without context in an attempt to convey a meaning that is in contrast with that actually expressed by the ALJ. Epistar br. at 5-6; *see* Pretrial Hearing transcript at 60-63. Despite Epistar's suggestion otherwise, the ALJ did not indicate that he had made a mistake during the prehearing conference, but instead generally criticized Epistar for not clearly referencing the Epistar-Philips agreement in its briefing and not objecting to Philips' motion to amend the complaint to add more of Epistar's products to the investigation. *See* Pretrial Hearing Transcript at 57-63. Moreover, Epistar did not mention what it now refers to as an "obviously and profoundly erroneous" determination in its post-hearing brief or petition for review even though the ALJ expressly allowed respondent to do so. *Id.* at 67; *see* Epistar br. at 9, Epistar Post-Hearing br., Epistar Petition for Review. Epistar fails to explain why it waited until after the hearing, the issuance of the final ID, and expiration of the 60-day period of Presidential review to file this motion. We reject Epistar's attempt to have us stay the exclusion order with tardy arguments made in circumvention of the Commission's rules, in particular 19 CFR §§ 210.46, 210.47 requiring that arguments be timely raised.

In addition, the claim construction arguments raised by Epistar in its motion for stay have been repeatedly considered and ruled on by the Commission. *See* Order No. 27 at 26-29, ID at 39-40; Comm'n Op. at 8-12. Particularly, the ALJ stated the following regarding Epistar's argument to exclude ITO from the "transparent window layer" construction:

> Nor does the specification expressly disavow the use of ITO. Though a patentee may narrow the meaning of a claim term by disavowing claim scope during the prosecution of a patent, that

> disavowal must be unequivocal [*(citing to Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1324 (Fed. Cir. 2003)]. Here, references in the specification to ITO discuss drawbacks to the use of ITO as a front contact, not as a transparent window layer. Thus, the [ALJ] finds that the inventors of the '718 patent have not made a clear disavowal in the specification of the use of ITO as a transparent window layer.

Order No. 27 at 26-29.

> The [ALJ] confirms that he does not find a clear disavowal of the use of ITO as a transparent window layer in the specification of the '718 patent. The specification does describe two unsatisfactory techniques proposed minimizing the current crowding solution which include modification of the front contact. One of those techniques involved the replacement of a metal front electrical contact with ITO. The [ALJ] does not find, however, that a statement in the background section that the use of ITO was not "completely satisfactory" as a front contact is a disclaimer that ITO does not fall within the scope of the claimed "transparent window layer," which serves a distinct function in an LED.

ID at 39-40.

Further, Epistar's argument regarding the construction of the limitation "substrate" is based solely on Epistar's misconception that the Commission views one of the thinner layers of the LED as constituting a "substrate," and fails to recognize that the intrinsic evidence makes no disclaimer restricting a "substrate" to a single layer. Epistar br. at 17-18. The Commission stated the following regarding how the intrinsic evidence allows for the construction of "substrate" to include a combination of layers:

> Therefore, after reviewing the '718 specification, we determine that the ALJ properly construed the term "substrate" in Order No. 27 to be the "supporting material in an LED upon which the other layers of an LED are grown or to which those layers are attached" which includes the disclosed embodiment of a substrate that is grown on top of, or attached to, the other (LED) layers. . . Furthermore, we find that the ALJ's construction of "semiconductor substrate" is too limiting because we find that this term may include multiple layers (elements), at least one of which

> must be a semiconductor material. The '718 specification does not mention the specific term "semiconductor substrate", nor does it contain any disclaimer limiting a "substrate" to a single layer. Rather, the LED structure depicted is described as exemplary, and therefore we view the semiconductor substrate helping to form the LED structure as exemplary as well. . . Additionally, the ALJ in his ID expressly notes that composite substrates, *i.e.*, composition of layers, may be considered the "substrate" to satisfy the asserted claims of the patents-at-issue which specifically includes a semiconductor material (silicon) on an insulator embodiment. . . Therefore, we do not view the specification as limiting the term "semiconductor substrate" to a single layer.

Comm'n Op. at 8-12; *citations omitted.*

Thus, we properly considered and ruled on all issues raised by Epistar in its stay motion, and a substantial factual record, along with Federal Circuit precedent, supports our determinations. Accordingly, we find that respondent has not demonstrated a likelihood of success on the merits or made any showing of "admittedly difficult legal question."

C. Irreparable Harm, Harm to Others, and Public Interest

Epistar contends that it will immediately and permanently lose customers unless the limited exclusion order is stayed because its customers will be reluctant to place excluded Epistar LEDs in their downstream products (*e.g.*, stop lights) for export, and will be more likely to switch to another company's LEDs than take the necessary time to test whether alternative, non-infringing Epistar LEDs are compatible with their downstream products. Epistar br. at 19-20. Particularly, Epistar contends that its downstream manufacturers and distributors, fearing that the exclusion order bars them from selling their products in the U.S., will likely turn to other manufacturers whose LEDs they have used in the past. *Id.* at 19.

Epistar's argument that it will lose sales such that it will be irreparably harmed contradicts the arguments it previously made in its briefs to us on remedy. *Id.* at 19-20; *see*

Epistar Submission on Remedy, the Public Interest, and Bonding at 3-4; Epistar Amended Answer to Complaint at 28-29 (*e.g.*, Epistar has very limited U.S. revenue and few direct sales to US customers, Epistar has no knowledge of what happens to LEDs after they are sold, etc.). Particularly, Epistar previously stated the following regarding its limited US sales and lack of tracking of those sales:

> Epistar sells very few of its products directly to customers in the US . . . [n]either Epistar nor [Philips] can say with any certainty where each other's chips go once sold to a packaging house . . . [
>
>].

Id.

As noted above in the procedural history, our limited exclusion order only applies to infringing LEDs, including those that are packaged, and boards on which the packaged LEDs are mounted. *See* Comm'n Op. at 29. The order does not exclude further downstream products including stop lights, as Epistar's motion implies. Epistar is well aware of the limits of the exclusion order as evidenced by its press release to its customers. Particularly, Epistar stated to its customers that "[the exclusion order] does not, however, bar the importation of completed 'downstream' products that may include the Epistar LEDs." See Epistar br. at 20, Philips br. at Exh. 25. Therefore, Epistar is aware that its customers are not required to exclude respondent's LEDs from their downstream products in order to comply with the limited exclusion order. Further, as referenced above, Epistar previously submitted that only small percentages of its revenue relating to the excluded LEDs comes from U.S. sales, so even potentially losing all sales (assuming the worst case scenario Epistar predicts) would not constitute the severe distress required for us to find irreparable harm to its business. Epistar will still receive significant revenue from its non-U.S. sales. Accordingly, we find that Epistar has failed to establish that it will suffer irreparable harm absent a stay.

The factor "harm to others" of the four-prong standard also weighs against granting a stay pending appeal in this instance. In considering whether to grant a requested stay in *Tractors*, the Commission stated that "[a] stay pending appeal prejudices the complainant by depriving it, in this case potentially for a year or more, of the relief to which it is statutorily entitled under section 337." *Tractors*, Comm'n Op. at 16 (public version April 24, 1997). In this investigation, Philips has established that respondent has infringed its '718 patent. Since the '718 patent will expire on December 18, 2009, granting a stay that would allow importation of respondent's infringing products would deprive complainant of the relief to which it is entitled under section 337 for a substantial portion, or mostly all of the remaining term of the patent.

Further, regarding the public interest, Epistar conveniently overlooks that the exclusion order inhibits only *illegal* competition. *See* Epistar br. at 20. In fact, a stay pending appeal in this investigation would not promote the public interest. The Commission has stated that —

> [t]he public interest generally favors the protection of intellectual property rights. One of the principal purposes of section 337 is to afford complainants with expeditious relief. S. Rep. No. 71, 100th Cong., 1st Sess. 128-29 (1987). Granting a stay pending appeal would undermine the purpose of the statutory scheme as designed by Congress.

EPROMs at 90. Thus, granting a stay here would frustrate "the public policy behind section 337, which is to provide U.S. intellectual property holders with rapid relief against unfair import practices." *Id.*

D. Conclusion

As discussed above, respondent Epistar has failed to demonstrate that there is an admittedly difficult legal question at issue, that it will suffer irreparable harm absent a stay, or that a balance of the equities or the public interest favor granting its motion for a stay.

Accordingly, the Commission denies its motion.

By order of the Commission.

Marilyn R. Abbott
Secretary to the Commission

Issued: September 11, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT-EMITTING DIODES AND PRODUCTS CONTAINING SAME **337-TA-556**

CERTIFICATE OF SERVICE

I, Marilyn R. Abbott, hereby certify that the attached **COMMISSION OPINION ON DENIAL OF MOTION FOR STAY** has been served by hand upon the Commission Investigative Attorney, Thomas S. Fusco, Esq., and the following parties as indicated, on September 11, 2007.

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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	**Investigation No. 337-TA-556**

NOTICE OF COMMISSION DECISION TO REVERSE-IN-PART AND MODIFY-IN-PART A FINAL INITIAL DETERMINATION FINDING A VIOLATION OF SECTION 337; ISSUANCE OF A LIMITED EXCLUSION ORDER; AND TERMINATION OF THE INVESTIGATION

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined to reverse-in-part and modify-in-part a final initial determination ("ID") of the presiding administrative law judge ("ALJ") finding a violation of section 337 by the respondent's products in the above-captioned investigation, and has issued a limited exclusion order directed against products of respondent Epistar Corporation ("Epistar") of Hsinchu, Taiwan.

FOR FURTHER INFORMATION CONTACT: Clint Gerdine, Esq., Office of the General Counsel, U.S. International Trade Commission, 500 E Street, S.W., Washington, D.C. 20436, telephone (202) 708-5468. Copies of non-confidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street, S.W., Washington, D.C. 20436, telephone (202) 205-2000. General information concerning the Commission may also be obtained by accessing its Internet server at *http://www.usitc.gov*. The public record for this investigation may be viewed on the Commission's electronic docket (EDIS) at *http://edis.usitc.gov*. Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal on (202) 205-1810.

SUPPLEMENTARY INFORMATION: The Commission instituted this investigation on December 8, 2005, based on a complaint filed by Lumileds Lighting U.S., LLC ("Lumileds") of San Jose, California. 70 *Fed. Reg.* 73026. The complaint, as amended and supplemented, alleges violations of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain high-brightness light emitting diodes ("LEDs") and products containing same by reason of infringement of claims 1 and 6 of U.S. Patent No. 5,008,718 ("the '718 patent"); claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580 ("the '580 patent"); and claims 12-16 of U.S. Patent No. 5,502,316 ("the '316 patent"). The complaint further alleges the existence of a domestic industry. The Commission's notice of investigation named Epistar, and United Epitaxy Company ("UEC") of Hsinchu, Taiwan as respondents.

On April 28, 2006, Lumileds moved to amend the complaint to: 1) remove UEC as a named respondent, 2) change the complainant's full name from Lumileds Lighting U.S., LLC to Philips Lumileds Lighting Company LLC ("Philips"), and 3) identify additional Epistar LEDs alleged to infringe one or more patents-in-suit. Neither respondent opposed the motion.

On May 15, 2006, the Commission determined not to review an ID (Order No. 14) granting the complainant's motion for partial summary determination to dismiss Epistar's affirmative defense that the '718 claims are invalid.

On August 2, 2006, the still pending motion to amend the complaint was discussed with the parties during the prehearing conference, and the evidentiary hearing was held from August 2-11, 2006. On October 23, 2006, the ALJ issued an ID (Order No. 29) granting Lumileds' motion to amend the complaint, and further ordering that the Notice of Investigation be amended to identify Philips as the complainant and to remove UEC as a named respondent. On November 13, 2006, the Commission published its notice that it had determined not to review Order No. 29. 71 *Fed. Reg.* 66195.

On December 13, 2006, the Commission determined not to review an ID (Order No. 31) extending the target date for this investigation to May 8, 2007, and the deadline for the ALJ's final initial determination to January 8, 2007.

On January 8 and 11, 2007, the ALJ issued his final ID and recommended determinations on remedy and bonding, respectively. The ALJ found a violation of section 337 based on his findings that the respondent's accused products infringe one or more of the asserted claims of the patents at issue. On January 22, 2007, the complainant and the respondent each filed a petition for review of the final ID. On January 29, 2007, all parties, including the Commission investigative attorney, filed responses to the petitions for review.

On February 22, 2007, the Commission determined to review-in-part the ID. Particularly, the Commission determined to review claim construction of the terms "substrate" and "semiconductor substrate" in claims 1 and 6 of the '718 patent, and claim construction of the term "wafer bonding" in claims 1-3, 8-9, 16, 18, 23-25, 27 and 28 of the '580 patent and claims 12-14 and 16 of the '316 patent. With respect to violation, the Commission requested written submissions from the parties relating to the following issue: the ALJ's addition of the limitation "must also be a material that provides adequate mechanical support for the LED device" to the construction of the term "substrate," and the implications of this addition for the infringement analysis. Further, the Commission requested written submissions on the issues of remedy, the public interest, and bonding.

On March 5 and March 12, 2007, respectively, the complainant Philips, the respondent Epistar, and the IA filed briefs and reply briefs on the issues for which the Commission requested written submissions.

Having reviewed the record in this investigation, including the ID and the parties' written submissions, the Commission has determined to reverse-in-part and modify-in-part the ID. Particularly, the Commission has modified the ALJ's claim construction of the term "substrate" in claims 1 and 6 of the '718 patent to be "the supporting material in an LED upon which the other layers of an LED are grown or to which those layers are attached" and includes the case in which the supporting material functioning as the substrate is grown on top of, or attached to, the other layers. Also, the Commission has modified the ALJ's claim construction of the term "semiconductor substrate" to be the above-mentioned "substrate" construction where additionally, "at least one layer of the supporting material functioning as the substrate includes a non-metallic solid that conducts electricity by virtue of excitation of electrons across an energy gap, or by introduced materials, such as dopants, that provide conduction electrons." Further, the Commission has reversed the ALJ's ruling of non-infringement of the '718 patent by GB I, GB II, OMA I, and OMA II LEDs and determined that those products infringe claims 1 and 6 under the ALJ's original claim construction of "substrate" and the modified construction of "semiconductor substrate".

Also, the Commission has modified the ALJ's claim construction of "wafer bonding" in claims 1-3, 8-9, 16, 18, 23-25, 27 and 28 of the '580 patent and claims 12-14 and 16 of the '316 patent. Particularly, the Commission has modified the claim construction of this term to be "the bringing of two wafer surfaces into physical contact such that a mechanically robust, largely optically transparent bond forms between them, but does not include Van der Waals bonding." This modification does not affect the ID's finding of non-infringement of the '316 and '580 patent claims.

Further, the Commission has made its determination on the issues of remedy, the public interest, and bonding. The Commission has determined that the appropriate form of relief is a limited exclusion order prohibiting the unlicensed entry of LEDs that infringe claims 1 or 6 of the '718 patent that are manufactured by or on behalf of Epistar, its affiliated companies, parents, subsidiaries, licensees, contractors, or other related business entities, or successors or assigns. The Commission has also determined to prohibit the unlicensed entry of packaged LEDs containing the infringing LEDs and boards primarily consisting of arrays of such packaged LEDs.

The Commission further determined that the public interest factors enumerated in section 337(d)(1) (19 U.S.C. § 1337(d)(1)) do not preclude issuance of the limited exclusion order. Finally, the Commission determined that the amount of bond to permit temporary importation during the period of Presidential review (19 U.S.C. § 1337(j)) shall be in the amount of 100 percent of the value of the LEDs or board containing the same that are subject to the order. The

Commission's order and opinion was delivered to the President and to the United States Trade Representative on the day of its issuance.

The authority for the Commission's determination is contained in section 337 of the Tariff Act of 1930, as amended (19 U.S.C. § 1337), and in sections 210.42, 210.45, and 210.50 of the Commission's Rules of Practice and Procedure (19 C.F.R.§§ 210.42, 210.45, 210.50).

By order of the Commission.

Marilyn R. Abbott
Secretary to the Commission

Issued: May 9, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT-EMITTING DIODES AND PRODUCTS CONTAINING SAME **337-TA-556**

CERTIFICATE OF SERVICE

I Marilyn R. Abbott, hereby certify that the attached **NOTICE OF COMMISSION DECISION TO REVERSE-IN-PART AND MODIFY-IN-PART A FINAL INITIAL DETERMINATION FINDING A VIOLATION OF SECTION 337; ISSUANCE OF LIMITED EXCLUSION ORDER; AND TERMINATION OF THE INVESTIGATION** has been served on upon the Commission Investigative Attorney Thomas S. Fusco, Esq., and all parties via first class mail and air mail where necessary on May 10, 2007.

Marilyn R. Abbott

Marilyn R. Abbott, Secretary
U.S. International Trade Commission
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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	**Investigation No. 337-TA-556**

LIMITED EXCLUSION ORDER

The Commission has determined that there is a violation of section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337) in the unlawful importation, sale for importation, and sale after importation by Epistar Co., Ltd. ("Epistar") of high-brightness light emitting diodes that infringe claims 1 and 6 of U.S. Patent No. 5,008,718.

Having reviewed the record in this investigation, including the written submissions of the parties, the Commission has made its determination on the issues of remedy, the public interest, and bonding. The Commission has determined that the appropriate form of relief is a limited exclusion order prohibiting the unlicensed entry of covered high-brightness light emitting diodes manufactured by or on behalf of Epistar, packaged LEDs containing the infringing high-brightness light emitting diodes, and boards primarily consisting of arrays of such packaged LEDs.

The Commission has determined that the public interest factors enumerated in 19 U.S.C. § 1337(d) do not preclude issuance of the limited exclusion order and that the bond during the Presidential review period shall be in the amount of 100% of the entered value of each LED whether imported singly, packaged, or as part of a board.

Accordingly, the Commission hereby ORDERS that:

1. High-brightness light emitting diodes that are covered by one or more of claims 1 and 6 of U.S. Patent No. 5,008,718 and are manufactured abroad or imported by or on behalf of Epistar or any of its affiliated companies, parents, subsidiaries, contractors, or other related business entities, or their successors or assigns, including packaged LEDs containing the infringing LEDs and boards primarily consisting of arrays of such packaged LEDs, are excluded from entry for consumption into the United States, entry for consumption from a foreign-trade zone, or withdrawal from a warehouse for consumption, for the remaining term of the patent except under license of the patent owner as provided by law.

2. High-brightness light emitting diodes, including those incorporated into packaged LEDs, and boards primarily consisting of arrays of such packaged LEDs, described in paragraph 1 of this Order are entitled to entry for consumption into the United States, entry for consumption from a foreign-trade zone, or withdrawal from a warehouse for consumption, under bond in the amount of one hundred (100) percent of entered value for covered high-brightness light emitting diodes imported separately, in packages, or within boards, pursuant to subsection (j) of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337(j), and the Presidential Memorandum for the United States Trade Representative of July 21, 2005 (70 *Fed. Reg.* 43251), from the day after this

Order is received by the United States Trade Representative until such time as she notifies the Commission that she approves or disapproves this action but, in any event, not later than sixty (60) days after the date of receipt of this action.

3. At the discretion of U.S. Customs and Border Protection ("CBP") and pursuant to procedures it establishes, persons seeking to import high-brightness light emitting diodes, packaged LEDs or boards primarily consisting of arrays of such packaged LEDs that are potentially subject to this Order may be required to certify that they are familiar with the terms of this Order, that they have made appropriate inquiry, and thereupon state that, to the best of their knowledge and belief, the products being imported are not excluded from entry under paragraph 1 of this Order. At its discretion, CBP may require persons who have provided the certification described in this paragraph to furnish such records or analyses as are necessary to substantiate the certification.

4. In accordance with 19 U.S.C. § 1337(l), the provisions of this Order shall not apply to high-brightness light emitting diodes, packaged LEDs and boards primarily consisting of arrays of such packaged LEDs that are imported by and for the use of the United States, or imported for, and to be used for, the United States with the authorization or consent of the Government.

5. The Commission may modify this Order in accordance with the procedures described in Rule 210.76 of the Commission's Rules of Practice and Procedure, 19 C.F.R. § 210.76.

6. The Secretary shall serve copies of this Order upon each party of record in this investigation and upon the Department of Health and Human Services, the Department of Justice, the Federal Trade Commission, and Customs and Border Protection.

7. Notice of this Order shall be published in the *Federal Register*.

By Order of the Commission.

Marilyn R. Abbott
Secretary to the Commission

Issued: May 9, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT-EMITTING DIODES AND PRODUCTS CONTAINING SAME **337-TA-556**

CERTIFICATE OF SERVICE

I Marilyn R. Abbott, hereby certify that the attached **LIMITED EXCLUSION ORDER** has been served on upon the Commission Investigative Attorney Thomas S. Fusco, Esq., and all parties via first class mail and air mail where necessary on May 10, 2007.

Marilyn R. Abbott

Marilyn R. Abbott, Secretary
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PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME	Investigation No. 337-TA-556

COMMISSION OPINION ON VIOLATION, REMEDY, THE PUBLIC INTEREST, AND BONDING

I. BACKGROUND

The Commission instituted this investigation on December 8, 2005, based on a complaint filed by Lumileds Lighting U.S., LLC ("Lumileds") of San Jose, California. 70 *Fed. Reg.* 73026. The complaint, as amended and supplemented, alleges violations of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain high-brightness light emitting diodes ("LEDs") and products containing same by reason of infringement of claims 1 and 6 of U.S. Patent No. 5,008,718 ("the '718 patent"), claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580 ("the '580 patent"), and claims 12-16 of U.S. Patent No. 5,502,316 ("the '316 patent"). The complaint further alleges the existence of a domestic industry. The Commission's notice of investigation named Epistar Corporation ("Epistar") of Hsinchu, Taiwan, and United Epitaxy Company ("UEC") of Hsinchu, Taiwan as respondents.

On April 28, 2006, Lumileds moved to amend the complaint to: 1) remove UEC as a named respondent since it had merged with Epistar, 2) change the complainant's full name from Lumileds Lighting U.S., LLC to Philips Lumileds Lighting Company LLC ("Philips") since it had undergone a name change, and 3) identify additional Epistar LEDs alleged to infringe one or more patents-in-suit. Neither respondent opposed the motion, and on May 10, 2006, the Commission Investigative Attorney ("IA") filed a response in support of Lumileds' motion. Philips also moved to amend the asserted claims against the respondent Epistar.

On May 15, 2006, the Commission determined not to review an ID granting the complainant's motion for partial summary determination to dismiss Epistar's affirmative defense that the '718 claims are invalid.

On July 31, 2006, the presiding administrative law judge ("ALJ"), issued Order No. 27 construing most of the disputed claims of the three patents-in-suit.

On August 2, 2006, the ALJ and the parties discussed the still pending motion to amend the complaint during the prehearing conference. The evidentiary hearing followed and continued through August 11, 2006. On October 23, 2006, the ALJ issued an ID (Order No. 29) granting Lumileds' motion to amend the complaint, and further ordering that the Notice of Investigation be amended to identify Philips as the complainant and to remove UEC as a named respondent. On November 13, 2006, the Commission published a notice determining not to review Order No. 29. 71 *Fed. Reg.* 66195.

On January 8 and 11, 2007, the ALJ issued his final ID and recommended determinations on remedy and bonding, respectively. The ALJ found a violation of section 337 based on his findings that some of the respondent's accused products infringe claims 1 and 6 of the '718 patent. Other products were found not to infringe any of the patents at issue. The ALJ's final ID incorporates the claim constructions he made in Order No. 27. See ID at 5.

On January 22, 2007, the complainant and the respondent each filed a petition for review of the final ID. On January 29, 2007, all parties filed responses to the petitions for review. On February 22, 2007, the Commission determined to review-in-part the ID. Particularly, the Commission determined to review the ALJ's construction of the claim terms "substrate" and "semiconductor substrate" in claims 1 and 6 of the '718 patent, and claim construction of the claim term "wafer bonding" in claims 1-3, 8-9, 16, 18, 23-25, 27, and 28 of the '580 patent and claims 12-14 and 16 of the '316 patent.

On review, with respect to violation, the parties were requested to submit briefing limited to the following issues: the ALJ's apparent addition of the limitation "must also be a material that provides adequate mechanical support for the LED device" to the construction of the term "substrate," and the implications of this addition for the infringement analysis.

In addition, the Commission requested written submissions from the parties relating to the appropriate remedy, whether the statutory public interest factors preclude issuance of that remedy, and the amount of bond to be imposed during the period of Presidential review.

On March 5 and March 12, 2007, the complainant Philips, the respondent Epistar, and the IA filed briefs and reply briefs, respectively, on the issues for which the Commission requested written submissions.

A. Patents at Issue

This investigation pertains to high-brightness light emitting diodes (LEDs), which are made from semiconductor materials and may be used in a variety of products (*e.g.*, cellphones, traffic signals, indoor/outdoor displays and signs, etc.). In particular, the asserted '718, '580, and '316 patents pertain to aspects of semiconductor manufacturing processes to produce LEDs with higher light output and improved efficiency.

The '718 patent is entitled "Light-Emitting Diode with an Electrically Conductive Window" and is directed to an LED with a special transparent window layer grown on top of the active LED layers of the semiconductor device in order to enhance current spreading (less light absorption) and thereby provide a higher light output and improved LED efficiency. The '718 patent is based on an application filed on December 18, 1989. The patent issued on April 16, 1999 to Robert M. Fletcher, *et al.*, and it was originally assigned to Hewlett-Packard Company ("HP"). Subsequently, the '718 patent was assigned to Agilent Technologies, Inc. ("Agilent"), and finally to the complainant Philips (then Lumileds). See Amended Complaint at 7, Exhibit 4 to Original Complaint.

The '580 patent is entitled "Wafer Bonding of Light Emitting Diode Layers" and is directed to a method of forming an LED which includes wafer bonding LED layers grown on top of a temporary growth substrate to a special second substrate to enhance optical transparency and thereby provide a higher light output and improve LED efficiency. The '580 patent is based on an application filed on March 19, 1993. The

'580 patent issued on December 27, 1994, to Fred A. Kish, *et al.*, and was originally assigned to HP. Subsequently, the '580 patent was assigned to Agilent, and finally to the complainant Philips. See Amended Complaint at 7, Exh. 5 to Original Complaint.

The '316 patent is also entitled "Wafer Bonding of Light Emitting Diode Layers" and is also directed to an LED semiconductor device that is made by LED layers grown on top of a temporary growth substrate and bonded to a special second substrate to enhance optical transparency and thereby provide a higher light output and improve LED efficiency. The '316 patent is based on an application filed on October 12, 1995. The patent issued on March 26, 1996, to Fred A. Kish, *et al.*, and it was originally assigned to HP. Subsequently, the '316 patent was assigned to Agilent, and finally to the complainant Philips. See Amended Complaint at 9, Exh. 6 to Original Complaint.

B. Processes and Devices at Issue

Generally, Philips contends that at least claims 1 and 6 of the '718 patent, claims 1-3, 8-9, 16, 18, and 23-25, 27, and 28 of the '580 patent, and claims 12-14 and 16 of the '316 patent are infringed, either literally or under the doctrine of equivalents, by the following types of LEDs, *viz.*, OMA, OMA II, MB, MB II, GB, and GB II,[1] that Epistar

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OMA refers to Epistar's mirrored-substrate AlGaInP LED products which use an active LED layer of at least AlGaInP coupled to a lower reflective layer (e.g., [ ] mirror) through wafer bonding and a higher transparent, current-spreading ITO layer to enhance LED efficiency with higher light output. An AlGaInP LED refers to an LED that uses an active layer of semiconductor comprised of at least a combination of aluminum, gallium, indium, and phosphorus. An ITO LED refers to an LED that uses a current-spreading layer of indium-tin oxide to enhance LED efficiency with higher light output. The designation OMA II refers to a second-generation of OMA products that Epistar is developing. See Amended Complaint at 18-20.

MB and GB refer to Epistar's "metal bond" and "glue bond" LEDs which use an active LED layer of at least AlGaInP coupled to a higher transparent, current-spreading ITO layer to enhance LED efficiency with higher light output. The AlGaInP layer is coupled to a lower reflective metal bonding layer through wafer bonding for the MB products and to a lower transparent organic adhesive (glue layer) for the GB products. The designations MB II and GB II refers to a second-generation of MB and GB products, respectively, that either currently produces or is in the process of developing. Philips asserts that Epistar's OMA LEDs infringe at least claims 1 and 6 of the '718 patent, claims 1-3, 16, and 18 of the '580 patent, and claims 12-14, and 16 of the '316 patent. Philips asserts that Epistar's MB LEDs infringe at least claims 1 and 6 of the '718 patent, and claims 8-9, 16, and 18 of the '580 patent. Philips asserts that Epistar's GB LEDs infringe at least claims 1 and 6 of the '718 patent, claims 1-3, 23-25, and 27-28 of the '580 patent, and claims 12-14 and 16 of the '316 patent.

With regard to its own products, Philips asserts that its AlGaInP LEDs practice the asserted claims as their LEDs include both the current-spreading ("p-GaP" - gallium phosphorus) window layer disclosed in the preferred embodiment of the '718 patent, and the wafer-bonded transparent substrate ("n-GaP") disclosed as a preferred embodiment of the '580 and '316 patents. See Amended Complaint at 28.

C. Relevant Prior Litigation and Merger

From September 1999 through September 2001, Philips asserted the '718 patent against UEC. *See United Epitaxy Co., Ltd. v. Hewlett-Packard Co., Agilent Technologies, Inc., and Lumileds Lighting U.S., LLC*, No. C 00-2518 CW (PVT) (ND. Cal. filed September 7, 1999) ("Prior UEC litigation"). In that litigation, Philips specifically asserted the '718 patent against Epistar's absorbing-substrate LEDs (the LED having a lower light absorbing substrate wafer-bonded to the LED active layers). On August 30, 2001, Philips and UEC settled the litigation by negotiating and executing a Settlement Agreement and Mutual Release ("Settlement Agreement"), Stipulated

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Epistar is developing. See Amended Complaint at 20-23.

Consent Judgment, and License Agreement. See Exhs. 8-10 of Complainant's Motion for Partial Summary Determination to Dismiss Epistar's Affirmative Defense that the '718 Patent Claims are Invalid.

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Also, from January 2003 through July 2004, Philips asserted the '718 patent against Epistar in district court. *See Lumileds Lighting U.S., LLC v. Epistar Corp.*, No. C 02-5077 CW (PVT) (N.D. Cal.) ("Prior Epistar litigation"). In that litigation, Philips specifically asserted the '718 patent against Epistar's [ ] LEDs. On approximately July 12, 2004, Philips and Epistar settled the litigation by negotiating and executing a Stipulated Dismissal with Prejudice Agreement, and a settlement and license agreement. See Exh. 11 of Complainant's Motion for Partial Summary Determination to Dismiss Epistar's Affirmative Defense that the '718 Patent Claims are Invalid. [

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Also, on December 30, 2005, UEC and Epistar completed a merger of the two companies. As part of the merger agreement, Epistar, as the surviving company, assumed "all assets, debts, rights, and obligations" previously held by UEC as of the date of the merger where these rights and obligations include those relating to patents and contracts, as well as UEC's status as a party to this investigation. See Exh. 3 of Complainant's Motion for Partial Summary Determination to Dismiss Epistar's Affirmative Defense that the '718 Patent Claims are Invalid.

Due to these prior agreements and stipulations between Philips and UEC/Epistar along with the UEC-Epistar merger agreement, the ALJ granted Philips' motion for partial summary determination to dismiss Epistar's Affirmative Defense that the '718 patent claims are invalid and Philips' motion to amend the complaint. See Orders 14, 29. Further, the ALJ determined in his final ID that Epistar's products at issue are not subject to the previous licenses between Philips and UEC/Epistar (more details below).

II. DISCUSSION

For the reasons set forth below, we have determined to reverse-in-part and modify-in-part the subject ID finding a violation of section 337 by Epistar's MB I and MB II LEDs.

A. Claim Construction

"substrate" and "semiconductor substrate"

We determined to review the construction of the terms "substrate" and "semiconductor substrate" in claims 1 and 6 of the '718 patent. '718 patent, col. 5, ll. 33-44. The ALJ originally construed "substrate" to be "the supporting material in an LED upon which the other layers of an LED are grown or to which those layers are attached". See Order No. 27 at 10-14, ID at 34-35. Particularly, in Order No. 27, the ALJ noted that the definition for "substrate" must include a preferred embodiment disclosed in the '718 specification which described a substrate embodiment where the substrate is grown on top of the other layers (*e.g.*, active layers of the LED). See Order No. 27 at 12-13. Thus, the ALJ construed the term to "include the case in which the layer functioning as the substrate is grown on top of, or attached to, the other layers." *Id.* In the subject ID, however, the ALJ supplemented his earlier construction to add that the substrate "must also be a material that provides adequate mechanical support for the LED device." See ID at 35.

During his infringement analysis, the ALJ did not apply the construction of "substrate" that he made in Order No. 27, *i.e.*, a construction that specifically includes a substrate that is grown on top of the other layers of the LED. Particularly, the ALJ stated the following in finding that Epistar's GB and OMA family of LEDs did not infringe the '718 patent:

The Administrative Law Judge finds that the [ ] layer identified by Dr. Dupuis as a 'substrate' is not a layer upon which the other layers of the GB are grown or to which they are attached. While it is true that some layers are formed on or attached to the [ ] layer, it also true that the [ ] layer is actually grown on top of the epitaxial light-emitting layers. Thus, the Administrative Law Judge concludes that the [ ] epitaxial layer is not a 'substrate' as construed in Order No. 27 . . . RX-181C shows that the manufacturing process of the GB II product, in relevant part, is approximately the same as described for the GB. For example, the [ ] layers are once again grown on top of the active layers and the [ ] layer is deposited on top the [ ]. It is also apparent that the thick layer of sapphire functions as the 'substrate' for the GB II and that all the other layers are either made on top of that layer or attached to it. There is no argument that sapphire is a semiconductor; therefore, there is agreement that it is not. Accordingly, the Administrative Law Judge finds that the GB and GB II products do not literally have a semiconductor substrate.

* * *

The Administrative Law Judge, however, concludes once again that the multiple layers identified by Dr. Dupuis as the 'semiconductor substrate' in the OMA and OMA II devices do not actually satisfy that limitation as construed in Order No. 27. In this case, the layers identified by Dr. Dupuis in both the OMA LEDs are not the layers upon which the layers of the OMA device are grown or to which they are attached because the [ ] layers are actually grown upon the active layers. In the OMA II device, Dr. Dupuis has identified the same layers as the 'semiconductor substrate' . . . According to the Staff 'the OMA and OMA II products rely upon the lowermost layer of silicon to provide support for the LED components' and the Administrative Law Judge agrees. The layers of silicon are also those upon which the layers of OMA and OMA II are grown or to which they are attached. Thus, the Administrative Law Judge concludes that the silicon layer in the OMA and OMA II device meets the requirements of a 'semiconductor substrate' as construed in Order No. 27.

See ID at 57-58, 67-68.

Also, it does not appear that the ALJ expressly construed the specific claim term "semiconductor substrate" as used in the first line of the body of claim 1 of the '718 patent, but instead separately construed "substrate" as described above and "semiconductor" as "a non-metallic solid that conducts electricity by virtue of excitation of electrons across an energy gap, or by introduced materials, such as dopants, that provide conduction electrons." See Order No. 27 at 11-12, 19-22. However, this construction of "semiconductor" refers solely to the use of the term in another portion of claim 1 to describe the transparent window layer, "a transparent window layer of semiconductor different from AlGaInP". See Order No. 27 at 20. During his infringement analysis of the GB and OMA family of LEDs in the ID, it appears that the ALJ construed "semiconductor substrate" to be a single-layer substrate composed of semiconductor materials similar to his "semiconductor" construction (*i.e.*, a good electrical conductor material) because he determined that a sapphire substrate (*i.e.*, a good insulator) could not be viewed as a semiconductor substrate. ID at 58-62.

We agree with Philips' that the ALJ improperly added the limitation of "providing adequate mechanical support" to his "substrate" construction by placing undue emphasis on one of the disclosed embodiments, contrary to established Federal Circuit precedent. *See Ventana Medical System, Inc. v. Biogenex Laboratories, Inc.*, 473 F.3d 1173, 1180-2 (Fed. Cir. 2006) (finding that the mere fact that embodiments included a particular example does not limit claims to that example); *see also Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) (claim need not be limited to single embodiment disclosed in the specification); *see also Cordis Corp. v. Medtronic AVE,* *Inc.*, 339 F.3d 1352, 1365 (Fed. Cir. 2003) ("As our case law makes clear, however, 'an applicant is not required to describe in the specification every conceivable and possible future embodiment of his invention.'"). We disagree with Epistar's and the IA's contention that the added limitation is merely a clarification of the ALJ's original "substrate" construction.

Particularly, the ALJ appeared to place undue emphasis on the second disclosed embodiment of "substrate" in the '718 patent which states that "[t]he GaP layer is also grown much thicker than the active layers to provide a desired mechanical strength for the completed device...[t]he relatively thick GaP layer which provides mechanical strength as a transparent 'substrate'". See ID at 34-35; the '718 patent, col. 5, ll. 1-9. However, these limitations are directed only to this second disclosed embodiment (Fig. 3). The first disclosed embodiment generally refers only to a GaAs (gallium arsenide) substrate having a magnitude of thickness greater than the active layers of the device (*e.g.*, micrometers vs. nanometers). *Id.* at col. 2, ll. 60-64. Therefore, we find that the ALJ's original "substrate" definition as "the supporting material in an LED upon which the other layers of an LED are grown or to which these layers are attached" covers these two disclosed embodiments without importing any limitations into the claim.

Therefore, after reviewing the '718 specification, we determine that the ALJ properly construed the term "substrate" in Order No. 27 to be "the supporting material in an LED upon which the other layers of an LED are grown or to which those layers are attached" which includes the disclosed embodiment of a substrate that is grown on top of, or attached to, the other (LED) layers. See Order No. 27 at 13-14.

Furthermore, we find that the ALJ's construction of "semiconductor substrate" is too limiting because we find that this term may include multiple layers (elements), at least one of which must be a semiconductor material. The '718 specification does not mention the specific term "semiconductor substrate", nor does it contain any disclaimer limiting a "substrate" to a single layer. Rather, the LED structure depicted is described as exemplary, and therefore we view the semiconductor substrate helping to form the LED structure as exemplary as well. See '718 patent, col. 2, ll. 48-49. Additionally, the ALJ in his ID expressly notes that composite substrates, *i.e.*, composition of layers, may be considered the "substrate" to satisfy the asserted claims of the patents-at-issue which specifically includes a semiconductor material (silicon) on an insulator embodiment. See ID at 130. Therefore, we do not view the specification as limiting the term "semiconductor substrate" to a single layer.

Accordingly, the Commission has determined to modify the ALJ's construction of the claim terms "substrate" and "semiconductor substrate" found in claims 1 and 6 of the '718 patent. Particularly, the Commission finds the correct construction of the term "substrate" to be "the supporting material in an LED upon which the other layers of an LED are grown or to which those layers are attached" and to include the case in which the supporting material functioning as the substrate is grown on top of, or attached to, the other layers. Also, we modify the ALJ's construction of the term "semiconductor substrate" to be the above-stated "substrate" construction where additionally "at least one layer of the supporting material functioning as the substrate includes a non-metallic solid that conducts electricity by virtue of excitation of electrons across an energy gap, or by introduced materials, such as dopants, that provide conduction electrons." See Order No. 27 at 22.

"wafer bonding"

We also determined to review the ALJ's construction of the term "wafer bonding" in claims 1-3, 8-9, 16, 18, 23-25, 27, and 28 of the '580 patent and claims 12-14 and 16 of the '316 patent. '580 patent, col. 16, ll. 36-49; col. 17, ll. 13-3; col. 18, ll. 12-28; '316 patent, col. 16, ll. 43-53. The ALJ deferred construction of the term "wafer bonding" until trial to allow presentation of additional evidence. See Order No. 27 at 56. Upon presentation of this additional evidence, which primarily consists of expert testimony, prior art references, and Epistar product sheets, the ALJ construed "wafer bonding" to be "the bringing of two wafer surfaces into physical contact such that a mechanically robust bond forms between them." See ID at 19. Additionally, the ALJ determined that "wafer bonding" is not strictly limited to semiconductors, but may also include glass or mirror bonding, but does not include Van der Waals bonding, metal-to-metal bonding, and glue bonding.[2]

Having reviewed the record, we find that the ALJ improperly limited "wafer bonding" to exclude metal-to-metal bonding or glue bonding. Instead of focusing on the particular physical composition of the layer(s) that are wafer bonded, the ALJ should have read the intrinsic evidence to determine that the critical feature of the "wafer bond" is the creation of an interface that is largely optically transparent to enhance the light output and efficiency of the LED. See '580 patent, col. 9, ll. 19-22.

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Van der Waals bonding is expressly disclaimed in the patents. See '580 patent, col. 13, ll. 9-16; see '316 patent, col. 12, ll. 43-50.

The ALJ points to portions of the '316 prosecution history (the '316 patent issued from a division of the application that issued as the '580 patent) as support for a finding that the inventors disclaimed metal-to-metal bonding as wafer bonding. However, we find that the entire relevant portion of the applicants' responses to the claim rejections indicates otherwise. See ID at 13, 18; citing CX-36 (LLITC 00000204, 405-406) (responses to Office Actions). Although these two office action responses expressly disclaim metal-to-metal (wafer) bonds that result in an optically absorbing (opaque) bond, they do not disclaim metal-to-metal bonds that result in an optically transparent wafer bond. Moreover, the applicants continually referred to this critical aspect of their invention (optical transparency) as being distinct over the relevant prior art cited, Jokerst et al. (U.S. Patent No. 5,280,184). Furthermore, the ALJ focused on nomenclature rather than bond properties in viewing metal as distinct from a mirror even though he acknowledged that mirror-semiconductor wafer bonding was included in his construction. See ID at 17. Regardless of whether one of the bonding layers is identified as a mirror or a metal, we find that the specification discloses that one of the critical inventive features is whether a largely optically transparent interface is created via wafer bonding. See the '580 patent, col. 9, ll. 19-22.

Similarly, we find that the ALJ erred when he excluded glue bonding from his construction of the term wafer bonding. Although the ALJ recognized that the '580 patent specification discloses that wafer bonding includes glass-semiconductor interfaces, he dismissed Philips' argument that glue-semiconductor interfaces were also included in the "wafer bonding" definition because glass was used as a glue in one embodiment disclosed in the '580 specification. See the '580 patent, col. 9, ll. 3-26; ID at 15. The

ALJ also dismissed Philips' argument since he viewed glass as distinct from glue and therefore excluded glue bonding from his construction. *Id.* Again, we find that the ALJ focused too much on labels and nomenclature and should have focused more on the properties of the interface formed by the wafer bond in construing the term. Contrary to the ALJ, we find that, regardless of whether one of the bonding layers is identified as a glue or glass layer, the critical inventive feature is present when a largely optically transparent interface is created via wafer bonding. *Id.*

Therefore, we have determined that the ALJ improperly excluded all forms of metal-to-metal and glue bonding from his construction of "wafer bonding". See ID at 19-20. Rather, we have determined that the correct construction of the term excludes only metal or glue bonds that produce an optically absorbing bond. Or in other words, the proper construction of "wafer bonding" is "the bringing of two wafer surfaces into physical contact such that a mechanically robust, *largely optically transparent* bond forms between them, and does not include Van der Waals bonding."

However, our modification of the ALJ's claim construction of "wafer bonding" in claims 1-3, 8-9, 16, 18, 23-25, 27, and 28 of the '580 patent and claims 12-14 and 16 of the '316 patent does not change the ALJ's finding of non-infringement of the '316 or '580 patents.

B. Infringement of the '718 Patent

1. The '718 Patent

The "substrate" limitation

The ALJ determined that Epistar's GB and OMA family of LEDs do not infringe claims 1 or 6 of the '718 patent, either literally or under the doctrine of equivalents. See ID at 64-65, 70-71. The ALJ's determination of non-infringement was based on his finding that neither of these products includes the claimed "substrate" element as he construed it in his ID. See ID at 53-62, 65-69. The ALJ reviewed the detailed structures of each accused LED to make his determinations. See ID at 53, 65; RX-180C, 181C; RDX-500-505.

The ALJ found that Epistar's GB I LED is formed by initially preparing a temporary [ ] substrate which is subsequently removed after further steps in the manufacturing process. After this temporary substrate is formed, the following steps occur: [

].

GB II follows a manufacturing process similar to that of GB I and further includes: [

]. For both GB I and GB II, [

]. Also, the OMA I and OMA II LED's are similarly structured to GB II with the following differences: [

].

After reviewing the accused LED structures, the ALJ determined that the only element of the GB and OMA family of LEDs that satisfied his "substrate" construction was the bottom-level sapphire or Si substrates, as these substrates provided the significant portion of the mechanical support for the active layers of the LEDs. The ALJ reasoned that only the bottom-level sapphire or Si substrates were of sufficient thickness to be "the supporting material in an LED upon which the other layers of an LED are grown or to which they are attached" to satisfy his additional limitation of "providing adequate mechanical support for an LED device". See ID at 53-62, 65-69. The ALJ also determined that the other layers beneath the active layers (*e.g.*, [ ] layers) do not provide adequate mechanical support for the LED device, because Philips did not provide sufficient evidence to prove that these layers in the respondent's products possess sufficient thickness to provide such support. The ALJ further determined that sapphire was not a semiconductor substrate because sapphire is an insulator. See ID at 58. Since neither substrate was connected to a bonding pad (electrode), the ALJ determined that neither family of LEDs infringed claims 1 or 6 of the '718 patent. Also, as referenced above, the ALJ found that because the substrate layers (*e.g.*, [ ] layers) in the accused LEDs are actually grown on top of the active LED layers, they did not meet his construction of the term "substrate", which he had limited to the layers upon which the LED layers are grown. See ID at 57-58, 67-69.

As discussed above, the Commission has determined that the ALJ correctly construed "substrate" in his Order No. 27 as "the supporting material in an LED upon which the other layers of an LED are grown or to which these layers are attached," a construction that properly included the disclosed embodiment of the '718 specification which described a "layer functioning as the substrate that is grown on top of, or attached to, the other layers." See Order No. 27 at 12-14.

During the infringement analysis, however, the ALJ did not apply this correct construction but rather applied his modified construction that added the limitation "provides adequate mechanical support" to his previous construction for the term "substrate". Moreover, the ALJ viewed "the supporting material" in his modified construction of "substrate" to be limited to only one layer (element), excluding one or more layers (combination of layers or elements) even though a "multiple layers" limitation is not excluded by the intrinsic evidence. Finally, the ALJ incorrectly found that a layer or layers formed after the active layers was not a substrate.

Under either the correct claim construction of Order No. 27 or the ALJ's modified construction in his ID, we find that "the supporting material" which functions as the substrate may properly include a combination of layers (multiple layers) that support the active LED layers above it, as is the case with Epistar's GB and OMA family of LEDs. While the '718 patent generally describes LED embodiments where the layer functioning as the substrate lies below the active layers of the LED device to provide support for the entire structure (Figs. 1-3), there is no express or implied disclaimer in the patent that necessarily limits the substrate to being comprised of a single layer (element). Furthermore, our construction of "supporting material" is not contrary to the purpose of the invention which is to produce an LED structure with a transparent window layer to promote current spreading leading to higher light output and greater LED efficiency.

Our construction is also consistent with the Federal Circuit's established precedent holding that the disclosure of a preferred or exemplary embodiment encompassing a singular element does not disclaim a plural embodiment when there is no limitation in the claim language or the prosecution history. *See KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000); *see also AbTox, Inc. v. Exitron Corp.*, 122 F.3d 1019, 1023 (Fed. Cir. 1997). Therefore, under established precedent, the term "a semiconductor substrate" may clearly include one or more semiconductor substrates. In this case, we find that a necessary corollary determination is that one or more substrates may include one or more layers to function as the "supporting material" for the active LED layers.

In addition, the Federal Circuit has consistently held that when the claim language calls for further inquiry to define a claim term, the tribunal must consult the specification to determine whether clear intent exists to limit the invention to a singular embodiment. *See KCJ Corp.*, 223 F.3d at 1356. In reviewing the '718 specification, we find no clear intent to exclude a substrate comprising one or more layers because the disclosed LEDs are exemplary, and we view the underlying substrates that contribute to the LED structure as exemplary as well. See the '718 patent, col. 2, ll. 48-49. Specifically, the specification states that "[a]n exemplary light emitting diode (LED) constructed according to principles of this invention has an n-type substrate 20 of GaAs." *Id.* Therefore, consistent with established patent law, it is our view that "the supporting material in an LED" may necessarily include one or more layers because the intrinsic evidence does not exclude an interpretation of the term that includes "multiple layers".

Additionally, the extrinsic evidence, if consulted, leads to the same conclusion. A number of references, mostly cited in Philips' petition for review, disclose substrates that are comprised of a combination of layers (multiple layers or elements). See Philips br. at 49-50; citing CX-70 and CX-632; U.S. Patent No. 6,677,617; www.semiconductor-technology.com/glossary/substrate.html. Also, we note that the ALJ specifically recognized that Philips originally asserted that a construction of "substrate" as "an underlying layer" was overly broad since it would include nearly every layer of the LED structure. See Order No. 27 at 13. The ALJ's concern that a "substrate" layer would be confused with "confining" or "active" layers of the LED device is not relevant here because the [ ] layers are clearly distinct from the confining and active layers of the GB and OMA family of LEDs.

As mentioned above, the ALJ found that the term "semiconductor substrate" also was not satisfied by the combination of supporting materials underlying the active layers of the LED for Epistar's GB and OMA LEDs. Again, although not expressly construed by the ALJ in his claim construction order (Order No. 27), we find "semiconductor substrate" to be properly construed as the above-mentioned "substrate" construction where additionally "at least one layer of the supporting material functioning as the substrate includes a non-metallic solid that conducts electricity by virtue of excitation of electrons across an energy gap, or by introduced materials, such as dopants, that provide conduction electrons." See Order No. 27 at 22.

In view of our construction that the claim term "substrate" need not be formed of a single layer, it follows necessarily that the term "supporting material" used in the ALJ's construction may include multiple layers which function as the substrate. Particularly, we find that the [ ] contact layers present in the GB and OMA family of LEDs, in combination with the thicker Si and sapphire bottom layers and any intervening layers, is a "composite substrate" that is "the supporting material" for the active LED layers above it so as to satisfy the "substrate" limitation under either the ALJ's original or supplemented claim construction. Thus, we find that this composite substrate also provides the adequate mechanical support for the LED device that is required by the ALJ's construction of the "substrate" limitation in his ID.

Accordingly, under either the ALJ's original or modified construction of the term "substrate", and our construction of "semiconductor substrate" discussed above, we find that Epistar's family of GB and OMA LEDs literally infringes claims 1 and 6 because of the following: 1) the combination of the [ ] layers, together with the Si or Sapphire bottom layers and any intervening layers, forms a "composite substrate" to satisfy the claimed "semiconductor substrate" element, 2) the [

] layer, one of the multiple layers of the composite substrate, contacts a metal bonding pad to provide "an electrical contact to the substrate" that satisfies this claimed element, and 3) the upper ITO contact layer performs current spreading and contacts another metal bonding pad to satisfy the other claimed elements.

For the reasons set forth above, we have determined that Epistar's family of GB and OMA LEDs literally infringes claims 1 and 6 of the '718 patent. Since the evidence supports a finding of literal infringement, we do not reach the issue of infringement under the doctrine of equivalents.

Accordingly, the Commission reverses the ALJ's finding of non-infringement of claims 1 and 6 of the '718 patent by Epistar's family of GB and OMA LED devices.

III. REMEDY, PUBLIC INTEREST, AND BONDING

For the reasons set forth below, we have determined to accept the ALJ's recommended determination (RD) on remedy and bonding with a few modifications. Also, we have determined that the public interest does not preclude the ALJ's recommended remedy.

A. Type of Remedy

The Commission is authorized to issue a limited exclusion order when the Commission determines that there is a violation of section 337 of the Tariff Act of 1930 (19 U.S.C. § 1337). Because we determined that Epistar's family of MB, GB, and OMA LEDs infringe the asserted claims of the '718 patent, we have issued a limited exclusion order directed to those LEDs. The sole remaining remedy issue, therefore, is whether to issue a limited exclusion order that covers downstream products.[3]

The ALJ recommended that, if the Commission determines there has been a violation of section 337, a limited exclusion order covering the infringing LEDs as well as packaged, infringing LEDs and boards on which the infringing LEDs are mounted is the appropriate remedy. Also, the ALJ recommended that the Commission set the bond, if necessary, at [ ] percent of the value of the infringing, imported LEDs or boards containing the same. RD at 3-8.

Regarding the possibility of a downstream remedy, the ALJ reasoned that an exclusion order against only Epistar LEDs might be ineffective if the LEDs could be imported as a component of other products or product components. *Id.* at 3-4. Therefore, the ALJ reviewed the *EPROMs* factors to determine if downstream products containing the infringing LEDs should be subject to an exclusion order. *See Certain Erasable Programmable Read-Only Memories, Components Thereof, Products Containing Such Memories, and Process for Making Such Memories*, Inv. No. 337-TA-276, Commission Opinion at 125-26 (May 1989). The *EPROMs* factors include the following: 1) the value of the infringing articles relative to the value of the downstream products in which they are incorporated, 2) the identity of the manufacturer of the downstream products in which they are incorporated, *i.e.*, whether it can be determined that the downstream products are manufactured by the respondent or by a third party, 3) the incremental value to the complainant of the exclusion of the downstream products, 4)

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[3] Complainant did not request a cease and desist order.

the incremental detriment to respondents of exclusion of such products, 5) the burdens imposed on third parties resulting from exclusion of downstream products, 6) the availability of alternative downstream products that do not contain the infringing articles, 7) the likelihood that the downstream products actually contain the infringing articles and are thereby subject to the exclusion order, 8) the opportunity for evasion of an exclusion order that does not include downstream products, and 9) the enforceability of an order by Customs ("1st *EPROMs* factor, 2nd *EPROMs* factor, etc."). *Id.*

From the record evidence presented, the ALJ found that individual LED chips are typically sold by manufacturers (*e.g.*, Epistar) to packagers who are located outside of the U.S. Since no domestic entities package LED chips, the ALJ determined that any Epistar chips entering the U.S. are imported in downstream products, making any exclusion order without downstream relief ineffective. *Id.* at 5. The ALJ viewed any exclusion order, especially one including downstream products, as placing a burden on Epistar and third parties that want to purchase products containing the infringing LEDs. However, the ALJ found that no evidence was presented to show that such a burden would be particularly heavy or would outweigh the necessity of including packaged LEDs and the boards on which the packaged LEDs are mounted in any limited exclusion order to provide effective relief to Philips. *Id.* at 6. Therefore, the ALJ recommended that if the Commission determines that there has been a violation of section 337, a limited exclusion order should issue covering the infringing LED devices along with the packaged LEDs and boards on which the packaged LEDs are mounted. Further, the ALJ recommended that any exclusion order include a provision that would permit importers of packaged LEDs or boards to certify that no infringing LEDs are contained in their products.

The ALJ reasoned that any exclusion order issued in this investigation should not go further than this first level of downstream products to exclude downstream products such as traffic lights and cell phones (as Philips requested). *Id.* The ALJ noted that while a packager or board manufacturer may be able to identify the source of its LEDs, Philips had not presented sufficient evidence relating to whether further downstream importers and manufacturers could identify the sources of LEDs used in their products or how such identification data, if it existed, could be obtained by Customs. *Id.* At 5-6. Thus, the ALJ reasoned that an order excluding products such as traffic lights and cellphones would unnecessarily disrupt legitimate trade and therefore should not be issued.

Regarding bonding, the ALJ reviewed Commission precedent on how to set the amount of the bond required of respondents, pursuant to section 337(j)(3), during the 60-day period of Presidential review following the issuance of permanent relief. *Id.* at 6. Particularly, the ALJ found that the Commission has used a reasonable royalty rate to set the amount of the bond where a royalty rate had been established for the product at issue. *See Certain Integrated Circuit Telecommunication Chips and Products Containing Same, Including Dialing Apparatus*, Inv. 337-TA-337, Commission Op. at 41 (1995).

The ALJ found that there is evidence of a reasonable royalty rate based on the settlement agreement in the prior litigation involving Philips and Epistar (UEC at that time) relating to the '718 patent. *Id.* at 7. [

]. Further, the ALJ recommended that the bond should be based on the value of any infringing LEDs actually contained in a downstream product, rather than on the value of a downstream product as a whole.

As discussed in the RD and party submissions, it appears to be undisputed that the overwhelming majority of Epistar's LEDs sales are to foreign manufacturers who then incorporate the LEDs into a variety of downstream products. The first level of downstream products consists of the following: 1) infringing, packaged LEDs and 2) boards consisting primarily of an array of infringing, packaged LEDs ("LED boards"). RD at 5. The ALJ recommended exclusion of these products. However, the ALJ did not recommend the exclusion of more than the first level of downstream products since he viewed Philips' evidence as insufficient regarding whether these further downstream manufacturers can identify the sources of LEDs used in their products, and how such information, if available, could be obtained by Customs to alleviate any disruption to legitimate trade. Id. at 5-6.

We agree with the ALJ that Philips' evidence to support further downstream product exclusion is insufficient. Philips has shown evidence that downstream customers outside of the U.S. purchase Epistar's LEDs which are intended to be incorporated into further downstream products such as automotive lights, mobile phones, and other downstream products. Particularly, Philips submits the identities of the downstream manufacturers and their related downstream products that were provided by Epistar's responses to interrogatories, Epistar's customer lists and emails, statements from

Epistar's president, and other Epistar business materials. See Philips' br. and Philips' response br. (attachments 1-4, 16-20). However, Philips does not point to any specific evidence that downstream products containing infringing LEDs made by Epistar actually enter the U.S. Instead Philips uses words such as "may", "can" and other qualifiers indicating a lack of evidence and mere speculation concerning further downstream product importation. See Philips br. at 13-15. Thus, we apply the *EPROMs* factors only to the first level of downstream products (packaged LEDs and LED boards).

Regarding the 1st *EPROMs* factor, the critical component of packaged LEDs and LED boards is the source of the lighting - *e.g.*, the high-brightness LEDs. Similar to the situation in *Certain Power Supply Controllers and Products Containing Same*, Inv. No. 337-TA-541, 2006 ITC Lexis 600 (Aug. 29, 2006), it is not an option to simply leave out the light source as these products could not operate as intended without them. *See Certain Power Supply Controllers*, at *8-9.

Regarding the 2nd *EPROMs* factor, Philips provides evidence regarding the identity of first level downstream manufacturers that import packaged LEDs and LED boards into the U.S. These are third-parties as the record indicates that Epistar apparently does not itself manufacture downstream products.

Regarding the 3rd *EPROMs* factor, it is apparently undisputed that most of Epistar's LEDs sales are to foreign manufacturers who use them in their downstream products, and that Epistar's LEDs are not imported into the U.S. without being first incorporated into a downstream product. See Philips br. at 14, Epistar response br. at 17. Thus, exclusion of downstream products would have a large incremental value to Philips.

Regarding the 4th *EPROMs* factor, there would be some detriment to Epistar. However, we note that only Epistar's MB, GB, and OMA family of LEDs are excluded, meaning that Epistar may still continue to sell its licensed [ ] LEDs to foreign manufacturers who wish to import into the U.S. In addition, a certification provision in the limited exclusion order, as discussed below, will help Customs ensure that non-infringing alternatives are not improperly excluded and will help protect both respondents and third parties.

Regarding the 5th *EPROMs* factor, the burdens imposed on third parties resulting from exclusion of downstream products will not be significant as Philips has presented sufficient direct evidence linking the specific downstream manufacturers and their related first level downstream products to actual U.S. importation. Using a certificate provision approved by Customs, we find that it is not an undue burden for third parties to make an appropriate inquiry of their suppliers and certify that, to the best of their knowledge and belief, that the first level downstream products are not excluded from entry by the exclusion order.

Regarding the 6th *EPROMs* factor, there are several alternative downstream products that do not contain the infringing articles. For instance, Epistar's [ ] LEDs, which are covered by a license, can be imported under the order. Further, as supported by Epistar's own statements, at least 90% of the U.S. market for high-brightness LEDs is provided by other manufacturers, including Philips, therefore making the supply of non-infringing alternatives very significant. See Epistar response br. at 15.

Regarding the 7th *EPROMs* factor, as noted above, Philips provides sufficient evidence that there are first level downstream products consisting of the packaged LEDs and LED boards that are imported into the U.S. that contain Epistar's infringing LEDs. Regarding the 8th *EPROMs* factor, it is not seriously disputed that there would be a significant opportunity for evasion of an exclusion order that does not exclude any downstream products. As noted by the ALJ's RD and Philips' submission, a vast majority (*e.g.*, 90%) of Epistar's LED sales are to foreign customers who produce packaged LEDs and LED boards. Therefore, any exclusion order that does not cover this first level of downstream products essentially provides no relief to Philips, as Epistar could still sell infringing LEDs to foreign entities who would export packaged LEDs and LED boards to the U.S.

Finally, regarding the 9th *EPROMs* factor, we believe the use of a certification process will greatly reduce any burden on Customs in enforcing this order.

In conclusion, the Commission has determined that the *EPROMs* factors weigh in favor of excluding first level downstream products consisting of packaged LEDs and LED boards. Regarding the 1st *EPROMs* factor, the infringing LEDs are critical to the operation of these downstream products as these products could not work without the infringing LEDs. Regarding the 2nd and 7th *EPROMs* factors, Philips has specifically identified downstream LED manufacturers that produce packaged LEDs and LED boards that are imported into the U.S. as the record indicates that Epistar does not itself manufacture downstream products. See Philips br. at 14, Epistar response br. at 17. Regarding the 3rd and 8th *EPROMs* factors, evidence has been presented that almost all of Epistar's LED sales are to foreign entities who then incorporate the infringing LEDs into packaged LEDs and LED boards for importation into the U.S. Therefore, any remedy that does not exclude these downstream products would provide no effective relief to Philips, which makes the incremental value to Philips of excluding first level downstream products significant.

In addition, regarding the 5th and 9th *EPROMs* factors, the limited exclusion order includes the type of certification provision that can be administered by Customs. This provision is designed to ease the burden on third parties that have to comply with the order and to improve Custom's ability to properly enforce the exclusion of the specific downstream products. Also, regarding the 6th *EPROMs* factor, several alternative downstream products exist including the previously licensed [ ] LEDs, Philips' own supply of high-brightness LEDs, and lighting products using incandescent bulbs. The 4th *EPROMs* factor (incremental detriment to respondent) does not substantially weigh against exclusion of first level downstream products because Epistar has other markets for its LEDs and its share of the U.S. market is small.

Therefore, the Commission finds that all the *EPROMs* factors favor exclusion of first level downstream products consisting of packaged LEDs and LED boards. Accordingly, we have issued a limited exclusion order against the infringing LEDs, packaged, infringing LEDs and infringing LED boards. "LED boards" are boards consisting primarily of an array of packaged, infringing LEDs.

B. Public Interest

When issuing an exclusion order under section 337(d), the Commission must weigh the remedy sought against the effect such a remedy would have on the following public interest factors: (1) the public health and welfare; (2) the competitive conditions in the United States economy; (3) the production of articles in the United States that are like or directly competitive with those subject to the investigation; and (4) United States consumers. *See* 19 U.S.C. § 1337(d)(1).

We agree with the IA and Philips that no public interest concerns will be raised by issuing a limited exclusion order directed to infringing LEDs produced by Epistar, and certain downstream products containing these LEDs. The IA is correct that viable non-infringing alternatives exist and there is no evidence that Philips cannot meet the demand for high-brightness LEDs. Both of these circumstances obviate any public interest concerns. Finally, protection of intellectual property rights is favored under section 337. Accordingly, the Commission has determined that the statutory public interest factors do not preclude issuance of the limited exclusion order.

C. Bonding

Section 337(j) provides for entry of infringing articles during the sixty (60) day period of Presidential review upon posting of a bond and states that the bond is to be set at a level "sufficient to protect the complainant from any injury." 19 U.S.C. § 1337(j)(3); *see also* 19 C.F.R. § 210.50(a)(3).

The ALJ reviewed Commission precedent on how to set the amount of the bond required of respondents during the 60-day period of Presidential review following the issuance of permanent relief. *Id.* at 6; *see* section 337(j)(3). Particularly, the ALJ found that the Commission has used a reasonable royalty rate to set the amount of the bond where a royalty rate had been established for the product at issue. *See Certain Integrated Circuit Telecommunication Chips and Products Containing Same, Including Dialing Apparatus*, Inv. 337-TA-337, Commission Op. at 41 (1995).

Similarly, in this case, the ALJ found that there is evidence of a reasonable royalty rate based on the settlement agreement in the prior litigation involving Philips and Epistar (UEC at that time) relating to the '718 patent. *Id.* at 7. [

]. Further, the ALJ recommended that the bond should be based on the value of any infringing LEDs actually contained in a downstream product, rather than on the value of a downstream product as a whole.

We agree with Philips that it is not appropriate to apply directly a royalty rate pertaining to [ ] LEDs to Epistar's products found to infringe Philips' patents in this investigation. In his summary determination dismissing the affirmative defense that the '718 patent was invalid, the ALJ recognized that there was a significant distinction between the [ ] LEDs of the previous license and the reflective and transparent LEDs currently at issue. [

].

Commission precedent allows for a 100% bond when no effective alternative exists. *See Certain Flash Memory Circuits and Products Containing Same*, Inv. No. 337-TA-382, USITC Pub. No. 3046, Comm'n Op. At 26-27 (July 1997) (a 100% bond imposed when price comparison was not practical because the parties sold products at different levels of commerce, and the proposed royalty rate appeared to be de minimis and without adequate support in the record). Here, the royalty rates proposed by the ALJ and the IA pertain to a completely different product and are not based on U.S. revenue, thereby eliminating any relevant comparison. Accordingly, the Commission has set a 100% bond for the infringing LEDs and downstream products containing the same.

By order of the Commission.

Marilyn R. Abbott
Secretary to the Commission

Issued: May 30, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT-EMITTING DIODES AND PRODUCTS CONTAINING SAME **337-TA-556**

CERTIFICATE OF SERVICE

I Marilyn R. Abbott, hereby certify that the attached **COMMISSION OPINION ON VIOLATION, REMEDY, THE PUBLIC INTEREST, AND BONDING,** has been served on upon the Commission Investigative, Thomas S. Fusco, Esq., and all parties via first class mail and air mail where necessary on **May 31, 2007.**

Marilyn R. Abbott

Marilyn R. Abbott, Secretary
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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C. 20436

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	**Investigation No. 337-TA-556**

NOTICE OF COMMISSION DECISION TO REVIEW-IN-PART A FINAL INITIAL DETERMINATION FINDING A VIOLATION OF SECTION 337 AND TO GRANT A MOTION TO STRIKE

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined to review-in-part a final initial determination ("ID") of the presiding administrative law judge ("ALJ") finding a violation of section 337 by the respondent's products in the above-captioned investigation. The Commission has also granted respondent's motion to strike complainant's arguments that are based on evidence that was excluded by the ALJ.

FOR FURTHER INFORMATION CONTACT: Clint Gerdine, Esq., Office of the General Counsel, U.S. International Trade Commission, 500 E Street, S.W., Washington, D.C. 20436, telephone (202) 708-5468. Copies of non-confidential documents filed in connection with this investigation are or will be available for inspection during official business hours (8:45 a.m. to 5:15 p.m.) in the Office of the Secretary, U.S. International Trade Commission, 500 E Street, S.W., Washington, D.C. 20436, telephone (202) 205-2000. General information concerning the Commission may also be obtained by accessing its Internet server at *http://www.usitc.gov*. The public record for this investigation may be viewed on the Commission's electronic docket (EDIS) at *http://edis.usitc.gov*. Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal on (202) 205-1810.

SUPPLEMENTARY INFORMATION: The Commission instituted this investigation on December 8, 2005, based on a complaint filed by Lumileds Lighting U.S., LLC ("Lumileds") of San Jose, California. 70 *Fed. Reg.* 73026. The complaint, as amended and supplemented, alleges violations of section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain high-brightness light emitting diodes ("LEDs") and products containing same by reason of infringement of claims 1 and 6 of U.S. Patent No. 5,008,718 ("the '718 patent"); claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580 ("the '580 patent"); and claims 12-16 of U.S. Patent No. 5,502,316 ("the '316 patent"). The complaint further alleges the existence of a domestic industry. The Commission's notice of investigation named Epistar Corporation ("Epistar") of Hsinchu, Taiwan, and United Epitaxy Company ("UEC") of Hsinchu, Taiwan as respondents.

On April 28, 2006, Lumileds moved to amend the complaint to: 1) remove UEC as a named respondent, 2) change the complainant's full name from Lumileds Lighting U.S., LLC to Philips Lumileds Lighting Company LLC ("Philips"), and 3) identify additional Epistar LEDs alleged to infringe one or more patents-in-suit. Neither respondent opposed the motion.

On May 15, 2006, the Commission issued a notice determining not to review an ID (Order No. 14) granting the complainant's motion for partial summary determination to dismiss Epistar's affirmative defense that the '718 claims are invalid.

On August 2, 2006, the still pending motion to amend the complaint was discussed with the parties during the prehearing conference, and the evidentiary hearing was held from August 2-11, 2006. On October 23, 2006, the ALJ issued an ID (Order No. 29) granting Lumileds' motion to amend the complaint, and further ordering that the Notice of Investigation be amended to identify Philips as the complainant and to remove UEC as a named respondent. On November 13, 2006, the Commission published a notice determining not to review Order No. 29. 71 *Fed. Reg.* 66195.

On December 13, 2006, the Commission issued a notice determining not to review an ID (Order No. 31) extending the target date for this investigation to May 8, 2007, and the deadline for the ALJ's final initial determination to January 8, 2007.

On January 8 and 11, 2007, the ALJ issued his final ID and recommended determinations on remedy and bonding, respectively. The ALJ found a violation of section 337 based on his findings that the respondent's accused products infringe one or more of the asserted claims of the patents at issue. On January 22, 2007, the complainant and the respondent each filed a petition for review of the final ID. On January 29, 2007, all parties, including the Commission investigative attorney, filed responses to the petitions for review.

Upon considering the parties' filings, the Commission has determined to review-in-part the ID. Specifically, with respect to the '718 patent, the Commission has determined to review claim construction of the terms "substrate" and "semiconductor substrate" in claims 1 and 6, and the ALJ's determination that Epistar's GB I, GB II, OMA I, and OMA II LEDs do not infringe the '718 patent. With respect to the '580 and '316 patents, the Commission has determined to review claim construction of the term "wafer bonding" in claims 1-3, 8-9, 16, 18, 23-25, 27 and 28 of the '580 patent and claims 12-14 and 16 of the '316 patent. The Commission has determined not to review the remainder of the ID. On January 25, 2007, the respondent filed a motion to strike certain portions of complainant's petition for review. The Commission has determined to grant this motion to the extent that it concerns arguments that are based on evidence excluded by the ALJ.

On review, with respect to violation, the parties are requested to submit briefing limited to the following issues: the ALJ's addition of the limitation "must also be a material that provides adequate mechanical support for the LED device" to the construction of the term "substrate," and the implications of this addition for the infringement analysis. In addressing these issues, the parties are requested to cite relevant authority.

In connection with the final disposition of this investigation, the Commission may issue an order that results in the exclusion of the subject articles from entry into the United States. Accordingly, the Commission is interested in receiving written submissions that address the form of remedy, if any, that should be ordered. If a party seeks exclusion of an article from entry into the United States for purposes other than entry for consumption, the party should so indicate and provide information establishing that activities involving other types of entry either are adversely affecting it or likely to do so. For background, *see In the Matter of Certain Devices for Connecting Computers via Telephone Lines*, Inv. No. 337-TA-360, USITC Pub. No. 2843 (December 1994) (Commission Opinion).

When the Commission contemplates some form of remedy, it must consider the effects of that remedy upon the public interest. The factors the Commission will consider include the effect that an exclusion order and/or cease and desist orders would have on (1) the public health and welfare, (2) competitive conditions in the U.S. economy, (3) U.S. production of articles that are like or directly competitive with those that are subject to investigation, and (4) U.S. consumers. The Commission is therefore interested in receiving written submissions that address the aforementioned public interest factors in the context of this investigation.

When the Commission orders some form of remedy, the U.S. Trade Representative, as delegated by the President, has 60 days to approve or disapprove the Commission's action. *See* Presidential Memorandum of July 21, 2005, 70 *Fed. Reg.* 43251 (July 26, 2005). During this period, the subject articles would be entitled to enter the United States under bond, in an amount determined by the Commission and prescribed by the Secretary of the Treasury. The Commission is therefore interested in receiving submissions concerning the amount of the bond that should be imposed if a remedy is ordered.

WRITTEN SUBMISSIONS: The written submissions reference above should be concise and thoroughly referenced to the record in this investigation. Also, parties to the investigation, interested government agencies, and any other interested parties are encouraged to file written submissions on the issues of remedy, the public interest, and bonding. Such submissions should be no more than twenty-five (25) pages and should address the recommended determination by the ALJ on remedy and bonding. The complainant and the Commission investigative attorney are also requested to submit proposed remedial orders for the Commission's consideration. Complainants are also requested to state the dates that the patents at issue expire and the HTSUS numbers under which the accused products are imported. All of the written submissions and proposed remedial orders must be filed no later than close of business on March 5, 2007. Reply submissions must be filed no later than the close of business on March 12. No further submissions on these issues will be permitted unless otherwise ordered by the Commission.

Persons filing written submissions must file the original document and 12 true copies thereof on or before the deadlines stated above with the Office of the Secretary. Any person desiring to submit a document to the Commission in confidence must request confidential treatment unless the information has already been granted such treatment during the proceedings. All such requests should be directed to the Secretary of the Commission and must include a full statement of the reasons why the Commission should grant such treatment. *See* 19 C.F.R. § 210.6. Documents for which confidential treatment by the Commission is sought will be treated accordingly. All nonconfidential written submissions will be available for public inspection at the Office of the Secretary.

The authority for the Commission's determination is contained in section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. § 1337, and in sections 210.42-46 of the Commission's Rules of Practice and Procedure, 19 C.F.R. §§ 210.42-46.

By order of the Commission.

Marilyn R. Abbott
Secretary to the Commission

Issued: February 22, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT-EMITTING DIODES AND PRODUCTS CONTAINING SAME **337-TA-556**

CERTIFICATE OF SERVICE

I Marilyn R. Abbott, hereby certify that the attached **NOTICE OF COMISSION DECISION TO REVIEW-IN-PART A FINAL INITIAL DETERMINATION FINDING A VIOLATION OF SECTION 337 AND TO GRANT A MOTION TO STRIKE,** has been served on upon the Commission Investigative, Thomas S. Fusco, Esq., and all parties via first class mail and air mail where necessary on February 23, 2007.

Marilyn R. Abbott

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PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	**Inv. No. 337-TA-556**

RECOMMENDED DETERMINATION ON REMEDY AND BONDING

I. Background

On January 8, 2007, the Administrative Law Judge issued the Initial Determination in this investigation, finding that a violation of section 337 of the Tariff Act of 1930, as amended, has occurred in the importation into the United States, the sale for importation, or the sale within the United States after importation, of certain high-brightness light emitting diodes and products containing same by reason of infringement of one or more of the following: claims 1 and 6 of U.S. Patent No. 5,008,718, claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580, and claims 12-16 of U.S. Patent No. 5,502,316. The Commission's Rules require that subsequent to an initial determination on the question of violation, the Administrative Law Judge issue a recommended determination containing findings of fact and recommendations concerning: (1) the appropriate remedy in the event that the Commission finds a violation of section 337, and (2) the amount of bond to be posted by respondents during Presidential review of Commission action under section 337(j) of the Tariff Act. 19 C.F.R. § 210.42(a)(1)(ii).

As stated in the Initial Determination, the parties consist of: the complainant, Philips

Lumileds Lighting Company, LCC ("Lumileds"); the only remaining respondent, Epistar Corporation ("Epistar") of Taiwan; and the Commission Investigative Staff of the Office of Unfair Import Investigations ("OUII").

II. Remedy

Lumileds requests a limited exclusion order that excludes Epistar's infringing LEDs as well as third-party downstream products that incorporate those LEDs, including traffic signals and bulbs; automobile parts (not attached to automobiles) such as brake lights, indicators and signals; cell phones; optical mouse products; and indoor and outdoor displays and signs such as variable message signs. Lumileds does not request a cease and desist order. Lumileds argues that during the Presidential review period, an importation bond should be set at 100% of entered value of the infringing products. Lumileds argues that a 100% bond is necessary because it is impossible to calculate a bond based on price differential due to the large number of imported products and their widely ranging prices. Lumileds Post-Hearing Brief at 68-69; Lumileds Reply Brief at 34-35.

Epistar argues that it makes and sells only highly fungible LED chips (either diced or still in wafer form). Epistar represents that it does not package its own finished LED devices, or sell any packaged LEDs. It is argued that if a violation of section 337 is found, the appropriate remedy would be a limited exclusion order directed only to Epistar's products, rather than an order that included unspecified downstream products. [

] *See* Epistar Post-Hearing Brief at 69-73; Epistar Reply Brief at 42-47.

The Commission Investigative Staff argues that if a violation of section 337 is found, it would be appropriate for the Commission to issue a limited exclusion order directed to Epistar's infringing products and downstream products such as LED boards. The Staff argues for [ ], which should be applied to the value of LEDs alone rather than on the basis on an entire downstream products. *See* OUII Post-Hearing Brief at 42-47; OUII Reply Brief at 21-23.

A. Limited Exclusion Order

The Commission has broad discretion in selecting the form, scope, and extent of the remedy in a section 337 proceeding. *Viscofan, S.A. v. United States Int'l Trade Comm'n*, 787 F.2d 544, 548 (Fed. Cir. 1986). A limited exclusion order is among the remedies that the Commission may impose. *See* 19 U.S.C. § 1337(d)(1).

In this instance, there is no request for a general exclusion order, and it is undisputed that a limited exclusion order would be appropriate if any accused devices are found to infringe one or more of the patents.[1] Indeed, it is undisputed that the accused Epistar devices are manufactured overseas, and then imported for sale in the United States. Consequently, the Administrative Law Judge recommends that if a violation of section 337 is found, the Commission should issue a limited exclusion order. A question is raised, however, as to whether a limited exclusion order should extend to downstream products, and if so which types of downstream products should be excluded.

This investigation was instituted to determine whether Epistar's LEDs "or products containing same" are imported and sold in violation of section 337. Indeed, inasmuch as the

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[1] In the Initial Determination, the Administrative Law Judge found that the Epistar MB and MB II products at issue in this investigation infringe claims 1 and 6 of the asserted '718 patent. No other products were found to infringe any other asserted claim of any patent. *See, e.g.*, Initial Determination at 202-204.

accused LEDs are eventually incorporated into other products, it might be ineffectual to issue an exclusion order only against Epistar LEDs, if the devices could be imported after incorporation into other products or product components. Thus, an exclusion order covering at least some downstream products could be part of an appropriate remedy if a violation of section 337 is found to exist.

The Commission has held that in determining whether or not to exclude downstream products it will consider the so-called EPROM factors, set forth in *Erasable Programmable Read-Only Memories, Components Thereof, Products Containing Such Memories, and Process for Making Such Memories*, USITC Pub. 2196, Inv. No. 337-TA-276, Commission Opinion at 125-26 (May 1989),[2] which are:

> (1) the value of the infringing articles compared to the value of the downstream products in which they are incorporated; (2) the identity of the manufacturer of the downstream products, i.e., whether it can be determined that the downstream products are manufactured by the respondent or by a third party; (3) the incremental value to complainant of the exclusion of downstream products; (4) the incremental detriment to respondents of exclusion of such products; (5) the burdens imposed on third parties resulting from exclusion of downstream products; (6) the availability of alternative downstream products that do not contain the infringing articles; (7) the likelihood that the downstream products actually contain the infringing articles and are thereby subject to exclusion; (8) the opportunity for evasion of an exclusion order that does not include downstream products; (9) the enforceability of an order by Customs; and any other factors the Commission determines to be relevant.

Commission Opinion at 125-26; see *also Certain Flash Memory Circuits and Products Containing Same,* Inv. No. 337-TA-382, Commission Opinion at 18, USITC Pub. 3046 (July

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[2] *Aff'd sub nom., Hyundai Electronics Co. v. United States Int'l Trade Comm'n*, 899 F.2d 1204 (Fed. Cir. 1990)

1997).

The asserted patents in this investigation are directed to the manufacturing of individual LED chips. *See, e.g.*, CX-2; CX-3; CX-4. There is evidence that in the relevant industry, individual LED chips are typically sold by companies such as Lumileds and Epistar to packagers, which at present are all located outside the United States. Silkwood Tr. 474, 477, 484-485. The packaged LEDs are often placed in another downstream product which is then imported. Silkwood, Tr. 477. The first level of downstream product containing individual packaged LEDs is referred to as a "board." Silkwood Tr. 485. A board may have, for example, sixteen LEDs arranged in a 4x4 array. *Id.*

Epistar sells LED chips, i.e., unpackaged LEDs. Silkwood Tr. 477. In light of the fact that there are no domestic entities packaging LED chips, it is clear that any Epistar chips entering the United States are imported in downstream products. In these circumstances, the absence of downstream relief in any exclusion order would render the order wholly ineffective. Thus, any exclusion order should be directed to packaged LEDs as well as the boards on which the packaged LEDs are mounted.

However, a remedy should not exclude products that are further downstream such as traffic lights and cell phones. While there is record evidence concerning the industry practice of importing packaged LEDs and boards, Lumileds presented insufficient evidence regarding products further down the stream of commerce. While a packager or board manufacturer is presumably able to identify the source of its LEDs, in the next levels of commerce manufacturers or importers might not be able to identify the sources of LEDs used in their products. Nor is it clear how such information could be obtained by inspectors in the United

States. Indeed, it is possible that an order excluding products such as traffic lights and telephones might unnecessarily disrupt legitimate trade and should not be issued.

Any exclusion order, and especially one that includes downstream products, would burden Epistar or those wishing to purchase products containing accused devices. There is however, no evidence that such burdens would be particularly heavy in this instance or outweigh the necessity of including in any exclusion order packaged LEDs and the boards on which the packaged LEDs are mounted.

Accordingly, it is the recommended determination of the Administrative Law Judge that if the Commission determines that there has been a violation of section 337, a limited exclusion order should issue covering the infringing devices as well as packaged LEDs and boards on which the packaged LEDs are mounted. In accordance with the Staff's suggestion,[3] it is also recommended that any limited exclusion order also permit importers of packaged LEDs or boards to certify that no infringing LEDs are contained in such products.

B. Bond

The Administrative Law Judge and the Commission must determine the amount of bond to be required of respondents, pursuant to section 337(j)(3), during the 60-day Presidential review period following the issuance of permanent relief, in the event that the Commission determines to issue a remedy. The purpose of the bond is to protect the complainant from any injury. 19 C.F.R. § 210.42(a)(1)(ii), § 210.50(a)(3).

When reliable price information is available, the Commission has often set the bond by eliminating the differential between the domestic product and the imported, infringing product.

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[3] *See* OUII Reply Brief at 22.

See Certain Microsphere Adhesives, Processes for Making Same, and Products Containing Same, Including Self-Stick Repositionable Notes, Inv. No. 337-TA-366, Comm'n Op. a 24 (1995). In other cases, the Commission has turned to alternative approaches, especially when the level of a reasonable royalty rate could be ascertained. *See, e.g. Certain Integrated Circuit Telecommunication Chips and Products Containing Same, Including Dialing Apparatus*, Inv. No. 337-TA-337, Commission Op. at 41 (1995). A 100 percent bond has been required when no effective alternative existed. *See Certain Flash Memory Circuits and Products Containing Same*, Inv. No. 337-TA-382, USITC Pub. No. 3046, Comm'n Op. at 26-27 (July 1997)(a 100% bond imposed when price comparison was not practical because the parties sold products at different levels of commerce, and the proposed royalty rate appeared to be *de minimis* and without adequate support in the record).

In this instance, there is evidence of [

]

Further, the bond should be based on the value of any infringing LEDs actually contained in a downstream product, rather than on the value of a downstream product as a whole. It is important to avoid greatly disparate treatment among consumer products containing accused LEDs of comparable value.

III. Conclusions

In accordance with the discussion of the issues contained herein, it is the RECOMMENDED DETERMINATION ("RD") of the Administrative Law Judge that in the event that the Commission determines that the respondent has committed a violation of section

337, the Commission should issue a limited exclusion order that includes certain downstream products as discussed above. If the Commission imposes a remedy following a finding of violation, the respondent should be required to post a bond [ ] of the value of infringing LEDs imported during the Presidential review period.

The Secretary shall serve a confidential version of this RD upon counsel who are signatories to the Protective Order issued by the Administrative Law Judge in this investigation (Order No. 1), and the Commission investigative attorney. To expedite service of the public version, counsel for each party are hereby ORDERED to file by no later than January 19, 2007, a copy of this RD with those sections considered by the party to be confidential bracketed in red, or if confidential treatment is not requested for any portion of this RD, a statement to that effect.

Sidney Harris
Administrative Law Judge

Issued: January 11, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

CERTIFICATE OF SERVICE

I, Marilyn R. Abbott, hereby certify that the attached **Order** has been served on upon Thomas S. Fusco, Esq. and upon the following parties via first class mail, and air mail where necessary on June 13, 2007.

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CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

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UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of
CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

Notice

On this date, the Administrative Law Judge issued his initial determination finding a violation of section 337. The initial determination contains the following conclusions of law:

1. The Commission has personal jurisdiction over the parties, and subject matter jurisdiction over this investigation.
2. The Epistar GB and GB II products at issue in this investigation are not found to infringe claims 1 and 6 of the '718 patent.
3. The Epistar MB and MB II products at issue in this investigation are found to infringe claims 1 and 6 of the '718 patent.
4. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 1 and 6 of the '718 patent.
5. Epistar has not proven that its OMA and MB products are licensed under the '718 patent.
6. The Epistar GB and GB II products at issue in this investigation are not found to infringe claims 1-3 of the '580 patent.
7. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 1-3 of the '580 patent.

8. The Epistar MB and MB II products at issue in this investigation are not found to infringe claims 8-9 of the '580 patent.

9. The Epistar MB and MB II products at issue in this investigation are not found to infringe claims 16 and 18 of the '580 patent.

10. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 16 and 18 of the '580 patent.

11. The Epistar process of making the GB product at issue in this investigation is not found to infringe claims 25, 27 and 28 of the '580 patent.

12. The Epistar GB and GB II products at issue in this investigation are not found to infringe claims 12-14 and 16 of the '316 patent.

13. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 12-14 and 16 of the '316 patent.

14. It is not found by clear and convincing evidence that claims 1-3, 8-9, 16, 18, 25, 27 and 28 of the '580 patent are invalid for lack of written description and enablement under 35 U.S.C. ¶ 112.

15. It is not found by clear and convincing evidence that claims 1-3, 8-9, 16, 18, 25, 27 and 28 of the '580 patent are invalid as anticipated.

16. It is not found by clear and convincing evidence that claims 1-3, 8-9, 16, 18, 25, 27 and 28 of the '580 patent are invalid as obvious.

17. It is not found by clear and convincing evidence that claims 12-14 and 16 of the '316 patent are invalid for lack of written description and enablement under 35 U.S.C. ¶ 112.

18. It is not found by clear and convincing evidence that claims 12-14 and 16 of the

'316 patent are invalid as anticipated.

19. It is not found by clear and convincing evidence that claims 12-14 and 16 of the '316 patent are invalid as obvious.

20. Lumileds has satisfied the economic prong of the domestic industry requirement with respect to the '718, '580 and '316 patents.

21. Lumileds has satisfied the technical prong of the domestic industry requirement with respect to the '718, '580 and '316 patents.

Sidney Harris
Administrative Law Judge

Issued: January 8, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

CERTIFICATE OF SERVICE

I, Marilyn R. Abbott, hereby certify that the attached **Notice** has been served on upon Thomas S. Fusco, Esq. and upon the following parties via first class mail, and air mail where necessary on January 9, 2007.

Marilyn R. Abbott

Marilyn R. Abbott, Secretary
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CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

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PUBLIC VERSION

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, D.C.

In the Matter of **CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME**	**Inv. No. 337-TA-556**

INITIAL DETERMINATION
Administrative Law Judge Sidney Harris

Pursuant to the notice of investigation, 70 Fed. Reg. 73026 (2005), this is the Administrative Law Judge's Initial Determination in the Matter of Certain High-Brightness Light Emitting Diodes and Products Containing Same, United States International Trade Commission Investigation No. 337-TA-556. *See* 19 C.F.R. § 210.42(a).

The Administrative Law Judge hereby determines that a violation of section 337 of the Tariff Act of 1930, as amended, has occurred in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain high-brightness light emitting diodes and products containing same by reason of infringement of one or more of the following: claims 1 and 6 of U.S. Patent No. 5,008,718, claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580, and claims 12-16 of U.S. Patent No. 5,502,316.

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Findings of Fact

The following abbreviations may be used in this Initial Determination:

ALJ	-	Administrative Law Judge
ALJX	-	Administrative Law Judge Exhibit
CDX	-	Complainants' Demonstrative Exhibit
CPX	-	Complainants' Physical Exhibit
CX	-	Complainants' Exhibit
Dep.	-	Deposition
EDIS	-	Electronic Document Imaging System
FF	-	Finding(s) of Fact
JPX	-	Joint Physical Exhibit
JX	-	Joint Exhibit
PCL	-	Proposed Conclusion of Law (CPCL, RPCL or SPCL)
PFF	-	Proposed FF (CPFF, RPFF or SPFF)
PRF	-	Proposed Reply or Rebuttal Finding (CPRF, RPRF or SPRF)
RDX	-	Respondents' Demonstrative Exhibit
RPX	-	Respondents' Physical Exhibit
RX	-	Respondents' Exhibit
SX	-	Commission Investigative Staff Exhibit
Tr.	-	Transcript.

I. BACKGROUND

A. Institution and Procedural History of This Investigation

By publication of a notice of investigation in the *Federal Register* on December 8, 2005, the Commission instituted this investigation pursuant to subsection (b) of section 337 of the Tariff Act of 1930, as amended, to determine:

> [W]hether there is a violation of subsection (a)(1)(B) of section 337 in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain high-brightness light emitting diodes or products containing same by reason of infringement of one or more of claims 1 and 6 of U.S. Patent No. 5,008,718, claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580, and claims 12-16 of U.S. Patent No. 5,502,316, and whether an industry in the United States exists as required by subsection (a)(2) of section 337.

70 Fed. Reg. 73026 (2005).

The complainant named in the notice of investigation is Lumileds Lighting U.S., LLC of San Jose, California. The complainant is now known as Philips Lumileds Lighting Company, LCC ("Lumileds").[1] The Commission named as the respondents: Epistar Corporation ("Epistar") of Hsinchu, Taiwan; and United Epitaxy Company ("UEC") of Hsinchu, Taiwan. UEC merged with Epistar, and is no longer a respondent.[2] The Commission Investigative Staff of the Office of Unfair Import Investigations ("OUII") is also a party in this investigation.

On April 13, 2006, the Administrative Law Judge issued Order No. 14, an initial determination granting Lumileds' Motion No. 556-3 for partial summary determination to

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[1] *See* Order No. 29 (Initial Determination); Commission Decision Not to Review (Nov. 6, 2006).

[2] *Id.*

dismiss Epistar's affirmative defense that the '718 patent claims are invalid. Lumileds' motion arose out of the merger between Epistar and UEC, and [

].

The Commission determined not to review Order No. 14 (Initial Determination). Notice of Commission Determination Not to Review (May 15, 2006). Consequently, during the evidentiary hearing on the question of violation of section 337, Epistar was precluded from presenting affirmative defenses based on alleged invalidity of any claim of the '718 patent.

On July 31, 2006, pursuant to *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) *(en banc)*, *aff'd*, 517 U.S. 370 (1996), the Administrative Law Judge issued Order No. 27, construing several disputed terms contained in the patent claims at issue in this investigation.

The evidentiary hearing on the question of violation of section 337 commenced on August 2, 2006, and concluded on August 11, 2006.

All parties have filed post-hearing briefs and reply briefs, with proposed findings of fact and conclusions of law.

B. The Products at Issue

The products at issue are high-brightness light-emitting diodes or "LEDs" capable of producing a beam of light brighter than that of conventional LEDs previously manufactured. High-brightness LEDs can be used for applications in which conventional LEDs had already been widely employed, and also for applications in which LEDs had not been employed at all, including traffic lights, automobile lights, outdoor advertising signs and numerous other applications.[3] Epistar's high-brightness LEDs that are the subject of this investigation have the following product designations OMA (I), OMA II, MB (I), MB II, GB (I) and GB II. Epistar's product designations are based on particular manufacturing characteristics. OMA refers to "Omnidirectional Mirror Adhesion." GB refers to "Glue Bond." MB refers to "Metal Bond."[4]

II. IMPORTATION AND SALE

Epistar argues that it sells very few of its products directly to customers in the United States. Nevertheless, Epistar admits that some sales have occurred. Moreover, Epistar does not contest the fact that the importation or sale requirement of section 337 is satisfied.[5]

III. CLAIM CONSTRUCTION

This is a patent-based investigation. Any finding of infringement or non-infringement requires a two-step analytical approach. First, the asserted claims of a patent must be construed as a matter of law to determine their proper scope. Second, a factual determination must be made as to whether the properly construed claims read on an accused device.[6] Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy.[7]

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[3] Dupuis Tr. 2006; Silkwood Tr. 448.

[4] Epistar Amended Response to the Complaint, ¶¶ 21, 80; CX-592C at 81, 100.

[5] *See* Epistar's Prehearing Statement at 10; Epistar Post-Hearing Brief at 70-71.

[6] *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995)(*en banc*), *aff'd*, 517 U.S. 370 (1996).

[7] *Vivid Tech., Inc. v. American Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Claim construction begins with the language of the claims themselves, which should be given its ordinary and customary meaning as understood by a person of ordinary skill in the art, viewing the claim terms in the context of the entire patent.[8] In some instances, claim terms do not have particular meaning in a field of art, and claim construction involves "little more than the application of the widely accepted meaning of commonly understood words."[9] In many cases, claim terms have a specialized meaning, and it is necessary to determine "what a person of skill in the art would have understood disputed claim language to mean," by analyzing "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art."[10]

In cases in which the meaning of a claim term is uncertain, the specification usually is the best guide to the meaning of the term.[11] As a general rule, the particular examples or embodiments discussed in the specification are not to be read into the claims as limitations.[12] However, the specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term."[13] Moreover, "[t]he

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[8] *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005), *cert. denied*, 126 S.Ct. 1332, 164 L.Ed.2d 49 (2006).

[9] *Id.* at 1314 ("In such circumstances, general purpose dictionaries may be helpful.").

[10] *Id.* (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)).

[11] *Phillips*, 415 F.3d at 1315.

[12] *Markman*, 52 F.3d at 979.

[13] *Phillips*, 415 F.3d at 1315 (citations omitted).

construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction."[14]

If the intrinsic evidence does not establish the meaning of a claim, then extrinsic evidence may be considered. Extrinsic evidence consists of all evidence external to the patent and the prosecution history, including inventor testimony, expert testimony and learned treatises. *Phillips*, 415 F.3d at 1317. Such evidence may be considered if a court deems it helpful in determining "the true meaning of language used in the patent claims." *Id.* at 1318. With respect to expert testimony, "a court should discount any expert testimony that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent." *Id.*

On July 31, 2006, the Administrative Law Judge issued Order No. 27 construing most of the disputed claims of the three patents-in-suit. Order No. 27 is incorporated herein in its entirety. The Administrative Law Judge construes the remaining three terms at issue below. The Administrative Law Judge has considered arguments made both in the parties' claim construction briefing, as well as in post-hearing submissions.

A. Person Of Ordinary Skill In The Art

Claim terms are to be given their ordinary and accustomed meaning as understood by one of ordinary skill in the art.[15] In Order No. 27, the Administrative Law Judge has defined a person of ordinary skill in the art as:

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[14] *Id.* at 1316.

[15] *See Phillips* 415 F.3d at 1312-13 (internal citations omitted).

a) a doctorate (PhD) degree in engineering, materials science, physics or related field and at least two years of work experience in LED semiconductor design or fabrication; or

(b) a master's (M.S.) degree in the same field and at least five years of experience in LED semiconductor design and fabrication.[16]

As such, the remaining disputed terms will be construed based on the above definition.

B. Disputed Terms

1. Wafer Bonding ('580 and '316 patents)

The parties have proposed the following claim construction of the term **"wafer bonding"**:[17]

Lumileds	**Epistar**	**Staff**
Joining wafers or the like together to provide a mechanically robust joined structure. Van der Waals or electro-static bonding is not wafer bonding because it does not provide sufficient mechanical strength.	Bringing two clean, flat, smooth, solid wafer surfaces into physical contact such that a bond forms between them. Van der Waals bonding is excluded from wafer bonding in this patent because it does not provide a bond with sufficient mechanical strength nor sufficient electrical conductivity.	Bringing two clean, flat, smooth, solid wafer surfaces into physical contact such that a bond forms between them. Van der Waals or electro-static bonding is not wafer bonding for purposes of the claims of the '580 patent.

Lumileds argues that its proposed construction "follows from the plain meaning of 'wafer bonding' and its usage in the '580 Patent."[18] In support of its construction, Lumileds cites to the McGraw-Hill Electronics Dictionary which broadly defines bonding as "[t]he joining of metallic or nonmetallic materials by soldering, cementing, or adhering, such as securing a semiconductor

[16] Order No. 27 at 10.

[17] *See* Joint Revised Claim Chart ("JRC") dated 5/24/06 at 4, 5, 7 and 8.

[18] Lumileds Replacement Claim Construction Br. ("CCBr.") dated 7/07/06 at 60.

chip to a lead frame or substrate."[19] In further support of its construction, Lumileds cites to several passages from the specification which contain "descriptions of the various embodiments [that] repeatedly refer to 'joining' different types of wafers and structures."[20]

Lumileds contends that Epistar tries to justify its overly narrow construction "by conveniently claiming that the meaning of 'wafer bonding' changed just after the '580 patent was filed.[21] However, Lumileds asserts that Epistar employees have admitted that glue bonding and metal bonding are examples of wafer bonding.[22] In addition, Lumileds contends that "wafer bonding" does not require "flat" and "smooth surfaces" because such a requirement "directly conflicts with the '580 Patent."[23] According to Lumileds, the specification "makes clear that wafer bonding may involved 'patterned' wafers, in which depressions are etched into the surfaces of wafers to redirect current flow and light emissions."[24] Lumileds argues that those wafers are neither flat nor smooth as Epistar argues they must be.[25]

Finally, Lumileds contends that van der Waals bonding must be excluded from the definition of "wafer bonding" as the term is used in the '580 patent.[26] According to Lumileds,

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[19] *Id.* (citing McGRAW-HILL ELECTRONICS DICTIONARY (6th ed. 1997)).

[20] *Id.* at 61 (citing '580 patent, 10:47-50; 15:58-62).

[21] *Id.* at 63 n.31.

[22] *Id.* at 67 (citing M.J. Jou Dep. at 47:16-48:6).

[23] *Id.* at 62.

[24] *Id.* (citing *e.g.*, 5:13-24; 10:37-11:37, discussing Figs. 13-17); Lumileds Post-Hearing Brief at 15.

[25] *Id.* at 62.

[26] *Id.* at 68.

the specification "distinguishes the weaker van der Waals bonding from the stronger wafer bonding of the invention."[27]

Epistar argues that "one skilled in the art at the time of the '580 patent filing, March 1993, would have understood the term 'wafer bonding' to refer to the direct bonding of two wafer surfaces without any intervening adhesives o[r] metals."[28] According to Epistar, "Lumileds presented no evidence to contra[di]ct this fact" and cited to only two of two hundred references that "used the term wafer bonding to include indirect types of bonding such as glue or metal to metal bonding."[29]

In addition, Epistar argues that "wafer bonding" occurs when two clean, flat, smooth, solid wafer surfaces are brought into physical contact such that a bond forms between them.[30] According to Epistar, the patent discusses "wafer bonding" "almost exclusively in terms of bonding two semiconductor layers together."[31] Epistar does indicate, however that "wafer bonding" may occur between LED semiconductor layers and a mirror, or between LED semiconductor layers and a layer of glass.[32]

In addition, Epistar contends that:

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[27] *Id.* (citing '580 patent, 5:25-30; 13:10-14).

[28] Epistar Post-Hearing Brief at 33.

[29] *Id.* (citing RPFF 685, 686).

[30] Epistar's Revised Claim Construction Brief (7/17/06) at 46 (citing '580 patent, 7:1-9).

[31] *Id* at 46.

[32] *Id.* at 46-47 (citing '580 patent, 12:66-13:10; 9:27-45 and Jokerst Decl. at ¶43).

> Nowhere in the patent is there any mention of bonding using intermediate metal or adhesive layers. The only detailed explanation of how to wafer bond describes the direct contact between two semiconductor wafer surfaces that have been cleaned of any contaminates and oxides. All other disclosed embodiments are consistent with the direct bonding of two solid layers.[33]

According to Epistar the reference in the '580 patent to a layer of oxide or glass does not disclose the use of an adhesive layer as Lumileds argues, but instead acts as a "transparent layer" within the meaning of claim 1.[34]

Epistar criticizes Lumileds' approach to claim interpretation which construes claims "based upon general dictionary definitions divorced from the usage in the patent."[35] Epistar further argues that the testimony of Dr. Dupuis on claim construction is "admittedly inconsistent with the patent disclosure" since Dr. Dupuis "acknowledges that the patent specification makes no mention of either glue or metal-to-metal bonding."[36]

In its post-hearing submissions, Lumileds responds to several of the arguments made by Epistar. First, Lumileds asserts that Epistar's proposed construction which defines wafer bonding only to include semiconductor to semiconductor bonds "would exclude several disclosed embodiments from the scope of the claims and, therefore, cannot be correct."[37] Specifically, Lumileds points to Figure 10 of the '580 patent which depicts "a layer 52 of glass"

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[33] Epistar Post-Hearing Brief at 34 (citing CX-3 at 12:34-13:14).

[34] *Id.* at 34-35 (citing CX-3 ('580 patent) at 9:23-26).

[35] *Id.* at 35 (citing *Phillips*, 415 F.3d at 1321-22).

[36] *Id.* (citing RPFF 722, 731).

[37] Lumileds Post-Hearing Brief at 14 (citing *Medrad, Inc. v. MRI Devices Corp.*, 401 F.3d 1313, 1320 (Fed. Cir. 2005)).

being brought into contact with "buffer layer 32" "to form[] a wafer bond between the layers"[38] and Figure 11 of the '580 patent which "depicts a 'mirror' that has been 'wafer bonded' to LED layers."[39] According to Lumileds, "both parties' experts agree [that] mirrors can be made of metal."[40] In addition, Lumileds argues that embodiments in the '580 patent with patterned surfaces "would also be excluded under Epistar's construction, which requires that surfaces be 'smooth,' 'clean,' and 'flat.'"[41] According to Lumileds, Epistar derives the 'flat, clean, smooth' requirement from the description of a single preferred embodiment."[42] Lumileds, however, indicated that "only one of the wafers [in that preferred embodiment] is described as having a smooth, clean, and flat surface."[43]

With respect to Epistar's argument that the patent refers only to "bonds" rather than "wafer bonds" to describe bonds between metallized contacts in an LED structure, Lumileds argues that "Epistar attempts to confuse the clear intrinsic record by citing to snippets of the '580 Patent and prosecution history of the '316 Patent," including a description of Figure 10.[44] Lumileds refers to Figure 10 which shows a small area of contact metallization and explains that the patent refers to the "bond" between the metallized contacts rather than the "wafer bond"

[38] *Id.* (citing CX-3 ('580 patent) at 9:11-12, 9:22-26).

[39] *Id.* at 15 (citing CX-3 ('580 patent) at 9:27-28).

[40] *Id.* (citing Dupuis Tr. 820:20-821:9, 823:23-824:20; Jokerst Tr. 1794:18-1795:3).

[41] *Id.* (citing CX-3 at 11:67-12:6).

[42] *Id.*

[43] *Id.* at 15-16.

[44] *Id.* at 16

because "each metal contact that is bonded is very limited in size compared to the surrounding layer."[45] According to Lumileds, "the statement in the patent relied upon by Epistar is not a disavowal of metal bonding, but rather a recognition that 'small area contacts' may not form wafer bonds."[46]

Lumileds further argues that there are "unequivocal assertions that metal bonding is a form of wafer bonding" in the prosecution history of the '316 patent.[47] According to Lumileds, Epistar attempts to overcome these assertions by pointing to the following statement by the applicant to overcome an obviousness rejection: "Jokerst [48] et al., ... teaches nothing about the fabrication of an LED with a wafer bond and suggests only two ways to bond semiconductor surfaces together."[49] According to Lumileds, "[t]his snippet does not disclaim metal bonding.... Instead, this passage emphasizes that the Jokerst patent does not teach the '*fabrication of an LED* with a wafer bond' because the Jokerst reference uses metal-to-metal wafer bonding to attach LEDs that *were already fabricated* into an integrated array."[50]

Furthermore, Lumileds also contends that "[t]he evidence also overwhelmingly indicates

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[45] *Id.* (citing CX-3 ('580 patent) at 8:61-64).

[46] *Id.*

[47] *Id.* at 17.

[48] U.S. Patent No. 5,280,184.

[49] Lumileds Post-Hearing Brief at 17 (citing CX-36 ('316 prosecution history) at LLITC 405-406).

[50] *Id.* (emphasis in original).

that those in the art consider metal bonding to be a type of wafer bonding."[51] Finally, Lumileds argues that Dr. Dupuis has refuted Dr. Jokerst's claim that "wafer bonding meant something different at the time of the patent, and changed due to the so-called 'term creep' resulting from a purported avalanche of government money provided for 'wafer-bonding' research."[52]

According to the Staff in its claim construction brief, the '580 patent does not provide a definition for the term "wafer bonding." The Staff further indicates, however, that the specification and prosecution history do appear to exclude van der Waals forces (electrostatic bonds) from the definition of "wafer bonding."[53] The Staff further argues that "the evidence demonstrates that a person of ordinary skill in the art, at the time the patent application was filed (1993), thought of 'wafer-bonding' as being narrower than just *any* method for bonding two wafers."[54] In support of its conclusion, the Staff relies upon the work of Professor Stefan Bengtsson[55] which describes the "wafer bonding mechanism" as follows:

> If two clean and exceptionally flat and smooth surfaces are brought into contact at room temperature, a weak bond between the surfaces develops. The bonded materials can be metals,

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[51] *Id.* at 18 (citing Bretscher Decl., Ex 43 at EC 096946).

[52] *Id.* at 18 (citing Dupuis Tr. 828:24-831:24, 1955:12-1957:11).

[53] Staff Claim Construction Br. ("CCBr.") at 15 (citing '580 patent, 5:27-30; 13:9-16).

[54] OUII Post-Hearing Brief at 17 (emphasis in original).

[55] RX-105 ("Semiconductor Wafer Bonding: A Review of Interfacial Properties and Applications," 21 *Journal of Electronic `Materials* No. 8 (1992)).

semiconductors, or insulators.[56]

The Staff continues that "[i]f the two wafers are subjected to heat treatment, the weak bond that is formed at room temperature 'is replaced by a much stronger bonding.'"[57] The Staff further refines its construction with reference to the prosecution histories of the '580 and '316 patents. The Staff argues that the applicants for the '580 and '316 patents specifically "distinguished their claimed wafer bonding step from prior art processes involving van der Waal's bonding or metal-to-metal annealing."[58] According to the Staff, Dr. Dupuis "admitted that the inventors were 'excluding' metal to metal annealing because it formed an opaque bond."[59]

"Wafer bonding" is the focus of the '580 and '316 patents and is required by each of the asserted claims of the '580 patent. There does not seem to be a dispute among the parties that the specification of the '580 and '316 patents discloses how to wafer bond two layers of material which may include semiconductor layers, a mirror, or a layer of glass[60] or that the bond produced must be mechanically robust.[61] At issue then is whether, the specification also discloses the use of an adhesive layer of metal to metal annealing.

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[56] OUII Post-Hearing Brief at 18 (citing RX-105 ((Bengtsson article) at LLITC 00089840).

[57] *Id.* (citing RX-105 at LLITC 00089841).

[58] *Id.* (citing CX-36 ('316 prosecution history) at LLITC 00000204).

[59] *Id.* (citing Dupuis Tr. 825:17-20).

[60] Lumileds asserts in its post-hearing brief that Epistar's proposed construction of "wafer bonding" covers only semiconductor to semiconductor bonding. In its claim construction brief, however, Epistar indicated that wafer bonding could also occur between semiconductors layers and a mirror or between semiconductor layers and a layer of glass as illustrated in Figures 10 and 12. Epistar CCBr. at 46-47.

[61] *See* JRC at 4.

Based upon an examination of the intrinsic evidence and consideration of the arguments of the parties, the Administrative Law Judge agrees with Epistar and the Staff that, within the context of the patents-in-suit, the term "wafer bonding" has a meaning more narrow than just the bonding together of two wafers by any method. The plain meaning of the term "wafer bonding" would appear to be simply the bonding of two wafers, and when the specification discusses how to perform wafer bonding, it describes in detail the placement of two wafers face to face which are then subjected to high heat and pressure.[62] The Administrative Law Judge does not find that the '580 and '316 patents provides guidance as to other ways to perform "wafer bonding." Drs. Jokerst and Dupuis agree.[63]

Specifically, the Administrative Law Judge finds that the specification does not discuss the use of any type of adhesive layer to "glue bond" wafers together. The Administrative Law Judge understands glue bonding to refer to the use of an adhesive such as [ ] or spin-on glass to glue two wafers together.[64] In her testimony, Dr. Jokerst indicates that the process of glue bonding is quite different from semiconductor-to-semiconductor wafer bonding. According to Dr. Jokerst, glue bonding is "easy" as the condition (e.g., cleanliness and smoothness) of the wafers is not as important as with wafer bonding because the glue will fill in any gaps on the wafers to be bonded.[65] In addition, processing temperatures with glue bonding are limited to less

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[62] *See* CX-3 ('580 patent) at 12:34-65 (Reduction to Practice).

[63] *See* Jokerst Tr. 1661; Dupuis Tr. 1095, 2052.

[64] *See* Jokerst Tr. 1659-60.

[65] *See id.* at 1660.

than 400°C and the use of an adhesive creates an insulating bond.[66]

Lumileds, however, bases its argument that glue bonding is disclosed in part on a discussion in the specification related to the use of glass.[67] The specification provides the following discussion of the semiconductor-glass bonds disclosed in the patent:

> Superior bonding strength has been observed for semiconductor-glass bonds, as compared to semiconductor-semiconductor bonds. The same is true of semiconductor-SiO_2 bonds as compared to semiconductor-semiconductor bonds. Thus, for reasons of mechanical integrity it may be desirable to form transparent substrate LEDs by fabricating a sandwich of semiconductor-glass-semiconductor or a sandwich of semiconductor-SiO_2-semiconductor.

The Administrative Law Judge does not conclude from this passage, that the glass layer here is being used as "glue." Instead, the glass is itself one of the wafers that is being wafer bonded in a process that is different from the use of an adhesive. Furthermore, the glass layer 52 in figure 10 appears to be functioning as a "transparent layer" within the meaning of claim 1 rather than as a glue.[68]

There was some testimony during the hearing that "spin-on glass" could be used as an adhesive in the fabrication of LEDs. The Administrative Law Judge, however, finds that while the use of a layer of "glass" to be wafer bonded is disclosed, the use of "spin-on glass" is not disclosed in the specification of the '580 patent. The evidence simply indicates that "glass" and

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[66] *See id.*

[67] *See* Lumileds Post-Hearing Brief at 36-37.

[68] *See* CX-3 ('580 patent) at 9:23-26 ("The surface of layer 52 is the brought into contact with the surface of the buffer layer 32, and treatment forms a wafer bond between the layers. Annealing will enhance the bonding strength between the materials.").

"spin-on glass" are not the same material so that one may not extrapolate from the disclosure of one to the disclosure of the other. Such a conclusion is supported by the testimony of Dr. Garrou, Epistar's expert on adhesives, who explained that "glass" and "spin-on glass" are in fact two different things, with the second being a precursor to the first.[69]

Moreover, under the circumstances presented here, the Administrative Law Judge does not give weight to Lumileds' argument that those of ordinary skill in the art understand the term "wafer bonding" to encompass glue bonding because Lumileds has cited to contemporary Epistar documents and references to make its point rather than documents from the time of the filing of the '580 patent application in 1993.[70]

Nor does the Administrative Law Judge find that the specification supports the conclusion that metal to metal bonding should be encompassed by the term "wafer bonding." The Administrative Law Judge understands that in metal-to-metal bonding, layers of metals are used as a type of adhesive to bond wafers together.[71]

The patent refers to the use of metal in several examples. First, there is a discussion regarding the use of a "metallization scheme" on the LED structure depicted in Figure 6 that employs "thin contact areas" on the upper surface of the substrate 42 to be wafer bonded and the

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[69] Specifically, Dr. Garrou stated that "[s]pin-on-glass is not a glass. It is a material that can be a precursor to glass, but it contains a significant amount of organic material." Garrou Tr. 1614:3-6.

[70] *See* Lumileds Post-Hearing Brief at 37.

[71] *See* Jokerst Tr. 1661-62.

lowermost layer 32 of the LED structure.[72] The specification notes that "[t]he anneal achieves a wafer bond in the non-metallized areas and a bond at the metallized contacts. (emphasis added)" Thus, the patent recognizes that this particular use of metal in the bonding process forms a bond rather than a wafer bond, and therefore, cannot support a conclusion that metal-to-metal bonding as wafer bonding is disclosed in the patent.[73]

In addition, the specification refers to the bonding of a mirror to an LED structure.[74] Though the patent only specifies that the mirror must be made of an "electrically conductive material," Lumileds assumes that the mirror will be made of metal.[75] Even if the mirror is made of metal, the Administrative Law Judge does not agree that the disclosure of bonding a metal mirror would amount to the disclosure in the specification of metal-to-metal bonding, such that it would be appropriate to include metal-to-metal bonding within the meaning of "wafer bonding" as defined by the '580 patent. Significantly, metal-to-metal bonding requires more than just the use of metal in an LED structure. Rather, it requires the use of specific metals heated at specific temperatures such that they will function as an adhesive to bond wafers together. Specifically, as Dr. Jokerst, an expert on metal bonding, explained:

> [Y]ou've got to be very careful about what metals you use, and

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[72] *See* CX-3 ('580 patent) at 8:52-58; *see also* CX-3 ('580 patent) at 9:11-26 (discussion Figure 10).

[73] In its post-hearing submission, Lumileds acknowledges that the bonding of the metallization contacts as described in the patent does not form a wafer bond. *See* Lumileds Post-Hearing Brief at 16.

[74] *See* CX-3 ('580 patent) at 9:27-28.

[75] Lumileds Post-Hearing Brief at 15 (citing Dupuis Tr. 820:20-821:9, 823:23-824:20; Jokerst Tr. 1794:18-1795:3.

> you'll see here, I'm showing three metals deposited because it's typical, you have to use three metals, some of them very expensive, like platinum, because the metals literally interact with what they're deposited on and with each other.
>
> So we've deposited our three metals, one for adhesion, one for diffusion barrier, one for bonding. We bring them together, we heat those metals up to the melting point, and then we cool them down again. So let's look at some advantages and disadvantages now of metal-to-metal bonding. Metal-to-metal bonding is harder than glue bonding.[76]

The patent specification gives absolutely no indication that the mirror is being used as an adhesive. Furthermore, the patent does not provide instructions as to how to perform metal bonding. Lumileds argues that the prosecution history for the '316 patent makes explicit that at least metal-to-metal bonding should be included as "wafer bonding" because of certain references made to metal-to-metal bonding as wafer bonding by the applicant or Examiner.[77] For example, in response to an obviousness rejection based upon the combination of the Fletcher '718 patent in view of the Jokerst '184 patent, the applicant made the following comments:

> Jokerst et al., U.S. Patent No. 5,280,184 ("Jokerst") teaches nothing about the fabrication of an LED with a wafer bond and suggests only two ways to bond semiconductor surfaces. These are by using van der Waals (electrostatic) forces or metal-to-metal bonding.[78]

Though it is true that the applicant, at other times, refers to the metal-to-metal annealing taught in

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[76] Jokerst Tr. 1662:3-17.

[77] *See* Lumileds Post-Hearing Brief at 17.

[78] CX-36 ('316 prosecution history) at LLITC00000405-406.

Jokerst as wafer bonding,[79] the applicant also distinguishes in the passage above the bonding taught in Jokerst (whether or not one calls it wafer bonding) from the type of "wafer bonding" of semiconductor surfaces that is disclosed in the '580 and '316 patents. As the Administrative Law Judge must interpret the claims in light of what is contained in the intrinsic evidence, the Administrative Law Judge concludes that metal-to-metal bonding is also not a type of "wafer bonding" within the meaning of the '580 patent.

Epistar and the Staff would also include within the definition of "wafer bonding" that the wafers must be clean, flat, smooth, and solid. Epistar and the Staff base their proposed construction on a preferred embodiment in the patent.[80] The specification, however, specifically provides examples in which the wafers used for wafer bonding are patterned such that they are neither flat, nor solid.[81] Furthermore, testimony indicates that III-V semiconductors are often not flat or smooth.[82] The Administrative Law Judge further concludes that requiring that the wafers involved in the wafer bonding process must be "clean, flat, smooth and solid" would be unnecessarily importing a limitation from the specification into the claims.

Accordingly, the Administrative Law Judge concludes that the term "wafer bonding" means the bringing of two wafer surfaces into physical contact such that a mechanically robust bond forms between them. The type of wafers that may be wafer bonded is not strictly limited to semiconductors, but may also include glass or a mirror. Furthermore, Van der Waals bonding,

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79 *See, e.g.,* CX-36 ('316 prosecution history) at LLITC00000204.

80 CX-3 ('580 patent) at 7:1-9; 12:66-13:7.

81 *See, e.g.*, CX-3 ('580 patent) Figures 10, 13, 14-16 and accompanying text.

82 Kish Tr. 337:7-16.

metal-to-metal bonding and glue bonding are not wafer bonding within the meaning of the '580 and '316 patents.

2. Interface ('580 patent)

The parties disagree on the claim construction of the term **"interface"** in claims 8 and 23 as follows:[83]

Lumileds	Epistar	Staff
A shared boundary, junction, or interconnection.	The shared boundary.	A shared boundary or junction.

Lumileds contends that "interface" should be given its ordinary meaning of "a shared boundary, junction, or interconnection."[84] Lumileds argues that "interface" must be defined broadly enough to encompass intervening layers of material" as the '580 patent "repeatedly describes that interface as having certain physical properties like any layer of material, and not as a material-less two-dimensional plane."[85] In support of its argument, Lumileds cites to Figures 10 and 12 of the '580 patent that show a "conductive interface" which is a "thickness of material" between the substrate and the semiconductor layers, and therefore, would act as an intervening layer.[86] In addition, Lumileds argues that Epistar's construction would exclude a preferred embodiment from the scope of the claim.[87] Lumileds also indicates that claim 22 refers

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[83] *See* JRC at 5.

[84] Lumileds CCBr. at 83 (citing Bretscher Ex. 12 at 7232 (McGraw-Hill Electronics Dictionary (6th ed. 1997)).

[85] *Id.* at 85.

[86] *See id.*

[87] Lumileds Post-Hearing Brief at 20.

to a tunnel junction as being "at the interface of the first and second LED structures."[88] According to Lumileds, the tunnel junction is described as a two layer structure and therefore would not be covered by Epistar's proposed construction of an "interface."[89]

Lumileds further asserts that although Epistar now argues that an "interface" must be a two-dimensional boundary, Epistar understood prior to this investigation that an interface "could refer to a three-dimensional layer of material."[90] According to Lumileds, Epistar filed for a patent in 2002 which refers "to an ITO layer in an LED as an 'interface layer.'"[91]

Epistar argues the term "interface has a generally accepted meaning, namely the 'shared boundary.'"[92] Thus, Epistar contends, "unless the permanent substrate and the semiconductor LED layers come into contact at a shared boundary, there is no 'interface' between them."[93] Epistar further refers to the language of claim 23 as informing the proper construction of "interface." According to Epistar, claim 23 requires a "first layer" to be wafer bonded to a "second layer" and describes those two layers as being "joined at an interface."[94]

Epistar further argues that Lumileds' proposed construction is "impermissibly broad and

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[88] *Id.*

[89] *Id.*

[90] *Id.*

[91] *Id.* (citing CX-638 at Col. 2, ¶0018 lns. 4-7 and Col. 2 ¶0019 lns 13-14; CCF 1931-34).

[92] Epistar CCBr. at 50.

[93] *Id.*

[94] *Id.* at 50-51 (citing '580 patent 18:64-65).

vague" because it includes a junction or interconnection.[95] Epistar notes that Lumileds' expert defined "interconnection" as occurring "if the two layers are joined in any manner no matter how distant and no matter now many distinct intervening layers separate the two layers."[96] According to Epistar, inclusion of "interconnection" in a construction of "interface" would "broaden the scope of the claim language beyond the meaning that language would have to one of ordinary skill in the art."[97]

In addition, Epistar argues that the patent "uses the term 'junction' as a term distinct from a shared boundary, making clear, for example, that a tunnel junction may be formed at the interface of two different LED layers when those layers are bonded directly together."[98]

The Staff "submits that the proper construction should be reached in the context of claim 8 rather than by examining the single word in a vacuum."[99] The Staff is of the view, therefore, that for the purposes of claim 8, the only "interface" of concern "is the shared boundary between the permanent substrate and the LED layers."[100] Thus, the Staff concludes that "interface" should be given its ordinary dictionary definition of "shared boundary or junction."[101] The Staff further indicates that "while some portions of the specification appear to suggest that the "interface"

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95 *Id.* at 51.

96 *Id.*

97 *Id.* at 52; Epistar Post-Hearing Brief at 38 (citing RPFF 666).

98 Epistar Post-Hearing Brief at 37 (citing RPFF 665)(emphasis in original).

99 Staff CCBr. at 17.

100 *Id.*

101 *Id.*

may have a very small thickness ("An interface that has undergone wafer bonding has been observed to exhibit misfit dislocations that primarily consist of "edge dislocations," Col. 4, lines 36-38), the Staff does not agree with Lumileds's contention that an "interface" can be several layers of material in thickness."[102] The Staff further notes that "[t]o the extent a given 'interface' has some thickness, such an interface would constitute a "junction" in accordance with the Staff's construction."[103]

The administrative law judge finds that the plain and ordinary meaning of the term "interface" is shared boundary or junction which is consistent with the way in which the term is used in the '580 and '316 patents.[104] When the term "interface" is used in the patents-in-suit, it typically refers to the place where two surfaces meet each other directly, with no intervening layers:

- ". . . a low resistance interface between the second substrate (**40**) and the LED layers (**42**)."[105];
- ". . . the total area covered by the contact should be sufficiently small that the interface between the LED structure and the substrate **42** allows the passage of light. . . ."[106]; and
- ". . . depressions (**148** and **150**) limit the area of electrical contact at the

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[102] OUII Reply Brief at 9.

[103] *Id.*

[104] CX-71 (McGraw-Hill Electronics Dictionary) at 232.

[105] Abstract.

[106] CX-3 ('580 patent) at 8:61-64.

interface."[107]

However, the language of claim 22 also refers to a "tunnel junction at the interface of the first and second LED structures" which is depicted in Figure 12 of the specification as having some thickness.[108] Such an "interface" must also be accounted for in any construction of the term. The use of small metallic contacts that do not cover the entirety of a layer as illustrated in Figure 10 must also be covered. The plain and ordinary definition for the term would appear to cover each of the ways "interface" is used in the patent, including in Figure 10 because the layers between which the small metal contacts are placed actually come into direct contact.

Lumileds, however, seeks to include "interconnections" in the definition which would appear to encompass multiple layers of a structure without limitation. In fact, Dr. Dupuis' testimony at the hearing makes clear that Lumileds does include multiple layers of materials within its definition of "interface."[109] The Administrative Law Judge finds that such a construction would be overly broad and further finds that the intrinsic evidence provides no basis for deviating from the plain meaning of the term. Accordingly, the Administrative Law Judge concludes that "interface" means a shared boundary or junction which may have some thickness.[110]

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[107] CX-3 ('580 patent) at 11:8-9.

[108] *See* CX-3 ('580 patent) at 18:59-61; *see also* 4:36-38 ("An interface that has undergone wafer bonding has been observed to exhibit misfit dislocations that primarily consist of "edge dislocations").

[109] *See* Dupuis Tr. 852:23-853:15.

[110] Lumileds argues that Epistar's proposed construction of a "shared boundary" renders certain claim language of the '316 patent superfluous. Lumileds point to claim 12 which recites (continued...)

3. LED Layers ('580 patent)

The parties disagree on the claim construction of the term **"LED layers"** in the claims of the '580 patent as follows:[111]

Lumileds	**Epistar**	**Staff**
Layers that form a light emitting diode or LED structure. The LED layers that form an LED structure may consist of a light emitting active layer, upper and lower confining layers, current spreading and light extraction layers and one or more buffer layers, but this is not critical.	Epitaxial semiconductor layers that form a p-n junction for emitting light and, optionally, any cladding, buffer, or current spreading and light extraction layers that are epitaxially grown.	Layers that form a light emitting diode or LED structure. The LED layers that form an LED structure may consist of a light emitting active layer, upper and lower confining layers, current spreading and light extraction layers and one or more buffer layers, but this is not critical.

Based upon a passage from the specification, Lumileds argues that the term "LED layers" is "not limited to the active layers that form the light emitting p-n junction, but should be construed more broadly to include other layers as well.[112] Lumileds further argues that "LED layers" should not be limited to layers that have been epitaxially grown.[113] According to Lumileds, there is no basis to import such a limitation into claim 1 which only speaks of "fabricating the LED layers."[114] In support of its argument, Lumileds points to embodiments in

[110] (...continued)
"an interface of said wafer-bond layer with the semiconductor layers," while dependent claim 13 adds the additional limitation that "[t]he device of claim 12 where the wafer bond is directly adjacent to at least one semiconductor layer." The Administrative Law Judge's construction of "interface" addresses Lumileds' concerns that certain claim language will be rendered superfluous because as construed, an interface may have "some thickness."

[111] *See* JRC at 3.

[112] *See* Lumileds CCBr. at 54-55 (quoting '580 patent, 3:23-27).

[113] *See id.* at 55.

[114] *Id.* (citing '580 patent at 16:43); Lumileds Post-Hearing Brief at 27.

the '580 specification in which it argues the layers were not epitaxially grown.[115] Furthermore, Lumileds argues that the patent indicates that "epitaxial growth is only one of a variety of methods that may be used to form the LED layers" including epitaxial growth. [116] According to Lumileds, the word "including" indicates that the list of growth methods described in the patent is "not an exclusive list, and it certainly does not limit the LED layers to those grown using an epitaxial growth process."[117]

Epistar argues that "LED layers" is "expressly defined in the specification:"

> LED layers are then grown using one or more of a variety of methods, including liquid phase epitaxy, vapor phase epitaxy, metalorganic chemical vapor deposition and/or molecular beam epitaxy. The LED layers that form an LED structure may consist of a light emitting active layer, upper and lower confining layers, current spreading and light extraction layers and one or more buffer layers, but this is not critical.[118]

According to Epistar, this passage "makes clear [that] the term "LED layers" refers to the epitaxially grown semiconductor layers used to form the light emitting diode, regardless of the exact structure ... or presence of other additional epitaxial semiconductor layers such as window layers or buffer layers."[119] Epistar further argues that the term "LED layers" does not include layers such as the

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[115] *Id.* at 56 (citing CX-3 ('580 patent) at 12:4-5 referring to "growth or deposition of insulating oxide layers; 9:11-4 "a layer 52 of glass or SiO_2 or other oxide").

[116] Lumileds Post-Hearing Brief at 26-27 (citing 3:20-23).

[117] *Id.* at 27.

[118] *See* Epistar CCBr. at 39-40 (citing '580 patent, 3:20-27).

[119] *Id.* at 40 (citing Jokerst Decl. ¶ 40).

substrate that are not epitaxially grown.[120]

The Staff agrees with Lumileds' construction of "LED layers." In support of its construction, the Staff points to claim 2 of the '580 patent that "specifically provides for epitaxially growing the LED layers, whereby claim 1 only calls for 'fabricating' the layers."[121] "[T]he Staff is of the view that it would be erroneous to limit the term to layers which are epitaxially grown. The Staff further provides that "[w]hile the specification of the '580 patent refers to epitaxially grown layers, it also states that other methods can be used."[122]

"LED layers" appears in claim 1 in the context of "selecting a first material having properties compatible with fabricating LED layers having desired mechanical characteristics."[123] The specification defines "LED layers" as follows:

> The LED layers that form an LED structure may consist of a light emitting active layer, upper and lower confining layers, current spreading and light extraction layers and one or more buffer layers, but this is not critical.[124]

As indicated above, each of the parties agrees that the above definition is at least part of the proper construction of "LED layers." The question remains, however, whether the layers that form an LED structure must be epitaxially grown, as Epistar contends.

It is instructive in this case to first compare the language of claims 1 and 2 of the '580

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[120] *Id.* at 41.

[121] Staff CCBr. at 13.

[122] OUII Post-Hearing Brief at 16 (citing CX-3 ('580 patent) at 3:20-21).

[123] CX-3 ('580 patent) at 16:38-43.

[124] CX-3 ('580 patent) at 3:23-27.

patent. Claims 1 and 2 read as follows:

> 1. A method of forming a light emitting diode (LED) comprising:
>
> selecting a first material having properties compatible with fabricating LED layers having desired mechanical characteristics;
>
> providing a first substrate made of the selected first material;
>
> fabricating the LED layers on the first substrate, thereby forming an LED structure;
>
> selecting an optically transparent material compatible with enhancing light-emitting performance of the LED structure; and
>
> wafer bonding a transparent layer of the selected optically transparent material to the LED layers.
>
> 2. The method of claim 1 wherein fabricating the LED layer is a step of epitaxially growing a plurality of layers on the first substrate, the first material being a selection of a material to provide a lattice compatible with epitaxially growing the plurality of layers, said step of epitaxially growing said layers including limiting each layer to a maximum thickness of 75 μm. (Emphasis added)

As the Staff notes, claim 1 requires only the "fabricating [of] LED layers" while claim 2 requires that "fabricating the LED layers" is "a step of epitaxially growing" those layers. Thus, the doctrine of claim differentiation dictates that the term "fabricating" must mean something other than "epitaxially growing," and therefore, the Administrative Law Judge finds that "LED layers" do not have to be epitaxially grown. Furthermore, the Administrative Law Judge does not find this interpretation to be inconsistent with the patent specification. The specification specifically indicates that a variety of methods including, but not limited to, epitaxy may be used to grow the LED layers.[125] Though Epistar argues that layers may only be "grown" using an epitaxial

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[125] CX-3 ('580 patent) at 3:20-23 ("LED layers are then grown using one or more of a

(continued...)

method, Dr. Dupuis provided testimony that layers, whether amorphous, polycrystalline, or crystalline, may also be "grown" using deposition or other methods as well.[126] Accordingly, the Administrative Law Judge concludes that "LED layers" means layers that form a light emitting diode or LED structure. The LED layers that form an LED structure may consist of a light emitting active layer, upper and lower confining layers, current spreading and light extraction layers and one or more buffer layers, but this is not critical since not every such layer need be included.

IV. INFRINGEMENT DETERMINATION

In a section 337 investigation, as in a federal district court action, infringement must be proven by a preponderance of the evidence. Complainants bear the burden of proving infringement of the asserted patent claims.[127] Each patent claim element or limitation is considered material and essential.[128] Literal infringement of a claim occurs when every limitation recited in the claim appears in the accused device, i.e., when "the properly construed claim reads on the accused device exactly."[129]

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[125] (...continued)
variety of methods, including liquid phase epitaxy, vapor phase epitaxy, metalorganic chemical vapor deposition and/or molecular beam epitaxy.")(emphasis added).

[126] *See* Dupuis Tr. 992-993.

[127] *Certain Flooring Products*, Inv. No. 337-TA-443, Commission Notice of Final Determination of No Violation of Section 337, 2002 WL 448690 at 59, (March 22, 2002); *Enercon GmbH v. Int'l Trade Comm'n,* 151 F.3d 1376 (Fed. Cir. 1998).

[128] *London v. Carson Pirie Scott & Co.*, 946 F.2d 1534, 1538 (Fed. Cir. 1991).

[129] *Amhil Enters., Ltd. v. Wawa, Inc.*, 81 F.3d 1554, 1562 (Fed. Cir. 1996); *Southwall Tech. v. Cardinal IG Co.*, 54 F.3d 1570, 1575 (Fed Cir. 1995).

If the accused product does not literally infringe the patent claim, infringement might be found under the doctrine of equivalents. The Supreme Court has described the "essential inquiry" of the doctrine of equivalents analysis as follows: "[D]oes the accused product or process contain elements identical or equivalent to each claimed element of the patented invention?"[130] Under the doctrine of equivalents, infringement may be found if the accused product or process performs substantially the same function in substantially the same way to obtain substantially the same result.[131] The doctrine of equivalents does not allow claim limitations to be ignored. Evidence must be presented on a limitation-by-limitation basis, and not for the invention as a whole.[132] Thus, if an element is missing or not satisfied, infringement cannot be found under the doctrine of equivalents as a matter of law.[133]

The "concept of equivalency cannot embrace a structure that is specifically excluded from the scope of the claims."[134] In applying the doctrine of equivalents, the Commission must be informed by the fundamental principle that a patent's claims define the limits of its protection.[135]

130 *Warner-Jenkinson Co., Inc. v. Hilton Davis Chemical Co.*, 520 U.S. 17, 40 (1997).

131 *Valmont,* 983 F.2d 1039, 1043 (Fed. Cir. 1993).

132 *Warner-Jenkinson,* 520 U.S. at 29; *Hughes Aircraft Co. v. U.S.*, 86 F.3d 1566 (Fed. Cir. 1996).

133 *See, e.g., Wright Medical*, 122 F.3d 144, 1444 (Fed. Cir. 1997); *Dolly, Inc. v. Spalding & Evenflo Cos., Inc.*, 16 F.3d 394, 398 (Fed. Cir. 1994); *London v. Carson Pirie Scott & Co.*, 946 F.2d 1534, 1538-39 (Fed. Cir. 1991); *Becton Dickinson and Co. v. C.R. Bard, Inc.*, 922 F.2d 792, 798 (Fed. Cir. 1990).

134 *Athletic Alternatives v. Prince Mfg., Inc.*, 73 F.3d 1573, 1581 (Fed. Cir. 1996).

135 *See Charles Greiner & Co. v. Mari-Med. Mfg., Inc.*, 92 F.2d 1031, 1036 (Fed. Cir. 1992).

As the Supreme Court has affirmed:

> Each element contained in a patent claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole. It is important to ensure that the application of the doctrine, even as to an individual element, is not allowed such broad play as to effectively eliminate that element in its entirety.[136]

Prosecution history estoppel may bar the patentee from asserting equivalents if the scope of the claims has been narrowed by amendment during prosecution. A narrowing amendment may occur when either a preexisting claim limitation is narrowed by amendment, or a new claim limitation is added by amendment. These decisions make no distinction between the narrowing of a preexisting limitation and the addition of a new limitation. Either amendment will give rise to a presumptive estoppel if made for a reason related to patentability.[137] The presumption of estoppel may be rebutted if the patentee can demonstrate that: (1) the alleged equivalent would have been unforeseeable at the time the narrowing amendment was made; (2) the rationale underlying the narrowing amendment bore no more than a tangential relation to the equivalent at issue; or (3) there was some other reason suggesting that the patentee could not reasonably have been expected to have described the alleged equivalent.[138]

In other circumstances, a patentee may obtain coverage of equivalents unforeseeable at

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[136] *Warner-Jenkinson*, 520 U.S. at 29.

[137] *Honeywell Int'l Inc. v. Hamilton Sundstrand Corp.*, 370 F.3d 1131, 1139-41 (Fed. Cir. 2004), *cert. denied*, 125 S.Ct. 2829, 162 L.Ed.2d 865 (2005)(citing *Warner-Jenkinson*, 520 U.S. at 22, 33-34; and *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.,* 535 U.S. 722, 733-34, 741 (2002)).

[138] *Honeywell*, 370 F.3d at 1140 (citing, *inter alia, Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.,* 344 F.3d 1359 (Fed. Cir.2003) (*en banc*)).

the time of the amendment and beyond a fair interpretation of what was surrendered, or for aspects of the invention that have only a peripheral relation to the reason the amendment was submitted.[139] The patentee must show that at the time of the amendment, one skilled in the art could not reasonably be expected to have drafted a claim that would have literally encompassed the alleged equivalent.[140]

A. U.S. Patent No. 5,008,718

1. Asserted Claims

Lumileds has accused Epistar of infringing claims 1 and 6 of the '718 patent. The asserted claims read as follows:

> **1.** A light emitting diode comprising:
>
> a semiconductor substrate;
>
> an electrical contact to the substrate;
>
> active p-n junction layers for AlGaInP over the substrate for emitting light;
>
> a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers; and
>
> a metal electrical contact over a portion of the transparent layer.
>
> **6.** A light emitting diode as recited in claim 1 wherein the transparent window layer has a resistivity at least an order of magnitude less than the resistivity of the AlGaInP.

Lumileds has asserted claims 1 and 6 of the '718 patent against each of Epistar's Metal Bond

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[139] *Festo*, 535 U.S. at 738.

[140] *Id.* at 741.

("MB") I and II products, Glue Bond ("GB") I and II products and OMA I and II products.

2. MB I & II

Epistar's MB and MB II products generally have the following structures:

CLAIM 1

a. "a semiconductor substrate"

Lumileds argues that Epistar does not dispute that the MB and MB II products have a "semiconductor substrate" within the meaning of claim 1.[141] Epistar provides no argument to the contrary in its post-hearing submissions.

The Staff argues that the thick [ ] layer in the MB and MB II products form the substrates for those two products.[142] The Staff, however, "believes that Lumileds has not met its burden of establishing that any layers of the accused products, other than the relatively thick

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[141] Lumileds Post-Hearing Brief at 5 (citing CPFF 1648).

[142] OUII Post-Hearing Brief at 9.

[ ] layers in the ... MB and MB II products, satisfy the claim requirement of a 'semiconductor substrate.'"[143] The Staff indicates that Lumileds "presented testimony at the hearing that those skilled in the art would recognize that t[h]in layers can be considered substrates," but further notes that when Dr. Dupuis was asked during cross-examination "whether a thin layer, standing alone, could provide mechanical support for an LED device, Dr. Dupuis further testified: 'It would provide support. It wouldn't provide adequate mechanical support for a device.'"[144] Thus, the Staff concludes that as construed, substrate "must be a material that provides *adequate mechanical support* for the LED device," and therefore, the "semiconductor substrate" limitation is satisfied in the MB and MB II products only "due to presence of the thick [ ] layer underlying the LED device."[145]

The Administrative Law Judge has construed the term "substrate" in the '718 patent to mean "the supporting material in an LED upon which the other layers of an LED are grown or to which those layers are attached."[146] Epistar and the Staff both understand that construction to mean that a "substrate" must be "mechanically robust enough to provide structural support for the <u>device</u>."[147] Testimony of Dr. Stringfellow supports the view of Epistar and the Staff. Specifically, Dr. Stringfellow testified that "a substrate is easily something that gives mechanical

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[143] OUII Post-Hearing Brief at 10.

[144] *Id.* (citing Dupuis Tr. 562:12 - 563:16; 1128:10-12).

[145] *Id.* at 10-11 (emphasis in original).

[146] Order No. 27 at 13-14.

[147] Epistar Reply Brief at 1 (emphasis in original); *see* OUII Post-Hearing Brief 10-11 (a substrate "must be a material that provides *adequate mechanical support* for the LED device"(emphasis in original)).

[st]ability to a light emitting diode structure."[148] In Order No. 27, the Administrative Law Judge specifically stated that "the specification gives an indication that a 'substrate' acts as a type of foundation for the LED and provides some 'strength' to the device"[149] and the Administrative Law Judge hereby further clarifies his construction to indicate that a substrate must also be a material that provides adequate mechanical support for the LED device.

With respect to the question of whether Epistar's MB and MB II have the claimed "semiconductor substrate," the Administrative Law Judge concludes that they do. Complainant's Exhibit 472C provides a detailed depiction of the structure of the MB and MB II products. The Administrative Law Judge finds that the diagram shows that the MB and MB II products have [ ] substrates. During the hearing, Dr. Stringfellow on direct indicated that the [ ] substrates of the MB and MB II products are indeed "semiconductor substrates" within the meaning of the '718 patent.[150] Dr. Dupuis, Lumileds' expert, concurs.[151] Accordingly, the Administrative Law Judge finds that the MB and MB II products both contain a "semiconductor substrate" within the meaning of claim 1 of the '718 patent.

b. "an electrical contact to the substrate"

Lumileds argues that Epistar does not dispute that the MB and MB II products have a "an

[148] Stringfellow Tr. 1579:1-3; *see also* Jokerst Tr. 1714:1-24.

[149] Order No. 27 at 12.

[150] Stringfellow Tr. 1506:20-1507:10, 1511:1-6 and RDX 551 which Dr. Stringfellow affirmed accurately reflected his opinions regarding the non-infringement of the '718 patent.

[151] Dupuis Tr. 681:6-13, 688:16-24.

electrical contact to the substrate" within the meaning of claim 1.[152] Neither Epistar nor the Staff provides any argument to the contrary in its post-hearing submissions with respect to this limitation.

Complainant's Exhibit 472C provides a detailed picture of the manufacturing process and resulting structure of the MB and MB II products. The Administrative Law Judge finds those pictures show that the MB and MB II products have an electrical contact attached to the [ ] substrate. Furthermore, during the hearing, Epistar presented the expert testimony of Dr. Stringfellow. On direct, Dr. Stringfellow agreed that the MB and MB II products contain "an electrical contact to the substrate."[153] Dr. Dupuis concurs.[154] Accordingly, the Administrative Law Judge finds that the MB and MB II products both contain "an electrical contact to the substrate" within the meaning of claim 1.

c. "active p-n junction layers for AlGaInP over the substrate for emitting light"

Lumileds argues that Epistar does not dispute that the MB and MB II products have a "active p-n junction layers for AlGaInP over the substrate for emitting light" within the meaning of claim 1. Neither Epistar nor the Staff provides any argument to the contrary in their post-hearing submissions with respect to this limitation.

During the hearing, Epistar presented the expert testimony of Dr. Stringfellow. On direct Dr. Stringfellow agreed that the MB and MB II products contain "active p-n junction layers for

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[152] Lumileds Post-Hearing Brief at 5 (citing CPFF 1655).

[153] Stringfellow Tr. 1506:20-1507:10, 1511:1-6 and RDX 551 which Dr. Stringfellow affirmed accurately reflected his opinions regarding the non-infringement of the '718 patent.

[154] Dupuis Tr. 683:3-8, 689:7-10.

AlGaInP over the substrate for emitting light."[155] Dr. Dupuis concurs.[156] Accordingly, the Administrative Law Judge finds that the MB and MB II products both contain "active p-n junction layers for AlGaInP over the substrate for emitting light" within the meaning of claim 1.

d. "a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers"

Order No. 27 provides that a "transparent window layer" is "a transparent layer that spreads current, composed of semiconductor material different from AlGaInP, where the material has a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers."[157] Epistar has invited the Administrative Law Judge to modify his construction of "transparent window layer" (1) to include that current must be spread to the active layers, (2) to require that the window layer must be made of a III-V semiconductor, and (3) to find that the use of ITO was disavowed in the specification.[158] The Administrative Law Judge declines to modify his previous construction with respect to any of these points, but discusses them briefly below. After this discussion of claim construction issues, the Administrative Law Judge will continue his analysis of whether Epistar's MB and MB II products contain the claimed "transparent window layer."

Claim Construction Issues

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155 Stringfellow Tr. 1506:20-1507:10, 1511:1-6 and RDX 551 which Dr. Stringfellow affirmed accurately reflected his opinions regarding the non-infringement of the '718 patent.

156 Dupuis Tr. 681:18-24, 689:10-17.

157 Order No. 27 at 19.

158 Epistar Post-Hearing Brief at 24-28.

As evidence to show that the window layer must spread current "to the active layers." Epistar points to language in the patent referring to the need to "provide a technique for distributing current from the front contact to the active p-n junction."[159] There is, however, nothing in the patent which requires that the current be spread directly from the window layer into the active layers. The language of claim 1 states only that the "transparent window layer" be "over the active layers" rather than directly above them, so that the window layer may spread current to another layer before entering the active layers.[160] In addition, the '718 patent points out that "[e]fficient operation of the LED *depends* on current injected from the metal front contact 14 spreading out laterally to the edges of the LED chips so that light is generated uniformly across the p-n junction."[161] This language is significant because it indicates that the critical component of the current crowding solution, and therefore, a critical feature of the claimed invention, is the lateral spreading of current away from the metal contact rather than the spreading of the current into the active layers, which all LEDs must do. [162] Accordingly, the Administrative Law Judge emphasizes that the claimed "transparent window layer" is not required to spread current directly "to the active layers."

Epistar also argues that a semiconductor different from AlGaInP must be limited to III-V semiconductors. According to Epistar, the "use of III-V semiconductors permeates the specification and the claims." In Order No. 27, however, the Administrative Law Judge rejected

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[159] *See* Epistar Post-Hearing Brief at 24.

[160] CX-2 ('718 patent) at claim 1.

[161] CX-2 ('718 patent) at 1:33-35 (emphasis added).

[162] *See id.* at Claim 1.

this argument. As indicated in Order No. 27, "the specification makes clear that those named compounds are merely examples of materials suitable for use as a window layer," and thus, the phrase "semiconductor different from AlGaInP" is not limited to III-V semiconductors.[163]

Finally, Epistar asserts that "the ALJ's conclusion that the inventors did not disclaim ITO as a window layer is not supported by the evidence"[164] In support of its assertions, Epistar argues that the "inventors identified the unique features of their window layer as being 'not only transparent, it has a higher electrical conductivity (lower resistivity) than the AlGaInP ... Since the window layer has a high conductivity [low resistivity] it significantly improves LED efficiency by promoting current spreading <u>without blocking the light generated or increasing series resistance</u>.'"[165] Epistar argues that ITO has been disavowed because the invention "criticizes other structures, here metal fingers, gridlines and ITO that block light or increase series resistance."[166]

The Administrative Law Judge confirms that he does not find a clear disavowal of the use of ITO as a transparent window layer in the specification of the '718 patent. The specification does describe two unsatisfactory techniques proposed for minimizing the current crowding solution which include the modification of the front contact. One of those techniques involved the replacement of a metal front electrical contact with ITO. The Administrative Law Judge does not find, however, that a statement in the background section that the use of ITO was not

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[163] Order No. 27 at 29-31 (citing CX-2 ('718 patent) at 5:25-31).

[164] Epistar Post-Hearing Brief at 25.

[165] *Id.* (citing CX-2 ('718 patent) at 3:6-13))(emphasis added).

[166] *Id.*

"completely satisfactory" as a front contact is a disclaimer that ITO does not fall within the scope of the claimed "transparent window layer," which serves a distinct function in an LED.[167] The Administrative Law Judge further disagrees that the verbiage "by promoting current spreading without blocking the light generated or increasing series resistance" serves as a limitation on the claimed "transparent window layer." Instead, the Administrative Law Judge finds that the language of the specification only requires that the "transparent window layer must have a "high conductivity" as is supported by the language of claim 1.[168]

<u>Infringement Analysis</u>

Lumileds argues that the MB and MB II LEDs have an [ ] ITO layer that functions as the claimed "transparent window layer."[169] According to Lumileds, Epistar "does not dispute that ITO has a much lower resistivity than the upper portion of the AlGaInP active layers and, therefore, necessarily functions as the claimed 'transparent window layer.'"[170] Lumileds further asserts that although it is not required by the claim, the MB and MB II products do in fact spread current to the active layers.[171] Lumileds describes the MB and MB II LEDs as having "a layer of ITO between the AlGaInP active layers and the metal contact" which spreads current "laterally

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167 *See Micro Chem, Inc. v. Great Plains Chem. Co.*, 194 F.3d 1250, 1260 (Fed. Cir. 1999).

168 CX-2 ('718 patent) at 3:10-13.

169 Lumileds Post-Hearing Brief at 6.

170 *Id.* (citing CPFF 1671, 1722).

171 *Id.*

through the ITO layer."[172] Lumileds further asserts that contrary to the testimony of Dr. Stringfellow, "Epistar's own witnesses admitted and its documents confirm that current flows directly from the ITO to the active layers."[173]

In addition, Lumileds contends that ITO is a "semiconductor different from AlGaInP." According to Lumileds, "ITO meets this definition both because it has a bandgap and excites electrons across this energy gap from the valence band into the conduction band and because ITO has electrons in the conduction band due to the introduction of tin ("Sn") dopants."[174] Lumileds further explains that "there is no dispute that ITO has a bandgap of approximately 3.7 eV and a substantial number of electrons are in its conduction band"[175] or that "tin substitutes for indium in ITO and that tin is in a different column of the periodic table and, thus, has one more valence electron than indium, resulting in the "donation" of an electron to the conduction band."[176] Thus, Lumileds concludes that "tin acts as an electron donor in exactly the same way any donor dopant added to any semiconductor increases the conductivity of the semiconductor."[177] Lumileds further argues that "Epistar's own expert has admitted seeing "a hundred" references describing ITO as a semiconductor."[178]

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172 *Id.* at 6-7 (citing CPFF 1678, and 1725).

173 *Id.* at 8 (citing CPFF 1057-58, 1341, 1344, and 3264; CX-438C at EC037401).

174 *Id.* at 9 (citing CPFF 1338, 1369-1372).

175 *Id.* (citing CPFF 1369, 1372, CX 102).

176 *Id.* (citing CPFF 1364-1377, 1384).

177 *Id.* (citing CPFF 558-564, 571-579, 619-627).

178 *Id.* (citing CPFF 3192-3195, 3252-3558).

Finally, Lumileds argues that the upper ITO layer has a "resistivity lower than the active layers." According to Lumileds, "Dr. Dupuis, calculated [ ][179] According to Lumileds, "[t]he top portion of the active layers in the MB I & II is the AlGaInP upper confining layer that Dr. Dupuis calculated as having a typical resistivity of [ ][180] The same layer in the MB II has [ ][181] Thus, Lumileds concludes that "the ITO window layer in the MB I & II LEDs has a resistivity that is less than [ ] of the resistivity of their AlGaInP upper confining layer."[182]

Epistar argues that the ITO layer in its products that Lumileds claims meets the "transparent window" limitation is not actually functioning as a window layer, but rather as a "transparent contact" or a "transparent electrode" as described in the prior art Lawrence and Yamagoshi patents.[183] Epistar continues that "it is clear in light of the objective prior art that one of ordinary skill would understand that the 'transparent front contact' of ITO disparaged in the '718 patent consisted of exactly the elements Lumileds now claims to have invented, namely a layer of ITO between the metal bond pad and the active layers, optionally with some sort of metal

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[179] *Id.* at 11 (citing CPFF 1431).

[180] *Id.* (citing CPFF 1690).

[181] *Id.* (citing CPFF 1432, 1738).

[182] *Id.* (citing CPFF 1738-39, 1690).

[183] Epistar Post-Hearing Brief at 18-19.

layer or structure to provide a more ohmic current path between the ITO contact layer and the LED active layers."[184]

Epistar further contends that Lumileds has not met its burden of demonstrating by a preponderance of the evidence that ITO is a semiconductor.[185] Epistar argues that "to classify ITO properly, one skilled in the art would not simply tally up the articles that call it one thing or another."[186] Instead, Epistar indicates that an analysis should focus on the fact that "ITO is an anomaly because its bandgap is very high," yet "despite its large bandgap, ITO has a very high conductivity which makes ITO act like a metal."[187] However, according to Epistar, ITO cannot be a metal because it is transparent.[188] Epistar concludes that ITO must then be a semimetal.[189]

Epistar further asserts that ITO cannot be a semiconductor because ITO, which is a combination of indium oxide and tin oxide, with tin being the "essential element," rather than an impurity or a dopant in the resulting alloy.[190] In addition, Epistar argues that "because ITO has a high energy bandgap it does not conduct electricity by virtue of excitation of electrons across an energy gap; instead it is in a permanent state of having an electron-full valence band."[191]

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[184] *Id.* at 19.

[185] *Id.* at 21.

[186] *Id.*

[187] *Id.* at 21-22 (citing RPFF 167-169, 159).

[188] *Id.* at 22 (citing RPFF 146).

[189] *Id.* at 22.

[190] *Id.* at 22 (citing RPFF 149-151).

[191] *Id.* (citing RPFF 156).

Finally, Epistar argues that its products do not have a bandgap greater than the active layers if the metal contacts and the ITO are considered part of the window layer.[192] Specifically, Epistar notes that "[t]here is nothing about [references to transition layers in] the patent that suggests an intermediate layer of opaque metal" as a transition layer.[193] Epistar concludes that a "reference to transition layers or steps does not support the conclusion that metal may separate the active layer and so called window layer and still be covered by claim 1."[194]

The Staff indicates that it "is of the view that regardless of the presence of fine grid lines or fine metal dots, the accused products have a window layer of ITO."[195] The Staff further argues that ITO "satisfies the definition of 'semiconductor' set forth by the Judge in Order No. 27.[196] According to the Staff, "ITO can be doped, albeit only on the n side" and "the ITO in the accused products has a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers."[197] The Staff notes that Epistar did not contend in its prehearing statement that the "bandgap" and "resistivity" requirements are not present in the accused products.[198]

In each of the MB and MB II products, it is undisputed that Epistar uses a thin layer of ITO which is located over the active layers. There are, however, three issue with respect to this

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[192] *Id.* at 23.

[193] *Id.* at 23 (citing RPFF 459).

[194] *Id.*

[195] OUII Post-Hearing Brief at 14.

[196] *Id.*

[197] OUII Post-Hearing Brief at 14 (citing Dupuis Tr. 1925:12-24).

[198] *Id.* fn.3.

element: (1) whether ITO is a semiconductor; (2) whether ITO meets the "bandgap" and "resistivity" requirements of the claims; and (3) whether the ITO layer spreads current.

(1) The Administrative Law Judge has defined a "semiconductor" to be a "non-metallic solid that conducts electricity by virtue of excitation of electrons across an energy gap, or by introduced material, such as dopants, that provide conduction electrons."[199] Dr. Dupuis explained during the hearing that materials can be classified by their fundamental properties which are largely related to the bandgap.[200] With reference to CDX-804 and 805, Dr. Dupuis explained the energy of electrons in solids with reference to a "valance band" and a "conduction band." The valence band contains the outermost electrons of an atom.[201] The "energy in a crystal above that band" is called the conduction band "because electrons here in this band can carry electricity in the solid and make it conductive."[202] As indicated in Order No. 27, the Administrative Law Judge based his interpretation of "semiconductor" upon this "band theory."[203]

In his testimony, Dr. Dupuis continued to explain the general properties of insulators, semiconductors and metals using this band theory. According to Dr. Dupuis, insulators, such as glass, have a large band gap energy, and as a result, very few (or no) electrons in the valence

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[199] Order No. 27 at 22.

[200] The parties agree that "bandgap" is the "minimum energy that must be added to a valence electron held within a semiconductor crystal lattice to permit it to become a conduction electron able to move freely throughout the crystal." JRC at 2.

[201] Dupuis Tr. 513:6-10.

[202] *Id.* at 513:11-18

[203] Order No. 27 at 20-21.

band have enough energy to move into the conduction band, so the material will not conduct electricity.[204] Dr. Dupuis further indicated that in general, semiconductors have a band gap energy which is typically in the "few electron volt range" and that most semiconductors at room temperature will contain some electrons in the conduction band due to thermal excitation.[205] In addition, semiconductors "can become very conducting at ... room temperature, for example, and because of the wide variety of materials that can be used to make semiconductors, they can be transparent or opaque."[206]

According to Dr. Dupuis, metals generally have no bandgap energy. "The filled orbitals in the valence band overlap with the empty electron space in the conduction band, forming essentially a band diagram where there are always electrons in the conduction band."[207]

Dr. Dupuis provided several illustrations of how the properties of a material can be affected through the introduction of a different material, often called a dopant or an impurity, that has a different number of valence electrons than the original material. For example, Dr. Dupuis explained with reference to CDX-807 that:

> This diagram here on the right side uses silicon as an impurity in gallium arsenide, and as I mentioned, silicon has a Valence electron count of four, replacing in this array of atoms what would have been a gallium atom, so this is a gallium site. It now has a silicon atom, one extra electron in the crystal due to silicon, and that creates this type of band diagram for gallium arsenide dopant silicon.

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204 Dupuis Tr. 515:10-18.

205 *Id.* at 511, 514.

206 *Id.* at 512:3-8.

207 Dupuis Tr. 516:6-14.

> The valence band is entirely filled and the extra electrons due to silicon are in the conduction band, and this is what we call an N-type semiconductor doped with donor impurity atoms, and in a similar way I mentioned using for silicon boron in this case, I show gallium arsenide, again, with magnesium.[208]

Dr. Dupuis then applies his discussion of valence and conduction bands to categorize Indium Tin Oxide ("ITO").[209] According to Dr. Dupuis, tin doped indium oxide starts with an indium oxide[210] lattice containing an "arrangement of indium and oxygen atoms with a chemical formula of indium sub 2, O sub three referring to the fact that on – in this solid, there are three oxygen atoms for each two indium atoms."[211] Dr. Dupuis further explains that "if you replace indium atoms with tin, replacing a column 3 indium atom with a column 4 tin atom, you end up with an extra electron for each tin atom in the solid."[212] To illustrate what happens when tin atoms are used to replace indium atoms in indium oxide, Dr. Dupuis refers to Figures 27a and 27b from an article in the Journal of Applied Physics as shown below:[213]

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[208] *Id.* at 521:18-22:9.

[209] Indium Tin Oxide is also referred to as In_2O_3:Sn. *See*, Dupuis Tr. 633. Dr. Dupuis further noted that the colon is "commonly use[d] to describe a dopant in a semiconductor film." *Id.*

[210] Indium oxide is a semiconductor material. Dupuis Tr. 62:17-203.

[211] *Id.* at 632:22-633:1.

[212] Dupuis Tr. 633:8-12.

[213] *See* CX-566 ("Evaporated Sn-doped In_2O_3 films: Basic optical properties and applications to energy-efficient windows" (1986)).

Dr. Dupuis explains that Figure 27a "shows the assumed band structure of undoped indium oxide in the vicinity of the top of the valence band."[214] "[T]he bottom of the conduction band, which is the upper band, which has no electrons in it, [is] indicated by the fact that it has no shading."[215] Dr. Dupuis explained that in Figure 27b, the electrons indicated by the shaded area in the upper band are due to the tin donor atoms.[216] The result is that "[t]here's an energy gap that is between the valence band and the conduction band, and a large concentration of electrons in the conduction band at room temperature due to the very heavy doping of tin in this material."[217] Though Epistar argues that the tin in ITO cannot be a dopant because the concentration of tin is too high,[218] the Administrative Law Judge agrees with Dr. Dupuis that to determine whether something is a semiconductor, one "need[s] to consider more fundamentally the band structure

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214 Dupuis Tr. 636:19-21.

215 *Id.* at 636:23-637:1.

216 *Id.* at 637.

217 *Id.* at 638:8-12

218 Epistar Post-Hearing Brief at 22.

and what that impurity does to the band structure" rather than just the concentration of the added material or "dopant."[219] In this case, the introduction of donor tin atoms to a lattice of In_2O_3 causes a "partial filling of the conduction band" in a manner similar to what Dr. Dupuis describes with respect to gallium arsenide doped with silicon above.[220] Furthermore, Dr. Stringfellow agreed that the addition of the tin to In_2O_3 produced carriers that partially filled the conduction band.[221]

Based on the evidence, the Administrative Law Judge concludes that ITO (or tin-doped indium oxide) is a "semiconductor" because it conducts electricity by virtue of the introduction of tin atoms to indium oxide which provides conduction electrons.

(2) In Order No. 27, the Administrative Law Judge defined "bandgap greater than the active layer" to mean that "the bandgap of the transparent window layer must only be greater than the bandgap of the light-generating portion of the active layers."[222] Lumileds indicates that it has "never argued that the fine dots or metal grid are part of the window layer."[223] Epistar does not contest that this requirement is met by its products if the metal is not included.[224] Accordingly, the Administrative Law Judge finds that the MB and MB II products meet the requirement that the window layer has a "bandgap greater than the bandgap of the active layers."

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219 Dupuis Tr. 640:20-24.

220 CX-566 at LLITC01323612.

221 Stringfellow Tr. 1475:2-6.

222 Order No. 27 at 36.

223 Lumileds Reply Brief at 9.

224 Epistar Post-Hearing Brief at 23.

In Order No. 27, the Administrative Law Judge defined "resistivity lower than the resistivity of the active layers" to mean that "the transparent window layer must only have a resistivity lower than the resistivity of the top portion of the active layers."[225] Epistar does not argue that its products do not meet this requirement. Accordingly, the Administrative Law Judge finds that the MB and MB II products have a window layer with a "resistivity lower than the resistivity of the top portion of the active layers."

(3) The Administrative Law Judge has defined "transparent window layer" in part to be "a transparent layer that spreads current."[226] In his testimony, Dr. Dupuis explained that ITO has a "high electrical conductivity and a high transparency throughout the visible spectrum, making it one of the ideal candidates for [a] current spreading window layer in an AlGaInP LED."[227] Dr. Stringfellow also testified that an ITO layer does spread current laterally which the specification indicates is a critical part of the function of the transparent window layer.[228] So long as current is spread laterally away from the front metal contact, the current crowding problem will be overcome. Dr. Hsieh confirmed that the ITO enables a current injected from an electrode to effectively spread through an ITO layer into a metal structure such as [ ]

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225 Order No. 27 at 39.

226 In addition, Dr. Hsieh has confirmed that [ ]. Hsieh Tr. 1321:5-13.

227 Dupuis Tr. 642:23-643:2.

228 Stringfellow Tr. 1540:15:1541:18, *see also* CX-2 ('718 patent) at 1:33-36 ("Efficient operation of the LED depends on current injected from the metal front contact spreading out laterally to the edges of the LED chip so light is spread uniformly across the p-n junction.").

[ ] because an ohmic contact is made with the ITO.[229] Furthermore, Dr. Chen indicated that the [

].[230] Thus, the Administrative Law Judge concludes that the weight of the evidence indicates that ITO does spread current.

Accordingly, as Epistar's MB and MB II products contain an upper ITO layer which is transparent, spreads current, is of a semiconductor different from AlGaInP, is over the active layers, and has a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers the Administrative Law Judge concludes that the ITO layer literally meets the requirements of a "transparent window layer."[231]

e. "a metal electrical contact over a portion of the transparent layer"

Lumileds argues that Epistar does not dispute that the MB and MB II products have a

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229 Hsieh Tr. 1311:10-1312:6.

230 Chen Tr. 1223:19-1224:19.

231 Epistar challenges whether claim 1 of the '718 patent can cover the use of an ITO window layer and still comply with the dictates of 35 U.S.C. §112. According to Epistar, ITO must be used in conjunction with some other type of material which may include metal dots or metal fingers, or no light will be produced from the device. The Administrative Law Judge concludes that the specification is broad enough to encompass the use of ITO as a "transparent window layer." As the Federal Circuit has indicated, "[o]ur case law is clear that an applicant is not required to describe in the specification every conceivable and possible future embodiment of his invention." *Rexnord Corp. v. Laitram Corp,* 274 F.3d 1336, 1344 (Fed. Cir. 2001). In this case, the '718 patent is not required to describe every possible window layer that might fall within the scope of claim 1.

"semiconductor substrate" within the meaning of claim 1.[232] Neither Epistar nor the Staff provides any argument to the contrary in its post-hearing submissions with respect to this limitation.

During the hearing, Dr. Dupuis testified that both the MB and MB II products have "a metal electrical contact over a portion of the transparent layer," as is illustrated by the depictions in Complainant's Exhibit 472C.[233] Accordingly, the Administrative Law Judge find that the MB and MB II products have "a metal electrical contact over a portion of the transparent layer."

As the MB and MB II LEDs contain each of the elements required by claim 1, the Administrative Law Judge finds that they infringe the '718 patent.

CLAIM 6

Lumileds argues that claim 6 of the '718 patent "includes the additional limitation 'wherein the transparent window layer has a resistivity at least an order of magnitude less then the resistivity of the AlGaInP.'"[234] According to Lumileds, Dr. Dupuis calculated "the highest potential resistivity value for the [

]"[235] Lumileds further argues that the "top portion of the active layers in the MB and MB II is the AlGaInP upper confining layer that Dr. Dupuis calculated as having a typical resistivity of [

232 Lumileds Post-Hearing Brief at 5 (citing CPFF 1684).

233 *See* CX-472C at EC192747 and EC192759.

234 Lumileds Post-Hearing Brief at 11.

235 *Id.* (citing CPFF 1431).

][236] Thus, Lumileds concludes that "the ITO window layer in the MB and MB II LEDs has a resistivity that is less than [ ] the resistivity of their AlGaInP upper confining layer," and therefore the MB and MB II products infringe claim 6.[237]

Neither Epistar nor the Staff contests that the additional limitation of claim 6 which depends from claim 1 is met if all of the limitations of claim 1 are satisfied.

Based upon Dr. Dupuis' calculations that the highest potential resistivity value for the upper ITO layer is [ ][238] and the typical resistivity of the top portion of the AlGaInP layers is [ ],[239] the Administrative Law Judge concludes that the upper ITO layer in the MB and MB II products has a resistivity that is at least an order of magnitude less than the AlGaInP, and therefore that the MB and MB II products infringe claim 6 of the '718 patent.

3. <u>GB I & II</u>

Epistar's GB and GB II products generally have the following structures:

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[236] *Id.* (citing CPFF 1690).

[237] *Id.* (citing CPFF 1738-39, 1690).

[238] Dupuis Tr. 654:14-22.

[239] Dupuis Tr. at 648:21-649:13.

CLAIM 1

a. "a semiconductor substrate"

Lumileds argues that the GB and GB II LEDs both have semiconductor substrates.[240] In the GB product, Lumileds identifies the [ ] as the supporting material to which the active layers are attached.[241] According to Lumileds, the [

]"[242] Lumileds further argues that "there is no dispute that [ ] is a semiconductor" or that "the other layers of the LED are attached to the [ ] within the meaning of the ALJ's interpretation."[243]

Lumileds further argues that thin layers may be considered substrates. According to Lumileds, "there it no 'thickness' limitation expressed anywhere in the '718 Patent claims, nor is there any basis to find that the substrate must be a 'very thick material,' let alone 'several orders of magnitude thicker than any of the confining or active layers.'"[244] Lumileds further referred to the testimony of Dr. Dupuis which explained "that engineered or composite substrates that use very thin layers have been used in many contexts for may year prior to the invention."[245]

Epistar argues that under the construction of "substrate" set forth by the Administrative

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[240] Lumileds Post-Hearing Brief at 30.

[241] *Id.* (citing CPFF 1552).

[242] *Id.*

[243] *Id.* at 31 (citing CPFF 1553).

[244] Lumileds Post-Hearing Brief at 31.

[245] *Id.* at 33.

Law Judge, "the only possible 'substrate' in Epistar's products is the [ ] substrate in the OMA and MB products and the [ ] substrate in the GB products.[246] According to Epistar, "[t]hese substrates are the only layers of the accused products with sufficient strength to provide the mechanical support needed to process the wafers through completion and they are the layers to which all others are attached, or on which all others are deposited or grown."[247]

The Staff argues that in the GB and GB II products, "the substrate is made of ... [ ][248] According to the Staff, "[i]t is uncontested that the [ ] substrate of the GB and GB II products is not a semiconductor material required by the claim.[249] Thus, the Staff submits that with respect to the GB and GB II products, the "semiconductor substrate" limitation is not met.[250]

The Staff notes that for the Glue Bond products, "Dr. Dupuis testified that the semiconductor substrate is both the [ ] layers, which he believes to provide support for the LED structure above it."[251] The Staff further refers to the testimony of Dr. Dupuis who asserted a position that "those skilled in the art would recognize that t[h]in layers can be considered substrates, citing to certain articles discussing 'compliant substrate[s]'

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[246] Epistar Post-Hearing Brief at 16 (citing RPFF 504).

[247] *Id.*

[248] OUII Post-Hearing Brief at 10.

[249] *Id.* (citing Dupuis Tr. 1139:19-21).

[250] *Id.* at 6.

[251] *Id.* at 8 (citing Dupuis Tr. 671:1-7).

or 'thin substrate technology.'"[252] With reference to that testimony of Dr. Dupuis, the Staff contends that when asked during cross-examination about the "silicon on sapphire" substrates discussed in the prior art, in which a thin layer of silicon is placed over a thicker layer of sapphire, Dr. Dupuis admitted that the thin layer standing alone would not provide adequate mechanical support for an LED device.[253] Thus, the Staff concludes that Lumileds has not met its burden of showing that any other layers except the relatively thick layers in Epistar's products, including the [ ] layer in GB and GB II, are "substrates."[254]

The Administrative Law Judge has defined a "substrate" to be the supporting material in an LED upon which the other layers of an LED are grown or to which they are attached." In the GB product, Dr. Dupuis has identified the [

]"[255] To determine whether the [ ] is the supporting material upon which other layers are grown or attached, it is necessary to examine the process by which the GB product is fabricated. Dr. Chen described that manufacturing process in pertinent part as follows:

Q. Now, Dr. Chen, we're going to put up a brief animation on the

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[252] *Id.* at 10 (citing Dupuis Tr. 562:12-563:16).

[253] OUII Post-Hearing Brief at 10-11 (citing Dupuis Tr. 1127:6-11, 1128:10-12)(Dr. Dupuis testified that a thin layer would "provide support," but "[i]t wouldn't provide adequate mechanical support for a device.").

[254] *Id.* at 10.

[255] Dupuis Tr. 665:3-17.

manufacturing process of the GB product, and I would like you to describe some of the steps.
A. Okay.
Q. This is RDX-508.
A. Okay. Okay. For the manufacturing process, now, first of all, we will [

].[256]

The Administrative Law Judge finds that the [ ] identified by Dr. Dupuis as a "substrate" is not a layer upon which the other layers of the GB are grown or to which they are attached. While it is true that some layers are formed on or attached to the [ ], it is also true that the [ ]. Thus, the Administrative Law Judge concludes that the [ ] is not a "substrate" as construed in Order No. 27. The only layer in the GB product which satisfies that definition is the [ ] [ ] layer. RX-181C shows that the active layers, [

[256] Chen Tr. 1231:23-1233:13.

].[257] The remaining layers of the LED structure are fabricated [ ] as a foundation.[258]

With respect to the GB II product, Dr. Dupuis has identified the [ ] to be "substrates."[259] RX-181C shows that the manufacturing process of the GB II product, in relevant part, is approximately the same as described for the GB. For example, [ ].[260] It is also apparent that the thick layer of [ ] functions as the "substrate" for the GB II and that all the other layers [ ].[261] There is no argument that [ ] is a semiconductor; therefore, there is agreement that it is not.[262] Accordingly, the Administrative Law Judge finds that the GB and GB II products do not literally have a semiconductor substrate.

Lumileds, however, has argued that the GB and GB II products have "semiconductor substrates" by virtue of the doctrine of equivalents. Lumileds notes that Dr. Dupuis explained "the function of the 'semiconductor substrate' in claim 1 of the '718 Patent is to support the active layers;" "[t]he way this function is achieved is by providing a supporting layer underlying the active layers;" and "[t]he result is that the active layers are supported by the underlying

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[257] RX-181C (GB/GB II processes step by step).

[258] *Id.*

[259] Dupuis Tr. 671:1-7.

[260] RX-181C at EC145927.

[261] *See id.* at EC145927, et seq.

[262] Dupuis Tr. 1139:19-21.

semiconductor layer."[263] Lumileds further argues that the [ ] in the GB and GB II "serve this function in the same way to achieve the same result."[264] According to Lumileds, [e]ven if the [ ] layer provides a significant portion of the mechanical support for the active layers, the [ ] still provides some support."[265] In addition, Lumileds asserts that "even if the [ ] layers are found not to be semiconductor substrates on their own,....the use of a semiconductor layer [ ] in conjunction with a thicker support layer of insulating and/or non-semiconductor material (such as [ ]) below the semiconductor layer is at least equivalent to 'a semiconductor substrate.'[266]

Epistar disputes that the GB and GB II products contain a "semiconductor substrate" under the doctrine of equivalents. Epistar argues that "[b]ecause the function of the substrate is to provide mechanical support for the device, and Dr. Dupuis concedes that the device would fall apart if it had to rely on the layers he identifies as the substrate for support, Dr. Dupuis' 'substrate' cannot possibly serve substantially the same support function as the substrate contemplated by the patent."[267] According to Epistar, Dr. Dupuis' "substrate" also does not function in the same way or accomplish the same result.[268]

The Staff does not provide an argument with respect to the doctrine of equivalents.

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[263] Lumileds Post-Hearing Brief at 34.

[264] *Id.*

[265] *Id.* at 35.

[266] *Id.*

[267] Epistar Reply Brief at 3.

[268] *Id.*

A product that does not literally infringe can infringe under the doctrine of equivalents. "[T]he doctrine allows a finding of infringement when the accused product and the claimed invention perform substantially the same function in substantially the same way to yield substantially the same result."[269] At issue, is whether some other layer or combination of layers is the "equivalent" of the "semiconductor substrate" of claim 1. In this case, the Administrative Law Judge has already found that the function of the claimed "semiconductor substrate" is to serve as a foundation for the device and that function is achieved by providing adequate mechanical support for a device such that it does not break apart.

In the GB product, Lumileds argues that the [ ] in combination with the [ ] is equivalent to the claimed "semiconductor substrate."[270] In the GB II product, Lumileds argues that the combination of the [ ] in the device or that those two layers with the [ ] layer are equivalent.[271]

[

] layer which Dr. Dupuis agrees is a "substrate."[272] Dr. Dupuis testified that the [ ] layer "provides support to the upper layers above it."[273] Though Lumileds argues that the [

], Lumileds provides no citation to the record in

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[269] *Atlas Powder Co. v. E.I duPont de Nemours & Co.*, 750 F.2d 1569, 1579 (Fed. Cir. 1974)(internal citations omitted).

[270] Lumileds Post-Hearing Brief at 34-35.

[271] *Id.*

[272] *See* Dupuis Tr. 1139:12-15.

[273] Dupuis Tr. 665:3-17.

support of that assertion. Further, Lumileds provides no other evidence regarding the strength provided to the device by the [ ]. Thus, the Administrative Law Judge concludes that Lumileds has failed to show by a preponderance of the evidence that the [ ] will provide adequate mechanical support for a device and therefore, has failed to show that the two are equivalent.

With respect to the GB II product, the [ ] of the device are at issue. However, the Administrative Law Judge concludes that these layers also are not "equivalent" to the "semiconductor substrate" of claim 1. Though Dr. Dupuis asserts that these layers provide "support" to the layers above,[274] he further admitted that a thin layer would not "provide adequate mechanical support for a device."[275] In addition, Dr. Dupuis specifically stated that the function of the[ ] and not to provide mechanical support. Thus, here again, Lumileds has failed to show by a preponderance of the evidence that the [ ] layers are equivalent to a "semiconductor substrate." In addition, Lumileds argues that the layers Dr. Dupuis identified may be equivalent to a semiconductor substrate when considered with the [ ] layer. The Administrative Law Judge rejects Lumileds argument as unsupported by the record. Placing primary reliance upon the [ ] layer in a doctrine of equivalents analysis would essentially be writing a limitation out of the claim as it is undisputed that [ ] is not a semiconductor and claim 1 of the '718 patent specifically requires a "semiconductor substrate."

b. "an electrical contact to the substrate"

Lumileds argues that the GB and GB II LEDs also have "an electrical contact to the

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[274] Dupuis Tr. 670:17-671:7.

[275] Dupuis Tr. 1128:10-12.

substrate." According to Lumileds, in MB "[

]."[276] Lumileds further argues that in GB II, "Epistar [

.]"[277] Lumileds concludes that "to the extent the ALJ finds that the [ ] are a 'semiconductor substrate,' either literally or under the doctrine of equivalents, then there is no dispute that the 'electrical contact to the substrate' limitation in claim 1 is also met by the GB I and GB II."[278]

Epistar argues that the GB and GB II do not have an "electrical contact" to the [ ] substrate.[279] Instead, Epistar explains that the GB and GB II products have "both a negative and positive contact on the top side of the device requiring all current injected into the device to flow to the active layers from one spot rather than being spread out over the entire device."[280]

As the Administrative Law Judge has concluded that the [ ] layers of the GB and GB II LEDs serve as the substrate for those devices, the Administrative Law Judge further concludes that there is no electrode attached to either of those [ ] layers.

c. "active p-n junction layers for AlGaInP over the substrate for emitting light"

The parties do not dispute that the accused GB and GB II products have "active p-n

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[276] Lumileds Post-Hearing Brief at 35.

[277] *Id.*

[278] *Id.* (citing CPFF 1296, 1305, 1306).

[279] Epistar Post-Hearing Brief at 16 (citing RPFF 533).

[280] *Id.*

junction layers for AlGaInP over the substrate for emitting light." Accordingly, the Administrative Law Judge concludes that the GB and GB II products satisfy that element of claim 1.

d. "a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers"

Lumileds argues that "[m]uch like the MB I, the GB I has an ITO layer between the top metal contact and AlGaInP active layers and has metal grid lines at the interface between the ITO and the AlGaInP."[281]

With respect to this claim term, Epistar makes the same arguments why the GB and GB II products do not have the required "transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers" as it did for the MB and MB II products.[282]

The Staff also makes the same argument for the claimed "transparent window layer" in the GB and GB II products as it did for the MB and MB II products. Specifically, the Staff indicated that it "is of the view that regardless of the presence of fine grid lines or fine metal dots, the accused products have a window layer of ITO."[283]

The same issues with respect to whether the MB and MB II products contain the claimed "transparent window layer of semiconductor different from AlGaInP over the active layers and

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[281] Lumileds Post-Hearing Brief at 36.

[282] Epistar Post-Hearing Brief at 18-24.

[283] OUII Post-Hearing Brief at 14.

having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers" are also raised with respect to the determination of whether the GB and GB II products have the required transparent window layer. The layer which Lumileds contends satisfies this element of claim 1 is made of ITO, as in the MB and MB II products, and thus, the same analysis would apply. Accordingly, the Administrative Law Judge finds that the GB and GB II products do contain "a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers" for the same reasons recited above with respect to the MB and MB II products.[284]

e. "a metal electrical contact over a portion of the transparent layer"

The parties do not dispute that the accused GB and GB II products have "a metal electrical contact over a portion of the transparent layer." Accordingly, the Administrative Law Judge concludes that the GB and GB II products satisfy that element of claim 1.

The Administrative Law Judge concludes, however, that the GB and GB II do not infringe claim 1 of the '718 patent because they do not contain a "semiconductor substrate" either literally or under the doctrine of equivalents.

CLAIM 6

As the Administrative Law Judge has found that the GB and GB II products do not infringe claim 1 of the '718 patent, they cannot infringe claim 6, which depends from claim 1.

4. OMA I & II

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284 *See, supra,* at 50-51.

Epistar's OMA and OMA II products generally have the following structures:

[

]

ANALYSIS OF CLAIM 1

Lumileds argues the OMA and OMA II meet each limitation of claim 1 and the '718 patent.[285] According to Lumileds, "[f]or all the reasons explained above [with respect to the GB and GB II], the[ ] layers are each a 'semiconductor substrate' with an electrical contact thereto, and the [ ] ITO layer is the claimed 'transparent window layer.'"[286] Thus, Lumileds concludes that "for all the reasons discussed above, the OMA I and the OMA II infringe claims 1 and 6 of the '718 patent."[287]

Epistar makes the same argument that the OMA and OMA II products do not have an

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[285] Lumileds Post-Hearing Brief at 47.

[286] *Id.* at 47-48 (citing CF 1282-1299).

[287] *Id.* at 48.

"electrical contact to the substrate" that it did for the GB and GB II devices.[288] Epistar further makes the same arguments that the OMA and OMA II products do not have a "transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers."[289]

The Staff also makes arguments that are similar to those it made for the other Epistar products. The Staff identified the lowermost layer of [ ] in the OMA and OMA II products as the layer upon which those products rely upon for support for the LED components, and concludes that the [ ] is, therefore, the "semiconductor substrate" in those devices.[290] The Staff further indicates that Lumileds has "not met its burden of establishing that any layer in the accused products, other than the relatively thick layers in the OMA [and] OMA II [] products, satisfy the claim requirement of a "semiconductor substrate."[291]

a. "a semiconductor substrate"

In the OMA product, Dr. Dupuis has identified the ITO, [ ] as the "semiconductor substrate" required by claim 1.[292] Dr. Dupuis further indicates that these layers "play a role in the substrate in supporting the LED

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[288] Epistar Post-Hearing Brief at 16-18.

[289] *Id.* at 18-30.

[290] OUII Post-Hearing Brief at 9.

[291] *Id.* at 10.

[292] Dupuis Tr. 560:5-17.

layers above it in combination with these other materials below."[293] With respect to the OMA II device, Dr. Dupuis has also identified the [ ] layers as the "semiconductor substrate."[294] The Administrative Law Judge, however, concludes once again that the multiple layers identified by Dr. Dupuis as the "semiconductor substrate" in the OMA and OMA II devices do not actually satisfy that limitation as construed in Order No. 27.[295]

In this case, the layers identified by Dr. Dupuis in both the OMA LEDs are not the layers upon which the layers of the OMA device are grown or to which they are attached because the [ ][296] In the OMA II device, Dr. Dupuis has identified the same layers as the "semiconductor substrate."[297] However, when asked by the Administrative Law Judge about the support role of the three layers he identified as the "semiconductor substrate," the following exchange occurred:

> JUDGE HARRIS: On this, are you saying, Dr. Dupuis, that the LED or the chip would not have sufficient support if the relay was identified as a substrate or removed?
> THE WITNESS: If those layers, if these layers described here as substrate layers were removed, clearly the LED wouldn't be attached to anything.
> JUDGE HARRIS: Well, I mean, then the electrode would then rest on the layers below it.
> THE WITNESS: You mean the cladding layer would be here on top of the [ ]?
> JUDGE HARRIS: Yes, let's assume that.

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293 *Id.* at 560:19-24.

294 Dupuis Tr. 657:24-658:10; CDX-825C.

295 *See* Order No. 27 at 13-14.

296 *See* RX-180 (OMA/OMA II processes) at EC145971.

297 Dupuis Tr. 657:24-658:10.

> THE WITNESS: My point is that these layers are essential to the function of this device. Without them, if they just disappeared, clearly there would be no connection. If you connect the cladding layer to the [ ], you have no way to adequately provide an electrical contact. While the design would probably be mechanically stable, it wouldn't function as an LED.[298]

Here Dr. Dupuis indicates that the function of the [ ] layers is not really to provide support, but rather to insure an electrical connection through the device.

The Staff, on the other hand, has identified the thick [ ] layer at the bottom of the device as the "semiconductor substrate."[299] According to the Staff "the OMA and OMA II products rely upon the lowermost layer of [ ] to provide support for the LED components" and the Administrative Law Judge agrees.[300] [ ].[301] Thus, the Administrative Law Judge concludes that the [ ] layer in the OMA and OMA II devices meets the requirements of a "semiconductor substrate" as construed in Order No. 27.

b. "an electrical contact to the substrate"

In the OMA an OMA II LEDs, the electrical contacts are both on the top side of the device. As there is no electrical contact attached to the [ ] substrate, the Administrative Law Judge concludes that this element has not literally been satisfied.

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[298] Dupuis Tr. 564:4-565:1.

[299] OUII Post-Hearing Brief at 9-10.

[300] *Id.* at 9.

[301] *See* RX-180 at EC145971-78.

Lumileds argues that this element is met through the doctrine of equivalents.[302] Lumileds, however, relies upon the testimony of Dr. Dupuis which was stricken in Order No. 28.[303] Furthermore, Dr. Jokerst testified that having two electrodes on the top side of a device is not equivalent to having one attached to the substrate.[304] Thus, the Administrative Law Judge concludes that Lumileds has failed to show that two top-side electrodes are equivalent to having one electrode attached to the substrate.

c. "active p-n junction layers for AlGaInP over the substrate for emitting light"

The parties do not dispute that the accused OMA and OMA II products have "active p-n junction layers for AlGaInP over the substrate for emitting light." Accordingly, the Administrative Law Judge concludes that the OMA and OMA II products satisfy that element of claim 1.

d. "a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers"

The same issues with respect to whether the MB and MB II products contain the claimed "transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers" are also raised with respect to the determination of whether the OMA and OMA II products have the required transparent window layer. The layer which Lumileds contends

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302 Lumileds Post-Hearing Brief at 48.

303 *See* Order No. 28 at 7.

304 Jokerst Tr. 1686:3-1688:11.

satisfies this element of claim 1 is made of ITO, as in the MB and MB II products, and thus, the same analysis would apply. Accordingly, the Administrative Law Judge finds that the OMA and OMA II products do contain "a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers" for the same reasons recited above with respect to the MB and MB II products.[305]

e. "a metal electrical contact over a portion of the transparent layer"

The parties do not dispute that the accused OMA and OMA II products have "a metal electrical contact over a portion of the transparent layer." Accordingly, the Administrative Law Judge concludes that the OMA and OMA II products satisfy that element of claim 1.

As the OMA and OMA II devices do not contain each and every element of claim 1of the '718 patent, namely a semiconductor substrate and an electrical contact to that substrate, the Administrative Law Judge concludes that they do not infringe.

ANALYSIS OF CLAIM 6

As the Administrative Law Judge has found that the OMA and OMA II products do not infringe claim 1 of the '718 patent, they cannot infringe claim 6 which depends from claim 1.

5. Licensing Defense for MB and OMA Products

On June 30, 2004, Lumileds Lighting, U.S. LLC and Epistar Corporation settled litigation that was pending in the Northern District of California. A copy of that settlement agreement is contained in CX-300C. [

[305] *See, supra,* at 50-51.

.][306] In particular, the "Licensed Field" delineated in the settlement agreement is as follows:

[

][307]

Epistar argues that the settlement agreement contains [

] However, Epistar acknowledges that there is a dispute among the parties as to whether its products [

] (i.e., OMA I, OMA II, MB I and MB II) are encompassed within the scope of the license. Epistar argues as an affirmative defense that such products are licensed, and thus there can be no infringement under the '718 patent.[308]

In particular, Epistar argues that Lumileds' CEO, Michael Holt, who signed and negotiated the settlement agreement on behalf of Lumileds, [

]; that Epistar's OMA I, OMA II, MB I, MB II have a [ ]; that Lumileds makes certain Luxeon products which [

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306 CX-300 at 1.4, 2.1, 3.1; Lee Tr. 965-966.

307 CX-300C at 1.2, 1.7; Dadok Tr. 1190.

308 Epistar Post-Hearing Brief at 34-37; Epistar Reply Brief at 13-19.

]. Thus, it is argued, there should be no serious dispute that Epistar's MB and OMA products are [

]

Epistar further argues that Lumileds has manufactured a linguistic dispute [

] – which is inconsistent with its actions and stated intent.

Lumileds argues that Epistar bears the burden of proving that its OMA and MB LEDs are covered by an existing license between the parties, and Epistar cannot meet this burden because its own witnesses and documents distinguish between [ ] that are the subject of the license agreement, and the [ ] OMA and MB products.[309]

In particular, Lumileds argues that in an [

[309] Lumileds Post-Hearing Brief at 52-58 (citing, *inter alia*, *Spindelfabrik Suessen-Schurr v. Schubert & Salzer Maschinenfabrik Aktiengesellschaft*, 903 F.2d 1568, 1576 (Fed. Cir. 1990) (accused infringer has burden of proving a licensing defense); and *McCoy v. Mitsuboshi Cutlery*, 67 F.3d 917, 920 (Fed. Cir. 1995) (licensing defense is an affirmative defense)); Lumileds Reply Brief at 31-33.

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Lumileds argues that when governing California law is applied, and one looks to the intention of the parties, one finds that the accused OMA and MB products cannot be covered by the license because [

[310]]

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[310] Epistar has dropped its affirmative defense [

(continued...)

Additionally, Lumileds argues that Epistar and others in the industry understand that LEDs [ ] For example, it is argued that Epistar owns a patent, the '778 patent, which is directed to the MB products and distinguishes between [ ]. Moreover, the result of using a [ ] in both the MB and OMA products is that light output by the devices is much higher than [ ] It is also argued that numerous publications differentiate [ ].

The Staff argues that the central question regarding the scope of the license is whether it covers those products with [ ]. The Staff notes that [ ] the Staff argues that evidence produced at the hearing established that at the time the license was entered into, [ ] was recognized as a category of LED devices. Indeed, the Staff argues, Lumileds put forward a large number of journal articles and patents (such as CX-116, CX-121, CX-127, CX-144, CX-145,

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310 (...continued)

]

CX-150, CX151, and CX-152) in which the authors distinguished [

][311]

Contrary to Epistar's argument, a review of the testimony of Mr. Holt and Mr. Dadok, who are both Lumileds employees or officers responsible for negotiating the settlement agreement, shows that there is no clear admission on Lumileds' part that the OMA and MB products are licensed under the terms of the agreement. For example, Mr. Dadok took a lead role in negotiating the agreement, and testified at the hearing that the Epistar products at issue [

][312]

Lumileds' expert, Dr. Dupuis, testified that AlInGaP LEDs are commonly discussed in terms of whether they have [ ] He pointed to several examples of such terminology in patents and industry publications, including printed material from Epistar.[313] The effect of [ ] techniques have been developed in the LED industry, including Epistar as shown in one of its patents. Contrary to Epstar's argument, it is not uncommon to differentiate [ ] products from other products [

[311] OUII Post-Hearing Brief at 41-42; OUII Reply Brief at 20.

[312] *See* Dadok Tr. 1194, 1198-1201. Any testimony approximating an admission that the Epistar [ ] products are licensed may have pertained [ ]. *See* RRX-84C (Holt Dep.) Tr. 133-134, 147-148.

[313] *See* Dupuis Tr. 692-695, 1949-1952.

].[314]

Epistar points out that some of the materials relied upon by Lumileds to differentiate [ ] were authored by, or otherwise connected to, Epistar's Dr. Chen. Although Dr. Chen testified at the hearing in opposition to Lumileds' arguments, he was not questioned about the art in question.[315]

].

No party disputes the fact that the type of [ ] used in Epistar's OMA and MB products has [ ]. Yet, the fact that [ ]. In the case of the accused OMA and MB products, one cannot ignore the so-called "improvements" to which Dr. Chen referred, and in particular, the [ ], which Dr. Chen described at the hearing, as follows:

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[314] *See* Dupuis Tr. 693-695, 699-700, 1950-1952; Dadok Tr. 1168-1169, 1949-1950.

[315] *See* Epistar's Reply Brief at 19 (citing Chen Tr. 1261).

[

.]

Chen Tr. 1227 (emphasis added).

[

[316]].

There is no evidence that Lumileds and Epistar concluded [

[316] Chen Tr. 1227-1228.

].

Epistar has not established that its OMA or MB products are licensed under the '718 patent.

B. U.S. Patent No. 5,376,580

1. <u>Asserted Claims 1-3</u>

Lumileds has accused Epistar's GB, GB II, OMA and OMA II products of infringing claims 1-3 of the '580 patent. Those asserted claims read as follows:

Claim 1. A method of forming a light emitting diode (LED) comprising:

selecting a first material having properties compatible with fabricating LED layers having desired mechanical characteristics;

providing a first substrate made of the selected first material;

fabricating the LED layers on the first substrate, thereby forming an LED structure;

selecting an optically transparent material compatible with enhancing light-emitting performance of the LED structure; and

wafer bonding a transparent layer of the selected optically transparent material to the LED layers.

Claim 2. The method of claim 1 wherein fabricating the LED layer is a step of epitaxially growing a plurality of layers on the first substrate, the first material being a selection of a material to provide a lattice compatible with epitaxially growing the plurality of layers, said step of epitaxially growing said layers including limiting each layer to a maximum thickness of 75 μm.

Claim 3. The method of claim, 1 further comprising removing the first substrate.

ANALYSIS OF CLAIM 1

2. GB and GB II

The only limitation in claim 1 of the '580 patent that Lumileds argues is in dispute is whether the manufacturing of the GB and GB II devices involve "wafer bonding a transparent layer of the selected optically transparent material to the LED layers." Lumileds first argues that "glue bonding" is a "wafer bonding" technique that "employs layers of glue or adhesive to form a wafer bonding interface."[317] Lumileds further argues that in the GB and GB II, "[ ] is glue bonded to the LED layers."[318] In addition, Lumileds argues that in the GB II, "[ ] layers are directly joined to the LED layers through the glue bonding interface."[319]

In addition, Lumileds contends that "[e]ven if the Administrative Law Judge found that "directly joining" the wafer bond layer to the LED layers precludes the presence of an interface there would still be direct infringement because "[t]he term "LED layers" is broadly defined in the patent to include many layers such as light extraction layers."[320] According to Lumileds, in addition to the AlGaInP and [ ] may also be considered

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[317] Lumileds Post-Hearing Brief at 38.

[318] *Id.* at 39 (citing CPFF 1115-21, 1160-64, 2250-55).

[319] *Id.* (citing CPFF 163, 2387).

[320] *Id.* (citing CPFF 1745, 1761-63).

LED layers because they act as light extraction layers.[321] Lumileds concludes that "[

]"[322]

Epistar argues that the GB and GB II products do not infringe the '580 patent literally or under the doctrine of equivalents. According to Epistar, with the GB products, the "[

"[323] and that "[

]."[324] In addition, Epistar contends that there is no wafer bonding in the GB products.[325]

The Staff submits that the manufacturing processes used to make Epistar's [] GB and GB II products do not literally practice claim 1 of the '580 patent."[326] The Staff asserts that "Epistar does not practice the step of 'selecting an optically transparent material compatible with enhancing light-emitting performance."[327] According to the Staff, Epistar uses [ ] which the evidence indicates "does not add to the devices' ability to emit light."[328] In addition, the Staff argues that Epistar does not perform the claimed step of "wafer bonding a transparent layer of the selected optically transparent material to the LED layers," because adhesive bonding does not

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[321] *Id.* at 39-40 (citing CPFF 1122, 1967, 2242, 2250).

[322] *Id.* at 40 (citing CPFF 1114-16, 1121, 1161, 2387).

[323] Epistar Post-Hearing Brief at 62.

[324] *Id.* at 60.

[325] *Id.* at 61.

[326] OUII Post-Hearing Brief at 20.

[327] *Id.*

[328] *Id.*

constitute "wafer bonding."[329] Furthermore, the Staff asserts that the [ ] is not brought into contact with the LED layers, but instead with the intermediate [ ] layer.[330]

The Administrative Law Judge has construed the key disputed terms as follows:

> "LED layers" – layers that form a light emitting diode or LED structure. The LED layers that form an LED structure may consist of a light emitting active layer, upper and lower confining layers, current spreading and light extraction layers and one or more buffer layers, but this is not critical since not every such layer need be included.
>
> "wafer bonding" – the bringing of two wafer surfaces into physical contact such that a mechanically robust bond forms between them. The type of wafers that may be wafer bonded is not limited to semiconductors, but may also include glass or a mirror. Furthermore, Van der Waals bonding, metal-to-metal bonding and glue bonding are not wafer bonding within the meaning of the '580 and '316 patents.
>
> "to the LED layers" – joined directly to the LED layers.[331]
>
> "material compatible with enhancing light-emitting performance of the LED structure" – a material that may be used, alone or in combination with other materials, to increase the light emitting performance, such as for example the light output or efficiency, of an LED source[332]

In this case, the parties have disputed whether two elements of claim 1 of the '580 patent are met by Epistar's process: (1) whether Epistar performs the step of "selecting an optically transparent material compatible with enhancing light-emitting performance;" and (2) whether Epistar performs the step of "wafer bonding a transparent layer of the selected optically transparent material to the LED layers." The parties to this investigation do not dispute that the remaining elements of claim 1 are satisfied.

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[329] *Id.* at 21.

[330] *Id.*

[331] Order No. 27 at 60.

[332] Order No. 27 at 52.

Drs. Dupuis and Chen explained how the GB and GB II products are made. During the fabrication of the GB product, [ ][333] According to Dr. Dupuis, Lumileds asserts that selecting the combination of [ ] satisfies the requirement of "selecting an optically transparent material compatible with enhancing light-emitting performance."[334] The Administrative Law Judge finds that the assertion that a combination of materials will meet the requirement of "selecting an optically transparent material" is acceptable as the Administrative Law Judge's construction specifies that the "optically transparent material" "may be used, alone or in combination with other materials."[335] In addition, however, the "optically transparent material" must also "increase the light emitting performance" of the device and Dr. Jokerst submits that the transparent materials selected by Dr. Dupuis do not in fact enhance the light-emitting performance of the LED.[336] Specifically, Dr. Jokerst notes that:

> The tests that I use to tell me if a layer is going to actually enhance the performance is to say, okay, if I take this layer off, is the performance worse? In other words, does adding that layer improve the performance? When we bond that [ ] substrate on, it doesn't enhance the performance because there's nothing absorbing here that we're moving.
>
> But once we take off that absorbing substrate, we have to support this structure on something. And so for Claim 1, the [ ] substrate does not enhance the optical performance of the device. You're replacing air with

[333] *See* RX-181 at EC145919 and RDX-520; Dupuis Tr. 889:18-25, 890:1-7.

[334] Dupuis Tr. 880:6-17.

[335] Order No. 27 at 52.

[336] Jokerst Tr. 1700:17-1701:21.

[ ], and they're both transparent.[337]

The Administrative Law Judge, however, disagrees with Dr. Jokerst's analysis. In this case, the Administrative Law Judge finds that you are not replacing air with [ ], but rather replacing the [

].[338] Taking that view, it is apparent that the [ ] substrate does enhance light-emitting performance because the [ ] is transparent in contrast to the [

] which absorbs light. Thus, the Administrative Law Judge finds that Epistar does perform the step of "selecting an optically transparent material compatible with enhancing light-emitting performance of the LED structure."

Whether or not there is infringement also depends upon whether Epistar's technique of glue bonding its LEDs together constitutes "wafer bonding" within the meaning described in the '580 patent. As indicated earlier in the claim construction section, the Administrative Law Judge has determined that wafer bonding only encompasses direct bonding and, therefore, glue bonding as indirect bonding is not included. Thus, the final element of claim 1 is not satisfied. Accordingly, the Administrative Law Judge concludes that the GB product does not literally infringe claim 1 of the '580 patent.

With respect to the GB II product, the manufacturing process is similar, but not identical to that for the GB device. In particular, on top of the [

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[337] Jokerst Tr. 1701:6-21.

[338] *See* RX-181C at EC145919-20.

] which is not found in the GB product.[339] In addition, there is also a layer of [ ].[340] The layers, however, are still bonded together using an adhesive.

Dr. Dupuis asserts that each of the [ ] are the transparent layers that are bonded to the LED structure.[341] Dr. Dupuis has further indicated that in addition to bonding, the [ ] are involved in light extraction.[342] Thus, the Administrative Law Judge agrees that the transparent layers will "enhance light-emitting performance." However, the GB II product is also made with glue bonding, and for that reason, the Administrative Law Judge concludes that the GB II product does not literally infringe claim 1 of the '580 patent.

Lumileds, however, has also asserted that glue bonded LEDs nevertheless infringe claim 1 under the doctrine of equivalents. Specifically Lumileds argues, "[t]he use of transparent layers of [ ] wafer to the epi wafer is equivalent to the 'wafer bonding [of] a transparent layer of the selected optically transparent materials to the LED layers' recited in claim 1."[343] According to Lumileds, "[t]he functions are substantially the same, *i.e.*, enhancing the light-emitting performance of the LED structure," and the way is substantially the same, *i.e.*, bonding a transparent layer (of a material upon which the

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339 RX-181 at EC145927.

340 *Id.*

341 Dupuis Tr. 904:2-9.

342 *Id.* at 799:12-800:2.

343 Lumileds Post-Hearing Brief at 40.

LED layers could not have been grown) to the epi wafer such that light-emitting performance is enhanced."[344] Lumileds concludes that "[t]he presence of an intervening layer between the wafer bonded layers and the LED layers does not change the way in which these layers function to achieve the results."[345]

Epistar argues that "the glue bonding [method] used by Epistar [is] very different from the claimed wafer bonding in function, way and result," and the Administrative Law Judge agrees.[346] The method of bonding disclosed in the '580 patent involves the direct bonding of two wafers at high temperature to form a mechanically robust and optically transparent bond between them without adding foreign materials, such as glues or metals, in between the layers.[347] The resulting device is electrically conductive from top to bottom.[348]

The doctrine of equivalents "prevents an accused infringer from avoiding infringement by changing only minor or insubstantial details of a claimed invention . . . ."[349] As with any infringement analysis, "equivalence [is] assessed on a limitation-by limitation basis, as opposed to from the perspective of the invention as a whole."[350] Accordingly, "an element of an accused product or process is not, as a matter of law, equivalent to a limitation of the claimed invention if

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[344] Lumileds Post-Hearing Brief at 40 (citing CPFF 2265-66).

[345] *Id.* (citing CPFF 2267).

[346] Epistar Post-Hearing Brief at 58.

[347] Jokerst Tr. 1654:15-1657:22.

[348] *Id.*

[349] *Sage Products v. Devon Indus. Inc.*, 126 F.3d 1420, 1424 (Fed. Cir. 1997) (emphasis added).

[350] *Freedman Seating Co. v. American Seating Co.*, 420 F.3d 1350, 1358 (Fed. Cir. 2005).

such a finding would entirely vitiate the limitation."[351] In other words, the doctrine cannot be used to improperly expand the scope of claim language.[352] Indeed, "for a patentee who has claimed an invention narrowly, there may not be infringement under the doctrine . . . even though the patentee might have been able to claim more broadly."[353] Here, the '580 patent specification and claims make clear that "wafer bonding" refers to direct fusion bonding. Indirect bonding, as performed for the accused products, cannot be found to meet this element of the claims because it would effectively ignore the proper construction of "wafer bonding . . . to the LED layers" and would "erase" limitations in claim 1 of the '580 patent.[354] In sum, Lumileds chose to claim its invention in the '580 patent narrowly, and cannot expand the breadth of it claims through the doctrine of equivalents.[355]

Furthermore, the evidence makes clear that by introducing foreign materials for bonding, such as adhesives or metals, the bonding process is different, and just as significantly, the resulting device is different from wafer bonding. With the glue bonding process, the [

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351 *Freedman*, 420 F.3d at 1358.

352 *See Conopco, Inc. v. May Dep't Stores Co.*, 46 F.3d 1556, 1562 (Fed. Cir. 1994) ("The doctrine of equivalents cannot be used to erase 'meaningful structural and functional limitations of the claim on which the public is entitled to rely in avoiding infringement.'").

353 *Sage*, 126 F.3d at 1424.

354 *See also Asyst Techs., Inc. v. Empak, Inc.*, 402 F.3d 1188, 1195 (Fed. Cir. 2005) ("unmounted" structure not equivalent where claim requires it to be "mounted").

355 *See Freedman*, 420 F.3d at 1361 ("[A]s between the patentee who had a clear opportunity to negotiate broader claims but did not do so, and the public at large, it is the patentee who must bear the cost of its failure to seek protection for this foreseeable alteration of its claimed structure.").

].[356] In addition, the [

], the GB and OMA products are not electrically conductive from top to bottom.[357] As a result, the current must pass in a "U" [

] in order to generate light. Such a path results in the generation of less light than the light emitted by a device which comports with the method of the '580 patent.[358]

From these differences, the Administrative Law Judge concludes that "wafer bonding a transparent layer of the selected optically transparent material to the LED layers" is not substantially equivalent in function, way and result to glue bonding a transparent layer of the selected optically transparent material to the LED layers. Bearing in mind that the Administrative Law Judge has construed "wafer bonding" to mean direct bonding, the Administrative Law Judge finds that while the "function" of the limitation may be to enhance light-emitting performance, the "way " must be more than simply bonding a transparent layer using any bonding method. Instead, the "way" is directly bonding of the transparent layer. As described above, the differences between direct and indirect bonding are substantial and thus the substitution of glue bonding for direct bonding cannot be characterized as insubstantial change from the claimed subject matter without rendering meaningless the limitation at issue.

3. OMA and OMA II

Lumileds argues that like the GB and GB II devices which are glue bonded LEDs, the OMA and OMA II infringe claim 1 of the '580 patent because those devices use an "adhesive

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[356] Jokerst Tr. 1654:7-1655:9; Hsieh Tr. 1288:3-15.

[357] Jokerst Tr. 1659:17-25.

[358] Jokerst Tr. 1685:16-1688:10.

layer of transparent [ ] to wafer bond transparent layers to the LED layers.[359] Lumileds further argues that OMA and OMA II [ ] like the GB II device.[360] According to Lumileds, in the OMA product "transparent layers of [ ] wafer are wafer bonded directly to the LED layers through the glue bonding interface."[361] Lumileds asserts that [ ] layers in the OMA are "compatible with enhancing light emitting output because they are transparent layers through which light travels on its way to and from the metal mirror."[362] In addition, Lumileds argues that "[i]n the OMA I, the transparent layers of [ ] wafer are wafer bonded directly to the LED layers through the glue bonding interface."[363] According to Lumileds, the interface includes that [ ] layers.[364]

Lumileds asserts that the OMA II "[ ]"[365] and the [ ].[366] In this case, Lumileds argues that the "transparent layers are joined to the LED layers through an

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[359] Lumileds Post-Hearing Brief at 49.

[360] *Id.*

[361] *Id.* (citing CPFF 993, 1963, 1968).

[362] *Id.* (citing CPFF 1070-71, 1967).

[363] Lumileds Post-Hearing Brief at 49 (citing CPFF 993, 1018-19, 1963, 1968).

[364] *Id.*

[365] *Id.* (citing CPFF 1095-96).

[366] *Id.* (citing CPFF 1097-1101).

interface that includes not only the bonding layers, but also a portion of the mirror."[367] In addition, Lumileds argues that "by bonding together the [ ] the mirror, [ ] work in conjunction with the other layers [ ] to be compatible with enhancing light-emitting output."[368]

Epistar argues that there can be no infringement of claim 1 of the '580 patent because "in the OMA products the bonding is not direct, it is with glue."[369] Epistar further argues that nothing is bonded directly to the LED layers.[370] In addition, as with the GB products, Epistar argues that there is no infringement under the doctrine of equivalents.[371] According to Epistar, there is no "bonding ....to the LED layers."[372] Nor is glue bonding equivalent to wafer bonding.[373]

The Staff argues that the manufacturing processes for the OMA and OMA II demonstrate that those products do not literally practice claim 1 of the '580 patent.[374] According to the Staff, "Epistar does not practice the step of 'selecting an optically transparent material compatible with

367 *Id.* (citing CPFF 1101, 1965-67).

368 *Id.* (citing CPFF 1072-73, 2062-66, 2127, 2129).

369 Epistar Post-Hearing Brief at 61 (citing RPFF 179-184, 747-749)

370 *Id.* at 60.

371 *Id.* at 61.

372 *Id.*

373 *Id.*

374 OUII Post-Hearing Brief at 20.

enhancing light-emitting performance.'"[375] In addition, the Staff argues that Epistar does not use the claimed step of "wafer bonding a transparent layer of the selected optically transparent material to the LED layers."[376] Further, the Staff argues that "to the extent the [ ] can be considered the "transparent material," since it is not brought into contact with the LED layers, but instead with the [ ], it cannot be considered wafer bonded to the LED layers as required."[377]

Once again, the fourth and fifth elements of claim 1 of the '580 patents are at issue with respect to the OMA and OMA II products. The fourth element requires the step of "selecting an optically transparent material." Dr. Jokerst argues that "there is no optically transparent material that's selected in the OMA I," but does not provide any further explanation.[378] On the other hand, Dr. Dupuis indicates during his testimony that the "[ ]" are the layers which correspond to the fourth claim element.[379] Dr. Dupuis has indicated that the [ ] layers are "compatible with enhancing light-emitting performance" as construed by the Administrative Law Judge. Specifically, Dr. Dupuis indicates that in the OMA device, "these transparent materials that were selected are the [

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[375] *Id.*

[376] *Id.* at 21.

[377] *Id.* (citing Jokerst Tr. 1684:5-8, 1696:7-13, 1701:22-1702:12, 1709:11-19).

[378] Jokerst Tr. 1683:17-19.

[379] Dupuis Tr. 836:8-17.

].”[380] In the OMA II device, Dr. Dupuis identified the [

]” as “optically transparent materials.” In essence, Dr. Dupuis indicates that the infringement analysis with respect to claim 1 of the ‘580 patent and the OMA II LED is “substantially identical.”[381] From Dr. Dupuis’ testimony, the Administrative Law Judge concludes that Epistar does perform the step of “‘selecting an optically transparent material compatible with enhancing light-emitting performance” in making the OMA and OMA II products.

However, the OMA and OMA II products are created using glue bonding which the Administrative Law Judge has already determined is not wafer bonding and thus, Epistar does not perform the claimed step of “wafer bonding a transparent layer of the selected optically transparent material to the LED layers.”

Lumileds’ argument that the OMA and OMA II infringe under the doctrine of equivalents consists of the following statement: “Thus, as explained above, the OMA I & OMA II infringe claims 1, 2, and 3 both literally and under the doctrine of equivalents.”[382] Lumileds has, however, cited to five findings of fact which appear to support an argument identical to Lumileds’ argument that the GB and GB II devices infringe claim 1 under the doctrine of equivalents.[383] As the OMA and OMA II also use a glue bonding process rather than wafer bonding, the Administrative Law Judge has determined that the doctrine of equivalents analysis

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380 *Id.*

381 Dupuis Tr. 866:1-11.

382 Lumileds Post-Hearing Brief at 49.

383 *See* CPFF 2002-2006.

would be identical to that set forth for the GB and GB II products.[384] Thus, the Administrative Law Judge concludes that the OMA and OMA II products do not infringe claim 1 of the '580 patent under the doctrine of equivalents.

ANALYSIS OF CLAIMS 2 AND 3

Claims 2 and 3 of the '580 patent depend from claim 1. As the GB and GB II, OMA and OMA II devices do not infringe claim 1, they also do not infringe claims 2 and 3.

4. Asserted Claims 8-9

Lumileds has accused Epistar's MB and MB II products of infringing claims 8 and 9 of the '580 patent. Those asserted claims read as follows:

Claim 8. A method of forming a light emitting diode (LED) comprising:

providing a temporary growth substrate having a lattice compatible with epitaxially growing LED layers;

epitaxially growing a lamination of LED layers on the growth substrate, the lamination having a first side and having a second side coupled to the growth substrate, the growth substrate thereby forming a growth support surface; and

substituting the temporary support surface with a permanent substrate having at least one of a higher electrical conductivity and an increased optical transparency relative to the growth substrate, the substituting including wafer bonding the permanent substrate to one of the first and second sides of the LED layers, the wafer bonding including elevating the temperature at the interface of the permanent substrate and the LED layers the wafer bonding further including applying force to compress the permanent substrate and the LED layers together to achieve a low resistance connection therebetween.

Claim 9. The method of claim 8 wherein substituting the temporary support surface includes removing the growth substrate following the wafer bonding of the permanent substrate to the first side of the LED layers.

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[384] *See supra* Section ??

ANALYSIS OF CLAIM 8

5. MB and MB II

Lumileds submits that there are three issues with regard to whether Epistar's MB and MB II products infringe claims 8 and 9 of the '580 patent: (1) whether the [ ] substrate has "a higher electrical conductivity" than the [ ] substrate; (2) whether the metal bonding of the [ ] substrate is "wafer bonding"; and (3) whether there is an "interface of the permanent substrate and the LED layers."[385]

Lumileds first argues that the MB and MB II products to have a "permanent substrate having a "higher electrical conductivity ... relative to the growth substrate."[386] According to Lumileds, a [

].[387] Furthermore, Lumileds concludes that the "[ ] substrate has a higher electrical conductivity than that [ ] substrate[388] based on Dr. Dupuis' calculations that "the [ ] substrate would have a lower resistivity than the lowest of the possible range of resistivities for the [ ] substrate in the MB products."[389] Lumileds provides the same infringement arguments

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[385] Lumileds Post-Hearing Brief at 12.

[386] *Id.* (citing CPFF 2437-2466).

[387] *Id.* (citing CPFF 2452-53).

[388] *Id.* (citing CPFF 2445-46).

[389] *Id.* at 13 (citing CPFF 2450-51).

with respect to the MB and MB II devices.[390]

With respect to the question of whether metal bonding is "wafer bonding" as that term is used in the '580 patent, Lumileds makes each of the arguments discussed in the section on claim construction.

Furthermore, the arguments Lumileds raised with respect to the proper definition of the term "interface" are also discussed in the claim construction section above. Lumileds concludes that "[a]pplying the proper construction, the MB I and MB II LEDs literally meet this limitation of claim 8. Specifically, the [ ] layer form an interface to the undisputed 'lamination of LED layers' in these LEDs."[391]

Epistar argues that the MB and MB II devices do not infringe claims 8 and 9 of the '580 patent for several reasons. First, Epistar asserts that "there is no bonded interface between the permanent substrate and the LED layers, as required by claims 8 and 9."[392] According to Epistar, the "bonded interface is between the [ ]" rather than between the substrate and the LED layers.[393] Epistar concludes that "to find this to be equivalent to a direct interface between [ ] and the LED layers, is to read this claim element out of the patent."[394]

Epistar further argues that "[c]laims 8 and 9 also require the wafer bonding to 'further

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[390] Dupuis Tr. 908:4-10 (indicating that the differences between the two products is not significant for purposes of Lumileds' infringement analysis).

[391] Lumileds Post-Hearing Brief at 22.

[392] Epistar Post-Hearing Brief at 64 (citing RPFF 781).

[393] *Id.* (citing RPFF 261-62, 275, 781, 783, 787, 789).

[394] *Id.*

includ[e] applying force to compress the permanent substrate and the LED layers together .....’”[395] According to Epistar, [i]n the MB products the [ ]” and “the permanent substrate and the LED layer are not ‘together;’ there are at least [ ] layers between them.”[396]

Finally Epistar argues that “[i]n the MB products, the permanent substrate is [ ]substrate does not have a higher electrical conductivity or an increased optical transparency over the [ ].[397]

The Staff agrees with Epistar that the “permanent substrate of the MB and MB II products is not wafer bonded to the LED layers by virtue of the fact that there are intermediate layers, including the [ ] layers, that prevent the substrate and the LED layers from coming into direct contact.”[398] According to the Staff, “these intermediate layers prevent the

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[395] *Id.* at 65.

[396] Epistar Post-Hearing Brief at 65 (citing 245-46).

[397] *Id.* (citing RPFF 777-80).

[398] OUII Post-Hearing Brief at 24 (citing Jokerst Tr. 1722:8-10).

formation of an interface between the permanent substrate and the LED layers where the temperature must be elevated in order to practice the claim.[1] Further the Staff argues that "the permanent substrate in the MB and MB II products is optically absorbing and thus does not satisfy claim 8's requirement for a 'permanent substrate having an increased optical transparency relative to the growth substrate.'"[2]

With respect to claim 8 of the '580 patent, only the third claim element is disputed. The Administrative Law Judge has construed the key disputed terms as follows:

> "coupled to" – joined directly.[3]
>
> "to achieve a low resistance connection therebetween" – as a result of wafer bonding, the interface between the permanent substrate and the LED layers has a low resistance.[4]
>
> "wafer bonding" – the bringing of two wafer surfaces into physical contact such that a mechanically robust bond forms between them. The type of wafers that may be wafer bonded is not strictly limited to semiconductors, but may also include glass or a mirror. Furthermore, Van der Waals bonding, metal-to-metal bonding and glue bonding are not wafer bonding within the meaning of the '580 and '316 patents.
>
> "interface" – a shared boundary or junction which may have some thickness.

Within the disputed element, the parties first debate whether or not the requirement that the permanent substrate has a higher electrical conductivity than the temporary substrate is met by the MB and MB II devices. To prove its point, Lumileds relies primarily upon a diagram from a

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[1] *Id.*

[2] *Id.* (citing Jokerst Tr. 1722:16-17).

[3] Order No. 27 at 63.

[4] Order No. 27 at 67.

textbook by Simon Sze which describes "the resistivity [of [ ] substrates] in ohm centimeters on the vertical scale versus impurity concentration on the horizontal scale."[5] Dr. Dupuis calculated the resistivities of [ ] (the temporary substrate versus the permanent substrate)[6] as follows:

[

][7]

Dr. Dupuis concludes that the resistivity of the [ ]substrate in Epistar's MB and MB II products would be less than the resistivity of the [ ] temporary substrates.[8] As resistivity is the inverse of conductivity, Dr. Dupuis, therefore concluded that the conductivity of the permanent [ ]substrate would be greater than the conductivity of the temporary [ ] substrate.[9]

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[5] Dupuis Tr. at 918:14-24. *See also* CDX-869C.

[6] There is no dispute that the permanent substrate is made of [ ] and the temporary substrate is made of [ ]. *See* Jokerst, Tr. at 1715.

[7] Dupuis, Tr. at 919:7-22.

[8] *Id.* at 920:6-13.

[9] Dupuis, Tr. at 919:7-320:13.

The testimony of Dr. Jokerst on this point was stricken from the record.[10] Instead Epistar relies upon CX-547C and CX-545C, even though CX-547C, which identifies the resistivity of the [ ] wafers used by Epistar, has been withdrawn.[11] Consequently, Dr. Dupuis' assertion regarding the resistivity of [ ] is unrebutted. Accordingly, based upon Dr. Dupuis' testimony, the Administrative Law Judge concludes the conductivity of the permanent substrate is higher than the conductivity of the temporary substrate.

However, the disputed claim element also requires "wafer bonding the permanent substrate to one of the first and second sides of the LED layers." As the MB and MB II utilize a metal bonding process which the Administrative Law Judge has determined is not "wafer bonding" within the meaning of the '580 patent, the Administrative Law Judge concludes that the MB and MB II products do not satisfy the requirements of the third element of claim 8.

Furthermore, the Administrative Law Judge finds that there is no bonded interface between the LED layers and the permanent substrate. Dr. Dupuis indicates that the LED layers within the context of claim 8 must be epitaxially grown and include the active layers, the [ ] layer and various buffer layers.[12] Dr. Dupuis further indicates that "Metal Bond products use an [ ]."[13] From RX-182C and RDX 504 and 505, it is apparent that there are [ ] in both the MB and

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[10] Order No. 28 at 20.

[11] *See* Lumileds' Final Exhibit List.

[12] Dupuis, Tr. at 909:8-20.

[13] Dupuis, Tr. at 909:25-910:2.

MB II devices. Lumileds identifies these layers as an "interface" to the LED layers. The Administrative Law Judge disagrees. While the Administrative Law Judge's construction of "interface" indicates that it can have "some thickness," that definition does not contemplate that an interface can consist of no less that [ ] separate layers of materials. Accordingly the Administrative Law Judge concludes that the MB and MB II devices do not include "an interface of the permanent substrate and the LED layers." Furthermore, the Administrative Law Judge's construction of "to .... the LED layers" requires that the permanent substrate be wafer bonded directly to the LED layers which does not happen in the MB and MB II products with so many layers between the substrate and the LED layers. Therefore, the Administrative Law Judge concludes that the MB and MB II products do not literally infringe claim 8 of the '580 patent.

Lumileds, however argues that there is nevertheless infringement under the doctrine of equivalents. According to Lumileds, "[t]he use of metal to join the permanent [ ] substrate to the LED layers is equivalent to the 'wafer bonding, including elevating the temperature of the interface' step of claim 8 of the 580 Patent."[14] Lumileds further argues "[a]s Dr. Dupuis explained at the hearing, the functions are substantially the same, *i.e.*, providing a permanent substrate that replaces the growth substrate to enhance the performance of the LED device,"[15] "[t]he way is substantially the same, *i.e.*, bonding a substrate to the epi wafer with a higher electrical conductivity,"[16] "[a]nd the result is substantially the same, *i.e.*, the performance of the

[14] Lumileds Post-Hearing Brief at 23.

[15] *Id.* (citing CPFF 2482, 2486).

[16] *Id.* (citing CPFF 2483, 2487).

LED structure is enhanced."[17]

Epistar argues that "the [metal bonding method] used by Epistar [is] very different from the claimed wafer bonding in function, way and result," and the Administrative Law Judge agrees.[18] The method of bonding disclosed in the '580 patent involves the direct bonding of two wafers at high temperature to form a mechanically robust and optically transparent bond between them without adding foreign materials, such as glues or metals, in between the layers.[19] Thus, the "way" is not just bonding by any method to the epi wafer but rather directly bonding that substrate with a higher conductivity. The evidence makes clear that bonding with the use of metal is different than direct wafer bonding. According to Dr. Jokerst, metal bonding requires the application of at least three metals on each structure: one for adhesion, one for diffusion barrier, and one for bonding.[20] Just as significantly, wafer bonding a permanent substrate to the LED layers as described in the '580 patent has a different result than metal bonding a substrate to the LED layers. The wafer bond of the '580 patent is optically transparent, and so the light can be outputted from both sides. In addition, wafer bond interfaces do not degrade under typical operating conditions, metal bonds do.[21] From those significant differences, the Administrative Law Judge concludes that "wafer bonding the permanent substrate" to the LED layers is not equivalent in function, way and result to metal bonding the permanent substrate as is required to

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[17] *Id.* (citing CPFF 2484, 2488).

[18] Epistar Post-Hearing Brief at 58.

[19] Jokerst, Tr. at 1654:15-1657:22.

[20] Jokerst, Tr. 1662:1-17.

[21] Jokerst, Tr. 1663:12-1664:9.

find infringement under the doctrine of equivalents. Thus, the Administrative Law Judge concludes that the MB and MB II do not infringe claim 8 of the '580 patent either literally or under the doctrine of equivalents.

ANALYSIS OF CLAIM 9

As the Administrative Law Judge has determined that the MB and MB II devices do not infringe claim 8 of the '580 patent, he further concludes that the MB and MB II products also do not infringe claim 9 of the '580 patent which depends from claim 8.

6. Asserted Claims 16 and 18

Lumileds has accused Epistar's MB and MB II, OMA and OMA II products of infringing claims 16 and 18 of the '580 patent. Those asserted claims read as follows:

Claim 16. A method of forming a light emitting diode (LED) comprising:

providing a temporary growth substrate, including selecting the growth substrate to be compatible with lattice matching for the fabrication of LED layers;

growing the LED layers on the growth substrate, the LED layers having a first side and having a second side joined to the growth substrate; and

wafer bonding an electrically conductive mirror to one of the first and second sides of the LED layers to reflect light emitted in the direction of the mirror, including elevating the temperature of the LED layers and the mirror during the wafer bonding such that a low resistance connection is achieved.

Claim 18. The method of claim 16 wherein the mirror is supported on a second substrate.

ANALYSIS OF CLAIM 16

7. MB and MB II

Lumileds argues that there are several issues with respect to claim 16 that must be resolved by the Administrative Law Judge including: (1) what portion of the MB I & II LEDs constitute the mirror and (2) whether wafer bonding [ ] to the LED layers infringes claim 16 either literally or under the doctrine of equivalents.[22] Lumileds argues that "[t]he mirror in the MB I & II LEDs includes the [ ]."[23] According to Lumileds, the mirror, which the Administrative Law Judge has defined as "an electrically conductive structure" may consist of multiple layers.[24] Furthermore, Lumileds argues that "[t]hose in the art would consider at least the entire bonded metal layer stack as the mirror."[25] In addition, Lumileds contends that "[t]hose of skill in the art also refer to the transparent layers on top of the reflective layer as part of the mirror."[26] According to Dr. Dupuis, "just like the glass layer supporting the reflective metal layers on a common household mirror is considered to be part of the mirror, those of skill in the LED art consider the transparent layers above the reflective surface as part of the mirror."[27] Thus, Lumileds concludes that "the [ ] constitute the mirror in the MB I & II."[28]

In addition, Lumileds argues that "[t]he limitation of 'wafer bonding an electrically conductive mirror to ... the LED layers' is literally met in the MB I and II process because the

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[22] Lumileds Post-Hearing Brief at 25

[23] *Id.* (citing CPFF 2524, 2526, 2531, 2535, Dupuis, Tr. 1081:12-1082).

[24] *Id.*

[25] *Id.* at 26.

[26] *Id.*

[27] *Id.* (citing CPFF 2044).

[28] *Id.* (citing CPFF 2063-2066).

mirror is formed by a wafer bonding process that results in the mirror being directly joined to the LED layers."[29]

Epistar argues first that in the MB and MB II products, there is no wafer bonding, and the bonding in the MB products is "substantially different from wafer bonding in method and result."[30] In addition, Epistar argues that "in the MB products, the mirror is not wafer bonded – it [ ]"[31] According to Epistar, "[ ]."[32] Therefore, Epistar concludes that "claim 16 is not infringed either literally or by equivalents."[33]

With respect to the processes for manufacturing the MB and MB II products, the Staff notes "that the mirror is not wafer bonded to the LED layers, but is [ ]"[34] In addition, the Staff argues that the MB and MB II products are bonded by metal to metal bonding.[35] Thus, the Staff concludes that claim 16 is not infringed either literally or under the doctrine of equivalents.[36]

With respect to claim 16, the Administrative Law Judge has construed the key disputed

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[29] Lumileds Post-Hearing Brief at 29 (citing CPFF 2525, 2527, 2531, 2535).

[30] Epistar Post-Hearing Brief at 65 (citing RPFF 725-26, 730, 737-41, 743).

[31] *Id.* (citing RPFF 792).

[32] *Id.* (citing RPFF 783).

[33] *Id.*

[34] OUII Post-Hearing Brief at 27 (citing Jokerst, Tr. at 1725:9-1726:2).

[35] *Id.*

[36] *Id.*

terms as follows:

> "joined to the growth substrate" – joined directly, and not through any intervening layers, to the growth substrate.[37]
>
> "electrically conductive mirror" – an electrically conductive substrate capable of reflecting a substantial portion of the light generated by the LED layers.[38]
>
> "to one of the first and second sides of the LED layers" – joined directly to either the first or second sides of the LED layers.[39]
>
> "such that a low resistance connection is achieved" – as a result of wafer bonding, there is a low resistance connection through the light emitting diode.[40]

The claim element in dispute indicates that the accused process must include the step of "wafer bonding an electrically conductive mirror to one of the first and second sides of the LED layers." The Administrative Law Judge finds that the manufacturing processes for the MB and MB II devices do not include such a step.

It is undisputed that the MB and MB II devices each contain a mirror. The parties, however, have debated which layers actually constitute the mirror and whether the mirror is bonded directly to the LED layers as required by the Administrative Law Judge's interpretation of the claims. According to Dr. Dupuis, the mirror in the MB and MB II products is:

[

] [[

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37 Order No. 27 at 68.

38 Order No. 27 at 71.

39 Order No. 27 at 73.

40 Order No. 27 at 75.

][41]

On the other hand, Dr. Jokerst argues that it is only the [ ] layer that constitutes the mirror.[42] Under either interpretation of what constitutes the "mirror" in the MB and MB II, it becomes clear from an understanding of the manufacturing processes for those devices that the "mirror" is not bonded to the LED layers as required by the Administrative Law Judge's claim construction.[43]

First, many of the layers to which Dr. Dupuis refers as the "mirror" are actually [ ] rather than bonded. For example, RX-182 indicates that an [

].[44]

According to Dr. Dupuis, [ ].[45] Other [

].[46] The [ ] layers are then bonded together with temperature and pressure.[47] Dr. Dupuis, however, admits that the bonding does not actually

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[41] Dupuis, Tr. at 923:19-924:4.

[42] Jokerst, Tr. at 1725:7-15.

[43] The composition of the LED layers in this instance is not disputed. The experts agree that the LED layers in the final product are the [
] layers. *See* Dupuis, Tr. at 923:3-14; Jokerst, Tr. at 1723:8-17; RDX-763-2.

[44] RX-182C (MB /MB II process step by step) at EC192739, 192749.

[45] Dupuis, Tr. at 909:24-910:1 (discussing the metal layers in the MB products in the context of claim 8).

[46] RX-182C at EC192740, 192750.

[47] *Id.*

occur between the [ ] and the LED layers as required by claim 16, but rather in the middle of the stack of layers that Dr. Dupuis has defined as the "mirror."[48] Specifically, Dr. Dupuis states that:

> Q. And there's no part of that mirror that is wafer bonded directly to the LED
> layers, is there?
> A. The mirror is a composite, as I've said, until the mirror is completed by the bonding process, it's not a complete mirror.
> Q. I understand that. But no part of that complete mirror is wafer bonded directly to the LED layers, is it?
> A. Well, the mirror is only wafer bonded when it's completed. No part is bonded directly. But, again, the mirror is directly connected to the LED layers.[49]

In essence, Dr. Dupuis has conceded that his opinion that the mirror is bonded directly to the LED layers is based upon the fact that the compilation of layers he calls the "mirror" is "connected to the LED layers" rather than bonded to them. Thus, the Administrative Law Judge concludes that the "mirror" is not bonded to the LED layers, but rather [ ] using Dr. Dupuis' definition.

Moreover, as described above, the Administrative Law Judge has determined that metal bonding is not "wafer bonding" as that term is used in the '580 patent. Accordingly, the Administrative Law Judge finds that Epistar does not practice the step of "wafer bonding an electrically conductive mirror to one of the first and second sides of the LED layers" and therefore, the MB and MB II devices do not literally infringe claim 16 of the '580 patent.

Lumileds, however, argues that the MB and MB II devices would nevertheless infringe

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48 Dupuis, Tr. at 1079:8-16.

49 Dupuis, Tr. at 1080:16-1081:3.

under the doctrine of equivalents. Specifically, Lumileds argues that "the functions are substantially the same, *i .e.* attaching elements below the LED layers so that light is reflected to the top side of the device, still allowing current to flow through the active layers,"[50] "[t]he way is substantially the same, *i.e.*, attaching a mirror below the LED layers and allowing the current to flow from the N electrode through the active layers to the P electrode,"[51] "[a]nd the result is substantially the same, *i.e.*, current flows through the active layers such that light is emitted, and the mirror reflects light toward the top side of the device.[52] Lumileds concludes that "the differences between wafer bonding, as construed by Epistar, and the metal bonding performed by Epistar, are insubstantial. The Administrative Law Judge, however, disagrees. Applying the "function, way, result" test, it is apparent that at least the "way" differs substantially. The third element of claim 16 covers "wafer bonding" (direct bonding) of a mirror to the LED layers. Epistar uses a [ ] in the MB and MB II schematics.[53] Based upon the high level of ordinary skill in the art, the Administrative Law Judge finds that one of ordinary skill would not consider [ ] of a mirror (which was known prior to the '580 patent) and the wafer bonding (direct bonding) to be substantially the same way of adding a mirror to an LED structure. As Dr. Jokerst, explained, [ ] is not even a type of bonding.[54] Thus the Administrative Law Judge

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[50] Lumileds Post-Hearing Brief at 29 (citing CPFF 2552).

[51] *Id.* (citing CPFF 2553, 2556).

[52] *Id.* (citing CPFF 2554, 2557).

[53] *See* Jokerst, Tr. at 1724:1-6, 1734:7-21.

[54] Jokerst, Tr. at 1724:1-1725-15; *see also* 1698:2-12.

concludes that the MB and MB II devices do not infringe claim 16 either literally or under the doctrine of equivalents.

8. OMA and OMA II

Lumileds argues that, in the OMA and OMA II, "the mirror is joined directly to the LED layers."[55] According to Lumileds, the "mirror in the OMA I includes as least the [

]."[56] Lumileds further asserts that both those of skill in the art and Epistar's engineers consider the reflective surface and the metal stack to be part of the mirror."[57] Lumileds concludes that "[ ], the mirror is directly joined to the LED layers."[58]

Furthermore, Lumileds asserts that "the OMA II forms a mirror by wafer bonding together a stack of metal layers .... using glue bonding."[59] According to Lumileds, the "formation of a mirror by wafer bonding a portion of the metal stack literally meets this limitation of claim 16."[60]

Because they utilize glue bonding which results in an insulating bond in the OMA and OMA II devices, there is an additional issue as to whether "as a result of wafer bonding, there is a

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[55] Lumileds Post-Hearing Brief at 50 (citing CPFF 2049).

[56] *Id.* (citing 1077, 1101, 2046-47).

[57] *Id.* (citing 2044, 2053-54, 2189, 1073-74, 2062-66).

[58] *Id.* (citing CPFF 990, 992, 2067).

[59] *Id.* at 50-51 (citing 1096-98).

[60] *Id.* at 51 (citing CPFF 2162, 2175-2200).

low resistance connection through the light emitting diode." Lumileds asserts that a "'low resistance connection' is achieved by wafer bonding, the mirror below the [ ] layer through which current flows to the LED layers, and, thus preserving the current path through the LED."[61]

Epistar disagrees. Epistar first argues that"[i]n the OMA I products, [

]'"[62] In addition, Epistar argues that "[t]he LED layers are likewise separated from the mirror by [ ]" and "[t]hus, there is no bonding to any side of the LED layers."[63] In the OMA II products, Epistar asserts that " [

], before any bonding is done."[64] Epistar concludes that "[

]'"[65]

In addition, Epistar argues that "in the OMA products, the [

], and so the bonding cannot achieve the low resistance connection required by claims 16 and 18."[66]

The Staff submits that "Epistar's OMA and OMA II devices do not have a low

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[61] *Id.* (citing CPFF 2055-57, 2179-80).

[62] Epistar Post-Hearing Brief at 61 (citing RPFF 756, 757, 759, 760).

[63] *Id.* (citing RPFF 177, 178, 762).

[64] *Id.*

[65] *Id.*

[66] Epistar Post-Hearing Brief at 62 (citing RPFF 762-63).

resistance connection throughout the LED as a result of the bonding process."[67] According to the Staff, "the OMA and OMA II devices have layers [ ] between the mirror and the LED layers.[68] Thus, the Staff concludes that the claim element "such that a low resistance connection is achieved" is not present in the OMA and OMA II products.[69]

The Staff further argues that the mirror is "glue bonded, not wafer bonded as called for is the claim.[70] Moreover, according to the Staff, "the mirror is not bonded directly to the LED layers as required by the claim because of the intervening [ ]"[71]

The element in claim 16 at issue requires "wafer bonding to one of the first and second sides of the LED layers ..." As noted in Order No. 27, the "electrically conductive mirror" must be wafer bonded directly to the LED layers.[72] Dr. Dupuis has identified the [ ] as parts of the "mirror" in the OMA device.[73] With respect to whether the "mirror" in the OMA and OMA II is joined directly to the LED layers, the Administrative Law Judge reaches the conclusion that they are not. While the [ ] does border the LED layers, the actual bonding of layers takes place between the layers [

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[67] OUII Post-Hearing Brief at 26.

[68] *Id.* (emphasis in original).

[69] *Id.*

[70] *Id.* at 26-27.

[71] *Id.* at 27.

[72] Order No. 27 at 73. As with the MB products, what constitutes the LED layers is not in dispute here. *See* Dupuis, Tr. at 844:3-6, 872:5-12; RDX 746-1.

[73] Dupuis, Tr. at 847:7-848:13.

]. Thus, the Administrative Law Judge concludes that in the OMA device, the "electrically conductive mirror" is not directly bonded to one of the first and second sides of the LED layers as is required under Order No. 27. In the OMA II device, Dr. Dupuis has identified "[ ][74] Once again, in the manufacture of the OMA II device, the bonding occurs between the [ ] rather than [ ]. Thus, the Administrative Law Judge concludes that the mirror in the OMA II device is also not directly bonded to the LED layers as is required by the claim language.

Furthermore, the OMA and OMA II devices are manufactured using glue bonding which the Administrative Law Judge has determined is not "wafer bonding."

Claim 16 also mandates the step of "wafer bonding .... including elevating the temperature of the LED layers and the mirror during the wafer bonding such that a low resistance connection is achieved. The only connection being made in the OMA products is between the [ ] layers.[75] The Administrative Law Judge finds that because the [ ], that a low resistance connection cannot be achieved through the LED as is required by Order No. 27. Though Dr. Dupuis indicates that such requirement is met in the OMA products because "the mirror has not interrupted the current path in any way,"[76] he does not indicate how a low resistance connection is achieved as a result of the elevation of the temperature of the LED layers, that the current path remains unchanged does not satisfy the requirement that a low resistance connection "be achieved." Thus, the Administrative

[74] Dupuis, Tr. at 872:13-21.

[75] *See* RX-180C.

[76] Dupuis, Tr. at 849:14-850:7.

Law Judge concludes that Epistar does not literally practice the claimed step of "wafer bonding ... including elevating the temperature during wafer bonding such that a low resistance connection is achieved," while making the OMA and OMA II devices.

Lumileds, however, argues that the Epistar nevertheless infringes claim 16 under the doctrine of equivalents. According to Lumileds, the function of the disputed claim element is to "attach[] elements below the LED layers so that light is reflected to the top side of the device, still allowing current to flow through the active layers;" the way is to "attach[] a mirror below the LED layers and allow[] the current to flow from the N electrode through the active layers to the P electrode; and the result is that "[c]urrent flows through the active layers such that light is emitted."[77]

On the other hand Epistar argues that "[ ] is not equivalent to wafer bonding" and thus, "[t]he claim element of 'wafer bonding [mirror] to one of the . . . sides of the LED layers" cannot be found in the OMA products by equivalents.[78] The Administrative Law Judge agrees with Epistar. As with the MB and MB II products, the mirrors of the OMA and OMA II devices are [ ] rather than bonded to the LED structure.[79] As previously discussed, [ ] is not substantially equivalent to "wafer bonding" that mirror as claimed in the '580 patent. Thus the Administrative Law Judge concludes that the OMA and OMA II devices do not infringe claim 16 of the '580 patent under the doctrine of equivalents.

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[77] CDX 848C; Dupuis, Tr. at 873:3-874:3.

[78] Epistar Post-Hearing Brief at 62.

[79] Jokerst, Tr. at 1698:2-12.

ANALYSIS OF CLAIM 18

As the MB and MB II and OMA and OMA II devices do not infringe claim 16 of the '580 patent, they also do not infringe claim 18 of the '580 patent which depends from claim 16.

9. Asserted Claims 25, 27, and 28

Lumileds has accused Epistar's GB product of infringing claims 25 and 27-28 of the '580 patent. Those asserted claims read as follows:

> **Claim 25.** The method of claim 23 wherein patterning the first surface of the first layer includes removing material from the first layer to form a depression along the first surface.
>
> **Claim 27.** The method of claim 23 wherein the first layer is selected of a material to form a current spreading window layer.
>
> **Claim 28.** The method of claim 23 wherein patterning the first surface includes selecting a pattern to define a light reflection pattern for light generated by the LED.

10. GB

Lumileds argues that "the process of making the GB I includes each and every limitation of non-asserted claim 23 and its asserted dependent claims 25, 27, and 28."[80] According to Lumileds, the "GB I LED is formed by glue bonding the [

]"[81] with the "[

] [

.]"[82] In addition, Lumileds asserts that the "resulting surface [

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[80] Lumileds Post-Hearing Brief at 41.

[81] *Id.* (citing CPFF 1112-21, 2308).

[82] *Id.* (citing CPFF 1112, 2324-26).

]"[83]

Lumileds argues that the "[ ]is patterned into a [ ]" and that the "patterning includes [ ]"[84] According to Lumileds, that is precisely the patterning that is recited in claim 25.[85] Lumileds further asserts that this patterning of [ ]" Furthermore, according to Lumileds, "the interface with [ ]"[86]

Epistar argues that in the GB I, there is no "wafer bonding" and in addition, "[.]"[87]

Epistar further argues that "the only possible interface of the first and second layers is the [ ] cannot make an interface with itself" and "along that

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[83] *Id.* (citing CPFF 2340-42).

[84] *Id.* (citing CPFF 1112, 2324; CX-43C (Epistar Interrog. at 9); CX-465C ([ ] at EC003248); CX-610 (Wang Dep. at 84-87)).

[85] *Id.* (citing CPFF 2325-26).

[86] *Id.* at 42.

[87] Epistar Post-Hearing Brief at 63 (citing RPFF 769, 771, 219).

interface the optical and electrical properties do not vary."[88] In addition, Epistar asserts that the [ ], being the first surface of the first layer, "is not patterned as required by claims 25, 27, and 28."[89] Nor is the required "first layer" a "current spreading window layer" as "[ ] is insulating and cannot spread current."[90]

The Staff makes no argument with respect to claims 25, 27 and 28 and whether or not the GB device infringes.

In order to determine if Epistar infringes claims 25, 27, or 28, it is first necessary to examine claim 23 from which they depend. Claim 23 reads:

> 23. A method of forming a light emitting diode (LED) having a plurality of layers including adjacent first and second layers joined at an interface, the method comprising the steps of:
>
> patterning a first surface of the first layer such that at least one of the optical and electrical properties will selectively vary along the interface of the first and second layers; and
>
> wafer bonding the first surface of the first layer to the second layer.

The language of claim 23 specifically requires the "patterning of a first surface of a first layer."[91] Lumileds argues that the claimed "first layer" is [ ].[92] However, it is not the [ ] that is actually patterned, but rather [ ]. In each of the embodiments described in the specification of the '580 patent, the patterning occurs on the layer that is considered the "first

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88 *Id.* (citing RDX-520; RPFF 775-76).

89 *Id.* (citing RPFF 774).

90 *Id.* (citing RFPP 773, 775).

91 CX-3 ('580 patent) claim 23.

92 Lumileds Post-Hearing Brief at 41.

layer" rather than something on that layer.[93] Furthermore, while that patterning on the [ ] layer may vary the optical and electrical properties along the interface with the [ ]layers are not wafer bonded. In fact the [ ]is not even bonded, but rather [ ].[94]

The bonding in the GB device actually occurs between the [ ]. If those [ ] layers are considered the "first" and "second" layers, the Administrative Law Judge finds that there is no patterning of the "first layer" because there is no removal of any of the [ ].[95] Nor is there any wafer bonding, as the Administrative Law Judge has determined that "wafer bonding" does not include glue bonding. Accordingly, the Administrative Law Judge concludes that the GB device does not literally infringe claim 23 of the '580 patent.

Lumileds, however, argues that the GB device, nevertheless, infringes under the doctrine of equivalents. According to Lumileds, "the wafer bond joining the [ ] wafer and the epi wafer in the GB I product would be at least equivalent to having 'adjacent first and second layers joined at an interface' as recited in claim 23 of the 580 Patent."[96] Lumileds further argues, "[t]he functions are substantially the same, *i.e.,* providing a boundary at which optical and/or electrical properties may be varied by patterning;"[97] "[t]he way is substantially the same, *i.e.*, providing two

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[93] CX-3 ('580 patent) at Figures 13-16 and accompany text in the specification.

[94] RX-181C at EC145919.

[95] *See* Jokerst, Tr. at 1705:21-1706:8.

[96] Lumileds Post-Hearing Brief at 43 (citing CPFF 2316).

[97] *Id.* (citing CPFF 2316).

separate wafers, the boundary between which is patterned before wafer bonding;"[98] "[a]nd the result is substantially the same, *i.e.*, the optical and electrical properties vary across the patterned boundary between the wafers."[99]

In addition, Lumileds argues that "the bonding of [ ] would be equivalent to 'wafer bonding the first surface of the first layer to the second layer' of claim 23."[100] According to Lumileds, "[t]he functions are substantially the same, *i.e.*, bonding layers together such that the pattern of the surface serves its desired purpose;"[101] "[t]he way is substantially the same, *i.e.*, layers are bonded together such that the interface contains a pattern that varies electrical and optical properties of the interface;"[102] "[a]nd the result is substantially the same, *i.e.*, the layers are bonded together such that the substrate is attached, the pattern forms a current path to the P electrode, and the pattern does not block a significant portion of the light emitted by the active layers."[103]

Epistar disagrees. According to Epistar, "[t]here is no element found in the GB equivalent to having 'one of the optical and electrical properties ... selectively vary along the interface of the first and second layers.'"[104] Furthermore, Epistar argues that there is nothing in

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[98] *Id.* (citing CPFF 2317).

[99] *Id.* (citing CPFF 2318).

[100] *Id.*

[101] Lumileds Post-Hearing Brief at 43 (citing CPFF 2316).

[102] *Id.* (citing CPFF 2317).

[103] *Id.* (citing CPFF 2318).

[104] Epistar Post-Hearing Brief at 63 (citing RPFF 775-76).

the GB I device that is equivalent to the added elements of claim 27 and 28.[105]

Once again, the Administrative Law Judge finds that Lumileds is attempting to read out limitations of the claim through the doctrine of equivalents. For example, Lumileds argues that the function of the third element of claim 23 is simply "bonding layers together such that the pattern of the surface serves its desired purpose." The language of the claim requires "wafer bonding" which has been construed to mean direct bonding and which definition has specifically excluded glue bonding and metal bonding because they are not direct bonding. Thus, the function of the third element of claim 23 would more appropriately be to directly bond layers together such that the pattern of the surface serves its desired purpose. To now find that glue bonding and metal bonding are "equivalent" to direct bonding would be to read a critical limitation out of claim 23. Accordingly, the Administrative Law Judge concludes that the GB device does not infringe claim 23 under the doctrine of equivalents.

ANALYSIS OF CLAIMS 25, 27, AND 28

As the GB device does not infringe claim 23 of the '580 patent, it also cannot infringe claims 25, 27 and 28 which depend from claim 23.

C. U.S. Patent No. 5,502,316

Lumileds has asserted that Epistar's GB, GB II, OMA and OMA II products infringe claims 12, 13, 14 and 16.

1. Asserted Claims 12, 13, 14, and 16

Claim 12. A light emitting semiconductor device comprising:

an arrangement of semiconductor layers for generating light in response to a

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[105] *Id.* (citing RPFF 776).

conduction of current;

an optically transparent wafer-bond layer coupled to said semiconductor layers, an interface of said wafer-bond layer with the semiconductor layers exhibiting properties characteristic of layers that have undergone wafer bonding, including being mechanically robust; and

electrode means for applying a current to said arrangement of semiconductor layers.

Claim 13. The device of claim 12 wherein the wafer bond is directly adjacent to at least one semiconductor layer.

Claim 14. The device of claim 12 wherein the semiconductor layers form a light emitting diode.

Claim 16. The device of claim 12 further comprising a second optically transparent wafer-bond layer coupled to the semiconductor layers.

ANALYSIS OF CLAIM 12

2. GB I & GB II

Lumileds argues that the GB and GB II meet each of the limitations of claim 12 of the '316 patent. In particular, Lumileds asserts that "[i]n those products, there are [

.]"[106] According to Lumileds, "[e]ach of the [ ] layers, act as a wafer bond layer and form part of the interface between the [ ] layer and the semiconductors layers."[107] Lumileds

[106] Lumileds Post-Hearing Brief at 45 (citing CPFF 2688, 2743).

[107] *Id.* (citing CPFF 2689-90, 2745).

further argues that the parties agree that the interface is mechanically robust.[108]

Lumileds indicates that infringement turns on whether the GB and GB II products have dislocations of "a different nature than an epitaxially grown mismatched heterointerface."[109] According to Lumileds, "the parties agree, that 'an epitaxially grown mismatched interface . . . typically exhibits a much higher density of 'threading dislocations,' i.e. dislocations which are not confined to the plane of the mismatched interface and tend to propagate perpendicular to the interface.'"[110] Lumileds contends that "the glue bonding process used in the GB I and II does not result in 'threading dislocations' that propagate perpendicular to the interface into the semiconductor layers" and thus, have "misfit dislocations that are of a different nature than an epitaxially grown mismatched heterointerface."[111]

To the contrary, Epistar argues that to be a wafer bond layer, a layer must "exhibit the properties that are characteristic of layers that have undergone wafer bonding" which requires the that the "wafer bond interface must either be a conductive ohmic bond, or 'hav[e] misfit dislocations that are of a different nature than an epitaxially grown mismatched interface.'"[112] According to Epistar, there is "no debate that [

]" and, therefore "can not form a conductive ohmic bond."[113] Epistar further argues that

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[108] *Id.*

[109] *Id.*

[110] *Id.* (citing CX 4, 316 Patent at col. 4:29-35).

[111] *Id.* (citing CPFF 2689, 2744, 2690, 2745).

[112] Epistar Post-Hearing Brief at 66 (citing Order No. 27 at 83).

[113] *Id.*

none of the "interfaces" identified by Lumileds "have misfit dislocations" as required by claim 12.[114] Epistar concludes that there are no "wafer bond layers" in the GB and GB II devices.[115]

The Staff is "of the view that the accused products do not infringe claim 12 or any of its dependent claims."[116] According to the Staff, the GB and GB II products do not satisfy claim 12's requirement that the optically transparent wafer bond layer be "coupled to" the semiconductor layers.[117] According to the Staff, Lumileds has identified the [ ] layers in the GB and the [ ] layers in the GB II as "optically transparent wafer bond layers."[118] The Staff asserts that because the [ ], which is not involved in the generation of light, sits between the "optically transparent wafer bond layer" and the semiconductor layers, the alleged wafer bond layer is not "coupled to" the semiconductor layers.[119]

Furthermore, the Staff argues that the GB and GB II products "have bond layers that consist [ ] and are the result of glue bonding."[120] According to the Staff, because [ ] is noncrystalline, "the interface of the [ ] layer with an adjacent layer does not have the lattice structure required to exhibit 'misfit dislocations that are of a different nature' from those

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[114] *Id.*

[115] *Id.* (citing RPFF 808).

[116] OUII Post-Hearing Brief at 30.

[117] *Id.* at 32.

[118] *Id.* at 31 (citing CDX-862C and 865C).

[119] *Id.* at 32.

[120] *Id.*

that appear when epitaxial growth is used."[121]

The Administrative Law Judge has construed the following key disputed terms as follows"

> "arrangement of semiconductor layers for generating light" – semiconductor layers that generate light in response to an electrical current.[122]
>
> "exhibiting properties characteristic of a layer that has undergone wafer bonding" – the interface does not have to exhibit *all* the characteristics of a layer that has undergone wafer bonding, but is mechanically robust and, in addition, exhibits other properties such as having a conductive ohmic bond to the LED layers or having misfit dislocations that are of a different nature than an epitaxially grown mismatched heterointerface.[123]
>
> "coupled to" – construed in the same manner as "coupled to" in claim 8 of the '580 patent, *i.e.*, joined directly and not through intermediate layers.[124]
>
> "interface" – shared boundary or junction which may have some thickness.
>
> "electrode means" – a means-plus-function limitation where the function is "applying a current to the arrangement of light-generating semiconductor layers" and the corresponding structures are Figure 7, components 44, 46; Figure 10, components 56, 58; Figure 12; components 74, 76; Figure 14, components 142, 144; Figure 15, components 154, 156; and Figure 16, component 16; the electrodes need not be in any particular location.[125]
>
> "light emitting diode" – construed in the same manner as in the asserted claims of the '580 patent, *i.e.*, a p-n junction that emits isotropic or incoherent light when biased in the forward direction.[126]

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[121] *Id.*

[122] Order No. 27 at 79.

[123] Order No. 27 at 82-83.

[124] Order No. 27 at 83.

[125] Order No. 27 at 87-88.

[126] Order No. 27 at 88.

"a second optically transparent wafer-bond layer coupled to the semiconductor layers" – the second layer is coupled directly to the semiconductor layers without any intervening layers.[127]

Claim 12 requires "an arrangement of semiconductor layers for generating light in response to a conduction of current." In the case of the GB product there does not seem to be a dispute as to which layers constitute those "semiconductor layers." Specifically, Dr. Dupuis discussed that those layers are "the epi layers, which have the active layers and the cladding layers and the [ ] transparent window layer."[128] Dr. Jokerst concurs.[129] With respect to the GB II device, Dr. Dupuis has identified the "epi layers, including the [ ] layer that's involved and the [ ]" as the "arrangement of semiconductor layers" mandated by claim 12 of the '316 patent.[130] Dr. Jokerst, however does not agree that the [ ] should be included among the "semiconductor layers."[131]

[[132]], the specification of the '316 patent explicitly provides that a current spreading transparent layer is separate from the light generating layers:

[127] Order No. 27 at 89.

[128] Dupuis, Tr. at 897:13-19.

[129] Jokerst, Tr. at 1749:24-1750:4 (referencing RDX-772-1C).

[130] Dupuis, Tr. at 905:6-15.

[131] Jokerst, Tr. at 1725:9-25 (discussing RDX-773 in which Dr. Jokerst has highlighted the layers that she believes are the semiconductor layers).

[132] [ ]

> Optionally, a window layer that is transparent and that has a higher electrical conductivity than the layers **34**, **36**, and **38** may be grown atop the upper confining layer **38** in order to promote current spreading, thereby enhancing the performance of the resulting structure.[133]

Thus, the Administrative Law Judge concludes that the [ ] in the GB II product is not part of the "arrangement of semiconductor layers for generating light."

At issue then is whether there is an "optically transparent wafer-bond layer coupled to said semiconductor layers" and whether the interface of the "wafer-bond layer" "exhibit[s] properties characteristic of layers that have undergone wafer bonding" as construed by the Administrative Law Judge. Dr. Dupuis testified that in the GB product, the "optically transparent wafer-bond layers include the [ ]"[134] In the GB II device, Dr. Dupuis further identifies the "optically transparent [ ] layers, as well as [ ] layers" as the "wafer-bond layers" and proceeds to explain that each of those layers is mechanically robust and would display a "different nature of threading dislocations or misfit dislocations compared to that of a hetero-epitaxially grown interface."[135]

If the layers that Dr. Dupuis has labeled "wafer-bond layers" are actually "wafer-bond layers" within the meaning of the '316 patent, then the interface of the wafer-bond layer and the semiconductor layers must be mechanically robust and exhibit "other properties such as having a

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[133] CX-4 ('316 patent), col. 6, lines 40-44.

[134] Dupuis, Tr. 897:20-898:6.

[135] *Id.* at 898:10-25, 905:22-906:23.

conductive ohmic bond to the LED layers or having misfit dislocations that are of a different nature than an epitaxially grown mismatched heterointerface." The Administrative Law Judge, however, disagrees that those layers identified by Dr. Dupuis meet the requirements of a "wafer bond layer."

The patent instructs that a "wafer-bond layer" must be a "layer or substrate that exhibits the properties that are characteristic of layers that have undergone wafer bonding."[136] As the GB and GB II products are bonded together with a glue bonding process that the Administrative Law Judge has determined does not constitute "wafer bonding," none of the layers of those selected by Dr. Dupuis can actually be "wafer-bond layers." Furthermore, the layers identified by Dr. Dupuis as "wafer-bond layers" cannot exhibit misfit dislocations that are of a different nature than an epitaxially grown mismatched hetero-interface because the [ ]layers are non-crystalline. As Dr. Jokerst explains, because [ ]has no lattice structure, it can have no dislocations.[137] Though, Lumileds argues that not having any dislocations qualifies as "dislocations of a different nature," the Administrative Law Judge finds that the language of the specification indicates that, at the very least, the "wafer-bond layer" must be able to have dislocations. Thus, the Administrative Law Judge concludes that the GB and GB II products do not have a "wafer-bond layer" as defined in the specification of the '316 patent, and therefore those products do not literally infringe claim 12.

Lumileds, however, argues that claim 12 is also infringed under the doctrine of equivalents. According to Lumileds, "[t]he functions are substantially the same, *i.e.*, attaching

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[136] CX-4 ('316 patent) at 4:19-22.

[137] Jokerst, Tr. at 1750:16-24.

elements of the LED device to the epi wafer to avoid problems characteristic of epitaxial growth;"[138] "[t]he way is substantially the same, *i.e.*, attaching wafer-bond layers below the bottom layer of the epi wafer formed by bonding rather than epitaxially growing them on the epi wafer;"[139] "[a]nd the result is substantially the same, *i.e.*, elements of the LED device are joined to the epi wafer to maintain proper function of the device."[140]

Epistar disagrees. According to Epistar, "[t]here is no interface that exhibits 'a different nature of misfit dislocations' 'formed at the wafer bonded interface.'"[141] Thus, Epistar argues that none of the GB products can satisfy this limitation by equivalents.[142]

In this case, Lumileds argues that the function of the limitation at issue is merely to attach elements of the LED device to the LED wafer in order to avoid problems associated with epitaxial growth.[143] The Administrative Law Judge, however disagrees. As has been discussed throughout this opinion, the Administrative Law Judge has determined that wafer bonding requires direct bonding. Thus, the "function" of the limitation should be "to directly bond the elements of an LED device. As the GB and GB II devices utilize glue bonding, those devices cannot perform substantially the same function as the limitation at issue here because they do not utilized direct bonding. Furthermore, Lumileds argues that the "way" is attaching a wafer-bond

138 Lumileds Post-Hearing Brief at 46-47 (citing CPFF 2699, 2746).

139 *Id.* at 47 (citing CPFF 2700, 2746).

140 *Id.* (citing CPFF 2701, 2746).

141 Epistar Post-Hearing Brief at 67.

142 *Id.*

143 *See* CDX-850C.

layer below the bottom layer of the epi wafer by bonding. The GB and GB II also do not satisfy this requirement because the Administrative Law Judge has determined that those devices do not have wafer bond layers. Thus, the Administrative Law Judge concludes that the GB and GB II products do not infringe claim 12 of the '316 patent either literally or under the doctrine of equivalents.

3. <u>OMA I & II</u>

Lumileds argues that the OMA and OMA II devices "meet each limitation of claim12 of the '316 patent."[144] According to Lumileds, the [ ] layers are transparent wafer bond layers.[145] Lumileds argues that "Epistar admits that these layers are amorphous and, thus lack dislocations of any kind, and further admits that these layers lack threading dislocations propagating perpendicular to the wafer bond interface into the [ ] layers."[146]

To the contrary, Epistar argues that to be a wafer bond layer, a layer must "exhibit the properties that are characteristic of layers that have undergone wafer bonding" which requires the that the "wafer bond interface must either be a conductive ohmic bond, or 'hav[e] misfit dislocations that are of a different nature than an epitaxially grown mismatched interface.'"[147] According to Epistar, there is "no debate that all of the transparent layers identified by Lumileds

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[144] Lumileds Post-Hearing Brief at 51.

[145] *Id.* (citing CPFF 1018-19, 1070-71, 2584, 2592-93).

[146] *Id.* at 52 (citing CPFF 1818, 2585, 2645).

[147] Epistar Post-Hearing Brief at 66 (citing Order No. 27 at 83).

are insulators" and, therefore "can not form a conductive ohmic bond."[148] Epistar further argues that none of the "interfaces" identified by Lumileds "have misfit dislocations" as required by claim 12.[149] Epistar concludes that there are no "wafer bond layers" in the OMA and OMA II devices.[150]

The Staff is "of the view that the accused products do not infringe claim 12 or any of its dependent claims."[151] According to the Staff, the OMA and OMA II products do not satisfy claim 12's requirement that the optically transparent wafer bond layer be "coupled to" the semiconductor layers.[152] According to the Staff, Lumileds has identified the [ ] layers in the OMA and the [ ]layers in the OMA II as "optically transparent wafer bond layers."[153] The Staff asserts that because the [ ]layer, which is not involved in the generation of light, sits between the "optically transparent wafer bond layer" and the semiconductor layers, the alleged wafer bond layer is not "coupled to" the semiconductor layers.[154]

Furthermore, the Staff argues that the OMA and OMA II products "have bond layers that

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[148] *Id.*

[149] *Id.*

[150] *Id.* (citing RPFF 808).

[151] OUII Post-Hearing Brief at 30.

[152] *Id.* at 32.

[153] *Id.* at 31 (citing CDX-849C and 855C).

[154] *Id.* at 32.

consist of [ ] and are the result of glue bonding."[155] According to the Staff, because [ ] is noncrystalline, "the interface of the [ ] layer with an adjacent layer does not have the lattice structure required to exhibit 'misfit dislocations that are of a different nature' from those that appear when epitaxial growth is used."[156]

With respect to whether the OMA and OMA II products infringe claim 12 of the '316 patent, the Administrative Law Judge reaches the same conclusions that he did with respect to the GB and GB II devices. First, the Administrative Law Judge concludes that [ ] is not part of the "arrangement of semiconductor layers for emitting light" because the patent specification differentiates between the current spreading layers and the light generating layers.[157] In addition, because the OMA and OMA II products are glue bonded, they are not "wafer bonded" and therefore cannot have a "wafer-bond layer" as required by claim 12. Furthermore, even if the OMA and OMA II devices did have "wafer-bond layers," those wafer-bond layers would not be "coupled to" the "arrangement of semiconductor layers" because there is [ ] layer between them. As discussed in Order No. 27, the "coupled to" limitation requires that the "wafer-bond layer" be joined directly to the "semiconductor layers."

Lumileds challenges the Administrative Law Judge's construction of the phrase "coupled to," arguing that the Administrative Law Judge has misinterpreted the way the term is used in claim 8 of the '580 patent, and did not properly consider the use of the term in claim 12 of the

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[155] *Id.*

[156] *Id.*

[157] CX-4 ('316 patent) 6:40-44.

'316 patent.[158] In the context of claim 8, Lumileds argues in essence that because a composite substrate contains more than one layer, the term "coupled to the growth substrate" should not be interpreted to mean joined directly to the growth substrate since the additional layers of the composite substrate would prevent anything from being directly grown on that substrate.[159] The Administrative Law Judge, however, takes a different view. Dr. Robbins discussed the use of a composite substrate for reasons of mechanical integrity. In such a case, it appears that the composition of layers would itself as a whole be considered the "substrate" which provides adequate mechanical support to a device. The remaining layers of a device would then be grown directly on top of the composite substrate. Dr. Kish's testimony supports this view. He explained composite substrates in the following manner:

> An engineered substrate is typically something that has composite layers, and so it might be as -- an example of an engineered substrate would be a silicon on insulator, so a silicon substrate with an oxide layer and then a silicon layer on top of that, and that in total is considered a composite or an engineered substrate and not just the silicon itself beneath it.[160]

The Administrative Law Judge thus concludes that the individual layers of a composite substrate would not be considered intervening layers that could prevent layers grown on top of a composite substrate from being directly joined or "coupled to" that substrate.

With respect to claim 12 of the '316 patent, the Administrative Law Judge's construction "coupled to" is once again entirely consistent. Claim 12 recites a "wafer-bond layer coupled to

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[158] Lumileds Post-Hearing Brief at 22 n.13.

[159] *Id.*

[160] Kish, Tr. 371:17-25.

said semiconductor layers" while claim 8 of the '316 patent recites a "wafer-bond layer coupled to said semiconductor layers .... without any intervening metallic layer contact." As described in the specification, the metallic layer contact refers to the thin metal contacts discussed with reference to Figures 6 and 10 of the '316 patent.[161] The use of the small metal contacts, nevertheless permits a wafer bond to occur in the non-metallized area because of the direct contact between the bonded layers where there is no metal.[162] Thus, the language of claim 8 covers the use of an LED device that employs the type of metallization scheme described in the specification which the language of claim 12 does not. The flaw in Lumileds' argument is that it assumes that the "metallic layer contact" must cover the entire surface of a layer rather that being applied as described in the specification. Thus, the Administrative Law Judge declines to modify his construction of the claim term "coupled to."

Based on the preceding analysis, the Administrative Law Judge concludes that the OMA and OMA II products do not infringe claim 12. Lumileds, however, argues that the OMA and OMA II LEDs nevertheless infringe under the doctrine of equivalents. The arguments that Lumileds presents for the OMA and OMA II devices are the same as those presented for the GB and GB II devices and, thus, the result would be the same. Accordingly, the Administrative Law Judge concludes that the OMA and OMA II devices do not infringe claim 12 under the doctrine of equivalents.

<u>ANALYSIS OF CLAIMS 13, 14, AND 16</u>

As the GB , GB II, OMA and OMA II products do not infringe claim 12, they cannot

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[161] CX-4 ('316 patent) at 8:32-9:4.

[162] *Id.* at 8:47-49.

infringe claims 13, 14, and 16 which depend from claim 12.

V. VALIDITY

Although Epistar's products have been found to practice certain claims of Lumileds' asserted patents, they will not be found to infringe any claim that is invalid. Indeed, one cannot be held liable for practicing an invalid patent claim.[163]

The claims of a patent are presumed to be valid.[164] Although a complainant has the burden of proving a violation of section 337, it can rely on the presumption of validity in the way that a plaintiff can rely on the presumption in a district court proceeding. A respondent must overcome the presumption by providing clear and convincing evidence of invalidity in the way that a defendant must provide clear and convincing evidence in a court case.[165]

The introduction of prior art that was not before the PTO examiner may facilitate the challenger's burden of proving patent invalidity. However, the presumption of validity remains intact. The burden of proving invalidity remains on the challenger throughout a case, and the clear and convincing standard does not change.[166]

A. U.S. Patent No. 5,008,718

As discussed above in Section I A (procedural history), Epistar was precluded from presenting any invalidity defense concerning the '718 patent, and Epistar asserts no invalidity

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[163] *See Pandrol USA, LP v. Airboss Railway Products, Inc.*, 320 F.3d 1354, 1365 (Fed. Cir. 2003).

[164] 35 U.S.C. § 282; *DMI Inc. v. Deere & Co.*, 802 F.2d 421 (Fed. Cir. 1986).

[165] *Checkpoint Systems, Inc. v. United States Int'l Trade Comm'n,* 54 F.3d 756, 761 (Fed. Cir. 1995).

[166] *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1375 (Fed. Cir. 1986).

defense against the '718 patent in its briefs.[167] The Commission Investigative Staff does not argue that any asserted claim of the '718 patent is invalid.[168] Indeed, there is no evidence of record that any asserted claim of the '718 patent is invalid.

B. U.S. Patent No. 5,376,580

Epistar argues that on several grounds the asserted claims of the '580 patent are invalid under any of the parties' proposed claim constructions, and that in other instances the claims are invalid under the constructions proposed by Lumileds. Lumileds argues that its asserted claims are not invalid. The Staff argues that Epistar has failed to carry its burden of proving invalidity by clear and convincing evidence.

1. Written Description and Enablement

The first paragraph of section 112 of the Patent Act provides:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

35 U.S.C. § 112, ¶ 1.

Epistar argues that under Lumileds' allegedly "broad" proposed claim construction, the asserted claims of the '580 patent are invalid for lack of written description and lack of enablement. It is argued that the inventors did not possess glue bonding or metal bonding as their invention, nor did they disclose how to use these different bonding techniques. Epistar

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[167] *See* Epistar Post-Hearing Brief at 10-32; Epistar Reply Brief at 33 (referring only to the '580 and '316 patent); Staff Post-Hearing Brief at 36 (referring to Epistar's Pre-Hearing Brief).

[168] *See* Staff Post-Hearing Brief at 36-40.

argues that Lumileds' interpretation of "wafer bonding" must be either rejected "because it covers matters not invented or taught in the '580 patent, or the claims must be held invalid as failing the written description and enablement requirement . . . ."[169]

Lumileds argues that Epistar's affirmative defense of lack of written description and enablement are flawed. In particular, it is argued that Epistar's written description defense is based on an alleged failure of the specification to describe all possible embodiments covered by the claims, yet a patent may contain a written description of "a broadly claimed invention without describing all species" that the claim encompasses.[170] Similarly, Lumileds argues that Epistar incorrectly premises its lack of enablement defense of an alleged failure by the specification to detail all possible embodiments covered by the claims, while a patent need not disclose what is already known in the art, or what could be accomplished without undue experimentation."[171]

The Commission Investigative Staff argues that Epistar was not permitted during the hearing to offer expert testimony regarding its affirmative defenses of enablement and lack of written description, and thus there is not clear and convincing evidence to support these defenses.[172]

In any event, Epistar's arguments concerning alleged lack of written description and

[169] *See* Epistar Post-Hearing Brief at 38-41.

[170] Lumileds Post-Hearing Brief at 66-67 (quoting *Cordis Corp. v. Medtronic AVE, Inc.*, 339 F.3d, 1352, 1365 (Fed. Cir. 2003), *cert. denied*, 540 U.S. 1213 (2004)).

[171] *Id.* (citing *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1533 (Fed. Cir. 1987)).

[172] OUII Post-Hearing Brief at 40 (citing Tr. 1790). The transcript portion cited by the Staff indicates that the Administrative Law Judge did not permit an Epistar expert to testify to a section 112 defense that was in essence being raised for the first time because it was not contained in the expert's report and was not raised in deposition. *See* Tr. 1789-1790.

enablement are raised in the event that the asserted claims of the '580 patent are construed so that "wafer bonding" covers the techniques of glue bonding or metal bonding. The Administrative Law Judge has not, however construed the claims in that manner.[173] Thus, Epistar's arguments are moot, and the claims of the '580 patent are not found to be invalid under section 112, paragraph 1.

2. Anticipation

Epistar raises several affirmative defenses based on anticipation. "Invalidity based on lack of novelty (often called 'anticipation') requires that the same invention, including each element and limitation of the claims, was known or used by others before it was invented by the patentee."[174] A single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation.[175]

A prior art reference without express reference to a claim limitation may anticipate by inherency. If the prior art necessarily functions in accordance with, or includes, the claim limitations, it anticipates. Inherency is not determined by the knowledge of one of ordinary skill in the art. "Artisans of ordinary skill may not recognize the inherent characteristics or functioning of the prior art."[176]

"A reference is no less anticipatory if, after disclosing the invention, the reference then

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[173] *See* Section III A (wafer bonding).

[174] *Hoover Group, Inc. v. Custom Metalcraft, Inc.*, 66 F.3d 299, 302 (Fed. Cir. 1995).

[175] *Minnesota Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir.1992).

[176] *In re Cruciferous Sprout Litig.*, 301 F.3d 1343, 1349 (Fed. Cir. 2002).

disparages it. Thus, the question whether a reference 'teaches away' from the invention is inapplicable to an anticipation analysis."[177]

Anticipation is a question of fact that must be proven by clear and convincing evidence.[178]

a. The Toshiba Application (RX-118/CX-426)

Epistar's exhibit RX-118 is a copy of Japanese patent application 61-183986 (with a certified translation), which was published on August 16, 1986, and identifies Toshiba Corp. as the applicant. Epistar argues that even under its proposed construction of "wafer bonding," which is narrower than Lumileds' proposed construction, the Toshiba application discloses all elements of claims 1-3, 8-9, 23 and 25 of the '580 patent, thus rendering those claims invalid pursuant to 35 U.S.C. § 102(b).[179, 180]

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[177] *Celeritas Tech. v. Rockwell Int'l Corp.*, 150 F.3d 1354, 1361 (Fed. Cir. 1998), *cert. denied*, 525 U.S. 1106 (1999).

[178] *Glaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1047 (Fed. Cir.), *cert. denied*, 516 U.S. 988 (1995); *Scripps Clinic & Research Found. v. Genentech Inc.*, 927 F.2d 1565, 1576 (Fed. Cir. 1991).

[179] Epistar Post-Hearing Brief at 42-47; Epistar Reply at 32-33.

[180] Section 102 of the Patent Act provides in part:

> A person shall be entitled to a patent unless—
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States . . . .

35 U.S.C. § 102(a)-(b).

In particular, Epistar argues that the Toshiba application teaches a method for manufacturing LEDs, including all elements of independent claim 1 of the '580 patent. It is argued that the preamble of claim 1 of the '580 patent sets forth a "method for forming a light emitting diode (LED)," and similarly the Toshiba application teaches "a method for manufacturing . . . light-emitting diodes."

Epistar argues that the first three steps of claim 1 require selecting and providing a substrate composed of materials for fabricating LED layers and then fabricating the LED on a substrate, and similarly the Toshiba application teaches providing a first substrate (identified in the application as **11**) made of gallium arsenide (GaAs) that is lattice matched, and therefore compatible with fabricating LED layers; and further that in the Toshiba application, LED layers **12**, **13**, and **14** are formed on the GaAs substrate **11**.

Epistar argues that the fourth step of claim 1 is "selecting an optically transparent material compatible with enhancing light-emitting performance of the LED structure," and similarly the Toshiba application teaches choosing a second substrate **15** made of silicon carbide SiC that is transparent to the wavelengths of light emitted by the LED layers, and acts as a heat sink to enhance light-emitting performance. Epistar points out that the Toshiba application specifically states that the SiC substrate "can be used as the second semiconductor substrate, whereby heat from the heterojunction structure can be dissipated quickly," and this "makes it possible to increase the light emission output." Indeed, it is argued that the Toshiba application teaches that the SiC the sink substrate **15** can be made of GaP, which is the same material that Lumileds uses for its transparent substrate.

Finally, with respect to claim 1, Epistar argues that claim 1 of the '580 patent requires "wafer bonding the transparent layer of the selected optically transparent material to the LED layers," and similarly the Toshiba application teaches wafer bonding substrate **15** to substrate **11**, where substrate **15** becomes a permanent substrate. In particular, it is argued that the GaAs substrate **11** (with the LED layers **12, 13** and **14** fabricated on it) faces substrate **15**, the substrates are pressed tightly together, and then heated to form a wafer bond. Epistar argues that while a Lumileds' expert, Dr. Dupuis, testified that a "robust" wafer bond could not be formed at 200°C, which is the temperature exemplified in the Toshiba application, the application does not limit the temperature to 200°C. Epistar points out that the Toshiba application states that adhesive strength is "markedly increased when the heat treatment temperature was over 200°C."

Epistar also argues that each of limitations contained in the asserted dependent claims of the '580 patent is also disclosed in the Toshiba application, and provides citations to the application.

Lumileds argues that no claim of the '580 patent is anticipated by the Toshiba application, and that Epistar's own expert admitted the application discloses a different type of bonding than that required by the '580 patent.[181] In particular, it is argued that the type of bonding taught by the Toshiba application is "Van der Waals" bonding at 200°C, which does not provide a sufficient mechanical strength to fall within the claims. However, wafer bonding is typically done at temperatures of 850 to 1,000 degrees C, and the Toshiba application does not disclose either the temperature or the time needed to form a wafer bond. While the Toshiba application discloses a bonding temperature of "200°C or higher," it is argued that such an open-ended range cannot under the law be relied upon to provide a disclosure of 850°C or higher

[181] Lumileds Post-Hearing Brief at 59-61; Lumileds Reply Brief at 25-28.

for the SiC used in the application, yet the disclosure of such a temperature would be necessary to invalidate any claim of the '580 patent.

Lumileds argues that in fact the Toshiba application teaches away from the use of the necessary temperatures because its bonding method supposedly avoids problems caused by "high temperatures" associated with epitaxially growing the second layer. In addition, it is argued that the Toshiba application specifically fails to meet the limitations of dependent claim 3 due to the laser method disclosed in the application for removing a first substrate.[182]

The Commission Investigative Staff argues that the Toshiba application does not disclose wafer bonding as required by all asserted claims of the '580 patent, and one would not practice all elements of the asserted claims if one followed the procedures taught in the Toshiba application. The Staff argues that the Toshiba application cannot anticipate any asserted claim of the '580 patent.[183]

It is uncontested that the Toshiba application constitutes prior art to the '580 patent. Further, it is uncontested that the application was not before the examiner during prosecution of the suit patent, and the question of whether or not it anticipates any claim of the '580 patent is considered for the first time.

It is also uncontested that each of the asserted claims of the '580 patent requires "wafer bonding" by its plain language, or because it depends from a claim that expressly contains the

[182] Lumileds' reply brief points out that since the filing of Epistar's main post-hearing brief, the Administrative Law Judge struck all Epistar testimony concerning alleged anticipation of claim 9 by the Toshiba application. *See* Lumileds Reply at 25-28 (citing, *inter alia*, Order No. 28 at 17).

[183] OUII Post-Hearing Brief at 37-38; OUII Reply Brief at 14-15.

limitation.[184] As discussed above in connection with claim construction, Section III A (wafer bonding), the term "wafer bonding," as used in the '580 patent requires, among other thing, the bringing together of two wafer surfaces into physical contact such that a mechanically robust bond forms between them. A certain type of weaker, electrostatic bonding, which is called Van der Waals bonding, is excluded from the claimed invention by the patent specification, and no party argues that it should be included in the proper construction of the term "wafer bonding." The question raised, therefore, is whether the technique disclosed in the Toshiba application concerns only a type of bonding such as Van der Waals which fails to provide the mechanically robust bond required by the claims, or whether the Toshiba application also discloses a bonding method that meets the limitations of the asserted claims.[185]

As pointed out by Epistar, one of Lumileds' experts, Dr. Kish, testified that the Toshiba application discloses a type of wafer bonding. Indeed, it is uncontested that the Toshiba application discloses some type of bonding. Yet, Dr. Kish was not familiar with the Toshiba application when it was shown to him during cross-examination, and moreover he never testified that the type of bonding it discloses is related to the claimed invention or that it satisfies the

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[184] While Lumileds no longer asserts independent claim 23 in this investigation, its dependent claims 25, 27 and 28 remain at issue. *See* Lumileds Post-Hearing Brief at 41-43. The final element of claim 23 consists of "wafer bonding the first surface of the first layer to the second layer." CX-3 at 19:4-5.

[185] Epistar does not argue that the Toshiba application anticipates the '580 patent claims through inherency. Indeed, inasmuch as the Toshiba application uses Van der Waals bonding at temperatures as low as 200°C, the application does not necessarily function in accordance with, or include, the claimed wafer bonding. *See Minnesota Mining & Mfg.*, 976 F.2d at 1565.

requirements of the '580 patent claims.[186]

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[186] Dr. Kish's relevant testimony is as follows:

> JUDGE HARRIS: Well, let's wait for the question. What is the question? You pointed him to the paragraph. What do you want him to answer or look for?
>
> MR. DeBRUINE: What I'd like him to do, Your Honor, is look here, where it talks about preparing the -- the first sentence there says, Therefore, the present inventors discovered that, by the following process, it was possible to bond semiconductor crystal bodies to one another in the same way as bonding glass to glass.
>
> BY MR. DeBRUINE:
> Q. Do you see that?
>
> JUDGE HARRIS: Okay. Now, what's the question?
>
> BY MR. DeBRUINE:
> Q. The question is, does this paragraph describe wafer bonding?
>
> JUDGE HARRIS: Have you read this paragraph before?
>
> THE WITNESS: No, I have not.
>
> JUDGE HARRIS: Since it's only one paragraph, do you want to just read it to yourself and then answer the question?
>
> THE WITNESS: Okay. The question is, does this describe wafer bonding?
>
> JUDGE HARRIS: Right.
>
> BY MR. DeBRUINE:
> Q. Yes.
>
> A. So, yes, this does describe a form of wafer bonding.
>
> Q. And let's turn to page 188239. Let's look at the highlighted portion at the top of that page. Refers to an LED, does it not?
>
> JUDGE HARRIS: Well, it says LED. Ask him the ultimate question. What is it that you want him to answer about that?

One of Epistar's experts, Dr. Jokerst, was also questioned about the bonding disclosed in the Toshiba application. She testified that temperatures near 200°C, such as that expressly disclosed in the Toshiba application, would create a Van der Waals bond which was the focus of the art at the time that the application was made:

> Q. Now, for silicon carbide to chemically bond, it's got to be heated to 800 or 900 degrees C for it to chemically bond to something like AlGaAs, isn't that right?
>
> A. I have never actually done any experiments on the bonding of silicon carbide, but my understanding is that silicon carbide can be used in wafer bonding, and wafer bonding is typically done at temperatures of 850 to 1,000 degrees C. That is correct.
>
> Q. And if you were to subject AlGaAs to those temperatures, it would adversely affect the integrity of the material, isn't that true?
>
> A. Aluminum gallium arsenide?
>
> Q. That's correct.
>
> A. Not to my knowledge.
>
> Q. And –
>
> A. I believe people do actually wafer bond AlGaAs.
>
> Q. What is the melting point of silicon carbide?

> BY MR. DeBRUINE:
>
> Q. So this patent talks about wafer bonding in the context of LEDs, does it not?
>
> A. I'd have to read further. There's a paragraph a few pages ago that says wafer bonding, and there's a paragraph here that says LED. I can't see how they're connected, without spending time and reading this.
>
> JUDGE HARRIS: You can take this up with your experts.

Kish Tr. 429-430.

A. I have no idea.

Q. What's the melting point of AlGaAs?

A. I'm not sure actually. I believe it's above 1,000 -- well, it must be above 1,000. I'm not sure what the melting point is.

Q. At 200 degrees C, silicon carbide will not form a chemical bond, isn't that right?

A. I would expect silicon carbide to form, if it's brought in, if silicon carbide – clean, smooth, flat is brought into contact with another semiconductor and only heated to 200 degrees C, I would expect that bond to be a Van der Waals bond.

Q. And in this patent, it refers to heating to 200 degrees C, isn't that right?

A. To 200 degrees C or higher.

Q. And it doesn't give any temperature higher than 200, so 201 degrees is higher than 200, isn't that right?

A. I believe the patent has some text associated with this that indicates that higher -- well, it says 200 degrees C or higher -- ah, yes, here it is. The adhesive strength of this junction was markedly increased when the heat treatment temperature was over 200 degrees C.

People thought Van der Waals bonding was fine in these days for most applications, and so a lot of the research done was what temperature do you need to go to in order to produce what kind of bond, and so this statement that the adhesive strength at the junction was increased when the heat temperature was over 200C was completely consistent with knowledge of wafer bonding at the time.

Q. So this is a reference in which they were doing Van der Waals bonding, right?

A. I wouldn't assume if they went up to -- well, if they went up to heat treatment temperatures over 200 degrees C, they could have been doing wafer bonding. It depends upon the temperature they went to.

> Q. But it doesn't say it ever went to a temperature high enough to do actual wafer bond, isn't that right?
>
> A. It's vague about what temperature they want to go to. They say this adhesive strength of this junction was markedly increased when the heat treatment temperature was over 200 C, so to make that statement, I'm assuming they went over 200 C and did some measurements and saw it was better.

Jokerst Tr. 1879-1882.

As pointed out by Dr. Jokerst, Toshiba may have performed some bonding at temperatures in excess of 200°C in order to know that increased temperature strengthened the bond. However, there is no discussion in the Toshiba application of any range of temperatures above 200°C, and no mention of temperatures near 850 or 1000°C, i.e., the level at which wafer bonding is usually performed today to make the robust bonds with the types of materials disclosed in the Toshiba application.[187] Nor is there any indication in the Toshiba application that a substantial increase in temperature is commensurate with the creation of a type of bond that differs from the Van der Waals.

Lumileds relies on *Atofina v. Great Lakes Chem. Corp.*, 441 F.3d 991 (Fed. Cir. 2006) to argue that Toshiba application's open-ended reference to a heat treatment temperature "over 200°C" does not disclose wafer bonding temperatures in the range of 850 to 1000°C. In *Atofina*, the Federal Circuit held that a prior art publication's disclosure of a temperature range of 100°C to 500°C did not disclose the narrower claim limitation of 330 to 450°C. The court emphasized

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[187] *See* Jokerst Tr. 1879; Dupuis Tr. 1974 ("heating silicon carbide to make anything happen chemically at the surface requires temperatures well above 900 centigrade"), 1976 (ohmic bond between silicon carbide wafers cannot be achieved at temperatures below 950°C), 1977-1978 (direct wafer bonding of silicon carbide occurs reliably above 950°C for a 60 minute bonding process).

its history of case law holding that the disclosure of a genus does not necessarily disclose every species contained therein, unless the genus is so small that disclosure of the genus is in fact a disclosure of all its species.[188]

The *Atofina* opinion supports Lumileds' argument that the Toshiba application fails to disclose the type of wafer bonding required by the claims of the '580 patent. The Toshiba application's broad reference to temperatures higher than 200°C does not disclose the material range of temperatures at which one can achieve the type of bonding required by the '580 patent. In fact, unlike the prior art publication discussed in the *Atofina* opinion, the Toshiba application does not even set a range of temperatures that encompasses 850 to 1000°C. The Toshiba application specifically discloses only the 200°C temperature, and makes a vague and open-ended reference to higher temperatures.

Epistar argues that it was well understood in the art in 1993 that bonding the type of semiconductor at issue should be done near the epitaxial growth temperature of the materials used, which would be in excess of 600°C. That argument is not well supported by the record.[189] Moreover, although wafer bonding of SiC (used in the Toshiba application) only occurs at the high temperatures required for epitaxial growth, the Toshiba application touts the fact that its use

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[188] 441 F.3d at 999-1000.

[189] *See* Epistar Post-Hearing Brief at 44 (citing RPFF 687). The proposed finding, which cites Jokerst Tr. 1650, 1654-1655 and RDX-703, relies on the testimony of Epistar's expert and sets forth in one sentence four general steps for semiconductor-to-semiconductor wafer bonding, including "raising temperature to 800° to 1000°C." Although the associated testimony of Dr. Jokerst discusses a temperature range of 800° to 1000°C, it is not clear whether that testimony reflects the knowledge of one of ordinary skill more than a decade ago.

of low temperature bonding avoids the "problems" of "high temperature."[190] Thus, notwithstanding whatever general knowledge one of ordinary skill might have possessed about wafer bonding, the Toshiba application clearly states that its method uses low temperatures, and the application separates its method from those that may require higher temperatures, such as that claimed by the '580 patent.

In addition, mere knowledge of high temperatures bonding or the simple disclosure of high temperatures, even in a specified range of 850 to 1000°C, would not be enough to disclose the type of wafer bonding required by the claims of the '580 patent.[191] For example, the Toshiba application lacks any information about factors such as the length of time during which high temperatures should be applied.

Consequently, the Toshiba application does not disclose wafer bonding as required by the claims of the '580 patent, and therefore does not invalidate any asserted claim due to anticipation.

Additionally, even if the '580 patent's wafer bonding limitation were disclosed by the Toshiba application, the additional limitations added by at least dependent claims 3 and 9 would be lacking in the Toshiba prior art. The Toshiba application is largely directed to producing lasers of aluminum allium arsenide with improved mode control, current confinement and heat

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[190] RX-118 at EC188238 ("[C]ompared with past methods in which the current-confinement structural part is formed by epitaxial growth on a hetero junction, there were none of the problems of exposing the hetero junction to an etching solution, or of high temperatures introducing structural or doping changes or crystal defects.").

[191] *See* Dupuis Tr. 1977-1978.

sinking.[192] While current confinement and confining the light to an optical mode are important design features for a laser, these are not important for an LED.[193] A differentiation between LEDs and lasers has already been made in this investigation.[194] The Toshiba laser embodiments relied upon by Epistar with respect to the limitations of claims 3 and 9 do not disclose the removal of a "first" or "growth" substrate as required by those dependent claims of the '580 patent.[195]

b. Pollentier Article (RX-162)

Epistar argues that, pursuant to 35 U.S.C. § 102(b), several asserted claims of the '580 patent are anticipated by an article by I. Pollentier entitled "Fabrication of High-Radiance LEDs by Epitaxial Lift-Off," which was published in 1990, three years before th filing of the '580 patent application. In particular, it is argued that if, as Lumileds argues, wafer bonding encompasses metal-to-metal or adhesive bonding, Pollentier anticipates because it provides an enabling disclosure of every element of claims 1, 3, 8, 16 and 18 of the '580 patent.[196]

Lumileds argues that the Pollentier article cannot anticipate any asserted claim of the '580 patent because it fails to disclose all claim elements, including a mechanically robust wafer bond and the "low resistence connection" limitations of claims 16 and 18.[197]

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[192] Dupuis Tr. 1969-1970.

[193] Dupuis Tr. 1970-1972.

[194] Order No. 27 at 44-45.

[195] *See* FF Section V B.

[196] Epistar Post-Hearing Brief at 47-49.

[197] Lumileds Post-Hearing Brief at 63-64; Lumileds Reply Brief at 29-30.

The Commission Investigative Staff argues that the Pollentier article cannot anticipate any asserted claim of the '580 patent because rather than disclosing the type of wafer bonding required by the patent, it teaches a type of metal-to-metal bonding excluded from the definition of wafer bonding.[198]

Epistar argues that the Pollentier article anticipates only in the event that the asserted claims of the '580 patent are construed to cover types of bonding that the Administrative Law Judge has not determined to be included in the proper claim construction. Consequently, the question of whether the Pollentier article might anticipate any claim of the '580 patent is moot. Further, the type of bonding disclosed in the article is not in fact the type required by the asserted claims.[199]

c. **Gmitter Patent (RX-4)**

United States Patent No. 4,883,351, entitled "Lift-Off and Subsequent Bonding of Epitaxial Layers," issued to Gmitter et al. on November 28, 1989, approximately four years before the application was filed for the '580 patent.

Epistar argues that if "wafer bonding" of the '580 patent is construed to cover adhesives or glue bonding, then the earlier Gmitter patent which disclosed the manufacture of LEDs using adhesives renders the '580 patent invalid as anticipated under 35 U.S.C. § 102(b).[200] Lumileds and the Commission Investigative Staff argues that the Gmitter patent fails to anticipate any

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[198] OUII Post-Hearing Brief at 38-39 (citing Jokerst Tr. 1891-1892); OUII Reply Brief at 15.

[199] *See* Jokerst Tr. 1891-1892.

[200] Epistar Post-Hearing Brief at 51-52.

asserted claim of the '580 patent.[201]

In view of the proper claim construction of the '580 patent, Epistar's arguments concerning the Gmitter patent are moot. Further, the Gmitter patent was considered by the examiner during prosecution of the '580 patent, and indeed it fails to disclose every claimed element.[202] For example, the Gmitter patent discloses Van der Waals and adhesive or glue bonding, rather than the type of bonding required by the '580 patent.[203]

3. Obviousness

Section 103 of the Patent Act provides, *inter alia*, that:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

35 U.S.C. § 103(a).

Obviousness under 35 U.S.C. § 103 is evaluated under the so-called *Graham* factors: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. When combining references in an attempt to show obviousness, the accused infringer must make

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[201] Lumileds Post-Hearing Brief at 61-63; Lumileds Reply Brief at 28-29; OUII Post-Hearing Brief at 16-17; OUII Reply Brief at 38.

[202] *See* CX-3.

[203] *See* RX-4 at 10:5-8, 4:66-67.

"a showing of a suggestion, teaching, or motivation to combine the prior art references."[204] The ultimate determination of whether an invention would have been obvious is a legal conclusion based on underlying findings of fact.[205]

As discussed above, Epistar argues that if Lumileds' proposed construction of "wafer bonding" is adopted, the Pollentier anticipates claims 1, 3, 8, 16 and 18 of the '580 patent. Epistar further argues that "[a]ssuming *arguendo* that Pollentier does not disclose the metal layers together as part of the bonding process, the combination of Pollentier article and an article (RX-164) entitled, "1-3 μm InGaAsP Ridge Waveguide Laser on GaAs and Silicon Substrates by Thin-Film Transfer," by C. L. Hsieh et al. ("Hsieh"), which was published in May 1991, renders claims 8 and 9 of the '580 patent invalid as obvious under 35 U.S.C. § 103."[206]

Lumileds argues that there is no evidence of a motivation to combine the Pollentier and Hsieh articles, and any obviousness argument is rebutted by overwhelming and unchallenged evidence of secondary indicia of nonobviousness.[207]

The Commission Investigative Staff argues that there is no evidence of motivation to combine the Pollentier and Hsieh, and in any event the articles address a different type of

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[204] *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124-25 (Fed. Cir. 2000); *Princeton Biochemicals, Inc. v. Beckman Coulter, Inc.*, 411 F.3d 1332, 1337 (Fed. Cir. 2005) (the relevant inquiry is "[whether] an artisan of ordinary skill in the art at the time of the invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, [would] have selected the various elements from the prior art and combined them in the manner claimed.").

[205] *In re Dembiczak*, 175 F.3d 994, 998 (Fed. Cir. 1999).

[206] *See* Epistar Post-Hearing Brief at 50-51.

[207] *See* Lumileds Post-Hearing Brief at 64-66.

bonding than that covered by the '580 patent.[208]

Indeed, the prior art relied upon by Epistar contains information about a type of bonding other than that covered by the '580 patent.[209] Thus, Epistar alleges obviousness only as an alternative argument. Inasmuch as the Administrative Law Judge has not construed the asserted claims in accordance with Lumileds' proposed interpretation of "wafer bonding," the question of obviousness is moot.

Further, there is a lack of evidence concerning any possible motivation to combine teachings from the Pollentier and Hsieh articles.[210] In addition, Lumileds has presented substantial objective evidence of nonobviousness.[211]

Consequently, it is not found that any claim of the '580 patent is invalid due to nonobviousness.

C. U.S. Patent No. 5,502,316

Epistar argues that asserted claims of the '316 patent are invalid under any of the parties' proposed claim construction in view of the Toshiba application (RX-118), and that in other instances the claims are invalid under the constructions proposed by Lumileds. Lumileds argues that its asserted claims are not invalid. The Staff argues that Epistar has failed to carry its burden of proving invalidity by clear and convincing evidence.

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[208] *See* OUII Post-Hearing Brief at 39-40.

[209] *See, e.g.*, Section V B 2 b (Pollentier).

[210] *See, e.g.*, Jokerst Tr. 1781-1782, 1889 (Pollentier (RX-104) is not in fact referenced in Hsieh (RX-164)).

[211] *See* FF V B.

1. Written Description and Enablement

Epistar argues that the '316 patent shares the same written description as the '580 patent, and that if Lumileds' proposed construction is adopted, the '316 specification is also deficient with respect to claims 12-14 and 16 for lack of written description and enablement under the first paragraph of section 112.[212]

Lumileds argues that the asserted '316 patent claims are not invalid due to a failure to meet the requirements of section 112.[213]

The Commission Investigative Staff argues that there is a lack of clear and convincing evidence concerning Epsitar's section 112 defenses.[214]

As detailed in previous sections of this opinion, the pertinent portions of Lumileds' proposed claim construction have not been adopted, and thus Epistar's defenses concerning written description and enablement are moot. In addition, Epistar's prehearing filings did not support the presentation of expert testimony on these topics during the hearing.[215]

Consequently, it is not found that the asserted claims of the '316 patent are invalid due to a lack of written description or enablement.

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[212] *See* Epistar Post-Hearing Brief at 52-53. Claims 12-14 and 16 of the '316 patent are the focus of Epistar's briefing because they recite "an optically transparent wafer bond layer coupled to said semiconductor layers." Epistar Post-Hearing Brief at 52-53 (quoting CX-4 at 16:47-48). Although claim 15 was included in the Commission's notice of investigation, those are also the only claims of the '316 patent asserted by Lumileds. *See* Lumileds Post-Hearing Brief at 44, 51.

[213] *See* Lumileds' Post-Hearing Brief at 66-67.

[214] OUII Post-Hearing Brief at 40.

[215] *See* Tr. 1789-1790.

2. Anticipation (The Toshiba Application)

Epistar argues that the Toshiba application (RX-118) renders claims 12-14 and 16 of the '316 patent invalid as anticipated.[216] Lumileds and the Commission Investigative Staff argue that the Toshiba application fails to disclose every element of the asserted claims of the '316 patent.[217]

As Epistar has pointed out in connection with other arguments concerning alleged invalidity, the '316 patent shares the same written description as the '580 patent. Further, it is undisputed that the asserted claims of the '316 patent contain a wafer bonding limitation similar to that of the '580 patent. As detailed above in Section V B 2 A, the Toshiba application does not contain or disclose the type of wafer bonding at issue, and thus at least for that reason it cannot anticipate the asserted claims of the '316 patent.

VI. DOMESTIC INDUSTRY

As stated in the notice of investigation, a determination must be made as to whether an industry in the United States exists as required by subsection (a)(2) of section 337. Indeed, section 337 declares unlawful the importation, the sale for importation or the sale in the United States after importation of articles that infringe a valid and enforceable U.S. patent only if "an industry in the United States, relating to articles protected by the patent . . . exists or is in the process of being established." 19 U.S.C. § 1337(a)(2).

The statute further provides that:

> [A]n industry in the United States shall be considered to exist if

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[216] Epistar Post-Hearing Brief at 53-54.

[217] *See* Lumileds Post-Hearing Brief at 59-61; OUII Post-Hearing Brief at 39.

> there is in the United States, with respect to the articles protected by the patent ... concerned –
>
> (A) significant investment in plant and equipment;
>
> (B) significant employment of labor or capital; or
>
> (C) substantial investment in its exploitation, including engineering, research and development, or licensing.

19 U.S.C. §1337(a)(3).

In most cases, the domestic industry requirement consists of two prongs: the technical prong and the economic prong.[218] "The technical prong involves whether the complainant practices the asserted patents; the economic prong involves investment activities, set out in section 337(a)(3), in a domestic industry with respect to articles protected by the asserted patents."[219]

However, it is not always necessary to show that the products of the complainant or its licensees are covered by the patent. For example, when a domestic industry exists under subsection 337(a)(3)(C) due to a substantial investment made in the licensing of a patent, it is not necessary to prove that a patent holder or licensee is involved in actual domestic production.[220]

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218 *Certain Ammonium Octamolybdate Isomers,* Inv. No. 337-TA-477, Commission Opinion at 55, USITC Pub. 3668 (Jan. 2004).

219 *Certain Variable Speed Wind Turbines and Components Thereof,* Inv. No. 337-TA-376, USITC Pub. 3003, Comm'n Opinion at 14-17 (1996).

220 *See Certain Semiconductor Chips with Minimized Chip Package Size and Products Containing Same,* Inv. No. 337-TA-432, Order No. 13 (Jan. 24, 2001)(unreviewed Initial Determination); *Semiconductor Chips,* Notice of a Commission Determination Not to Review (Feb. 26, 2001)(EDIS Document Identification No. 200102260025).

Whether a licensing program could constitute a domestic industry was an open question until section 337 was amended to provide specifically for such an industry. *See, e.g., Certain Soft Sculpture Dolls Popularly Known as "Cabbage Patch Kids," Related Literature and Packing*

The complainant bears the burden of proving the existence of a domestic industry.[221]

A. Technical Analysis

1. U.S. Patent No. 5,008,718

The parties stipulated to the fact that Lumileds practices at least one claim of the '718 patent.[222] The technical prong of the domestic industry requirement is satisfied with respect to the '718 patent.

2. U.S. Patent No. 5,376,580 and U.S. Patent No. 5,502,316

Lumileds argues that there has been no material dispute concerning its practice of claims 1 and 8 of the '580 patent and claim 12 of the '316 patent by making and selling trans-substrate or "TS" AlGaInP LEDs. It is argued that in post-hearing briefing Epistar has mischaracterized or ignored Lumileds' domestic industry evidence.[223]

Epistar argues that the evidence offered with respect to Lumileds' alleged practice of the '580 and '316 patents is insufficient. It is argued that the document relied upon by Lumileds for the '580 patent is an IEEE paper published in 1997, and is not even Lumileds internal documentation. It is further argued that the document replied upon with respect to the '316 patent is dated 1994, and yet Lumileds admits that changes have been made to its AlGaInP LED

Therefor, Inv. No. 337-TA-231, Comm'n Decision to Review Portions of an Initial Determination Finding a Violation of Section 337 of the Tariff Act of 1930 (Sept. 4, 1986)(51 Fed. Reg. 31731 (1986)(referring to *Certain Products with Gremlin Character Depictions*, Inv. No. 337-TA-01)).

[221] *Certain Methods of Making Carbonated Candy Products,* Inv. No. 337-TA-292, Commission Opinion at 34-35, USITC Pub. 2390 (June 1991).

[222] Tr. 533-534.

[223] Lumileds Post-Hearing Brief at 67; Lumileds Reply Brief at 33-34.

products since then. Epistar argues that the testimony of Lumileds' expert testimony is indefinite, and demonstrates that Dr. Dupuis does not know the manufacturing process or conditions used by Lumileds for its transparent substrate AlGaInP LEDs.[224]

The Commission Investigative Staff credits Dr. Dupuis' testimony, and argues that Epistar did not present any evidence to counter Lumileds' contentions that it practices the patents.[225]

With respect to the '580 patent, Lumileds expert, Dr. Dupuis, provided testimony concerning the manufacture of Lumileds' AlGaInP LEDs to show that it practices at least claims 1 and 5.[226] Dr. Dupuis relied on much of the same information used by Lumileds' Chief Technical Officer, Dr. George Craford, when he testified about currently manufactured products. The technical aspects of Dr. Dupuis' testimony have not been disputed, nor was any basis shown at the hearing to call into question the evidentiary foundation of his analysis.[227] Further, no opposing evidence or expert analysis was offered by Epistar concerning Lumileds' products.

Consequently, it is found that Lumileds satisfies the technical prong of the domestic industry requirement with respect to the '580 patent.

With respect to the '316 patent, Dr. Dupuis also provided a detailed analysis of Lumileds' practice of claim 12.[228] Much of the evidence that he relied upon was also the subject of Dr.

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[224] Epistar Post-Hearing Brief at 68-69; Epistar Reply at 34.

[225] OUII Post-Hearing Brief at 34-35.

[226] *See* Dupuis Tr. 744-746.

[227] *See* Craford Tr. 164-169.

[228] *See* Dupuis Tr. 732-739.

Craford's testimony concerning Lumileds' current manufacturing process. While Dr. Craford's testimony shows that there have been minor adjustments in Lumileds' manufacturing process since 1994, there is no evidence that such changes would materially affect the analysis performed by Dr. Dupuis.[229] Indeed, Epistar offered no evidence or expert analysis in opposition to the testimony of Dr. Dupuis.

Consequently, it is found that Lumileds satisfies the technical prong of the domestic industry requirement with respect to the '316 patent.

B. Economic Analysis

Lumileds argues that there should be no material dispute with respect to the economic prong of the domestic industry requirement because Epistar has stipulated to the financial figures in the expert report of Lumileds' expert, Mr. Meyers, which include [

.][230]

Lumileds also relies on the fact that it makes its products at least through the wafer stage in the United States before shipping them to its facility in Malaysia, where they are cut into dies. It is argued that because Lumileds is a leading manufacturer of AlGaInP LEDs and practices all

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[229] *See* Craford Tr. 164-168, 193-195.

[230] Lumileds Post-Hearing Brief at 67-68.

of the steps of the '518 and '316 patent claims in the United States, the Commission should forego a "comparative analysis" or an any sort of exhaustive analysis of the economic prong of the domestic industry requirement. In addition, Lumileds argues that [

] are sufficient to satisfy the domestic industry requirement.[231]

Epistar argues that although it has stipulated to the financial data offered in the expert report of Lumileds' Mr. Meyers, Lumileds has not met its burden of demonstrating what portion if any of the costs and expenses listed by Mr. Meyers are attributable to the production of products that practice the suit patents. Aside from responding to certain Lumileds proposed findings of fact, Epistar does not elaborate on its argument.[232]

The Commission Investigative Staff argues that the evidence provided through Mr. Meyers is sufficient to find that the economic prong of the domestic industry requirement is satisfied.[233]

The economic prong of the domestic industry requirement was not the subject of extensive testimony during the hearing, and was not placed at issue.[234] Further, as stipulated by

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[231] Lumileds Post-Hearing Brief at 68.

[232] *See* Epistar Post-Hearing Brief at 69; Epistar Reply Brief at 34.

[233] OUII Post-Hearing Brief at 35-36.

[234] The following colloquy occurred during the hearing:

> MR. FUSCO: Well, Your Honor, I think perhaps one question would be if the numbers were stipulated to, would the Respondents still be challenging the legal assertion, conclusion of the economic prong?
>
> JUDGE HARRIS: Of course, if they want to, they would be challenging it. I mean, they say if, if, if the numbers show a billion dollars, that's not domestic industry, they can argue that. All they've stipulated to is a billion

the parties, in less than a decade, Lumileds has made domestic investments in plant, equipment and other domestic expenditures that total [ ]. While Lumileds has not provided precise calculations to apportion its expenditures on a product-by-product basis, the record shows that the bulk of Lumileds' expenditures are related to products that practice the suit patents [

> dollars.
>
> MR. FUSCO: Well, I guess, like Mr. Johnson, I'm sort of wondering whether the expert would be needed or whether we can do away with the expert's arrival completely.
>
> JUDGE HARRIS: Well, if it's a billion dollars, probably you could.
>
> MS. COYLE: Your Honor, I think we have been willing to stipulate to the economic prong of the domestic industry, but not to the technical prong of the domestic industry.
>
> JUDGE HARRIS: Well, that's okay.
>
> MS. COYLE: So domestic industry is not, you know, something that's ever been an issue.
>
> JUDGE HARRIS: So now, they've gone further, willing to stipulate the economic prong. The only thing you need is for your technical expert to prove that you're manufacturing products covered by the patents.
>
> MR. JOHNSON: I'll accept that stipulation.
>
> MR. FUSCO: Well, and, Your Honor, this is one of those fine points that I think only OUII gets concerned about, that our understanding of the practice would be that the parties would stipulate to the numbers, but the Respondents here would then agree that, as a legal matter, the economic prong has been satisfied.
>
> JUDGE HARRIS: Well, they just, that's what Ms. Coyle just said.

Tr. 437-438.

].[235]

Consequently, it is found that the economic prong of the domestic industry requirement is satisfied.

[235] In addition, Lumileds and its predecessors have earned approximately [

]. Silkwood Tr. 451-452, 467-468.

FINDINGS OF FACT

I. BACKGROUND

1. The complainant named in the notice of investigation is Lumileds Lighting U.S., LLC of San Jose, California. The complainant is now known as Philips Lumileds Lighting Company, LCC ("Lumileds"). 70 Fed. Reg. 73026 (2005); Order No. 29 (Initial Determination); Commission Decision Not to Review (Nov. 6, 2006).

2. The Commission named as the respondents: Epistar Corporation ("Epistar") of Hsinchu, Taiwan; and United Epitaxy Company ("UEC") of Hsinchu, Taiwan. UEC merged with Epistar, and is no longer a respondent. 70 Fed. Reg. 73026 (2005); Order No. 29 (Initial Determination); Commission Decision Not to Review (Nov. 6, 2006).

3. The Commission Investigative Staff of the Office of Unfair Import Investigations ("OUII") is also a party in this investigation. 70 Fed. Reg. 73026 (2005).

4. Lumileds is a corporation organized and existing under the laws of the State of Delaware. Complaint ¶5, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

5. Lumileds principal place of business is at 370 West Trimble Road, San Jose, California, 95131. Complaint ¶5, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

6. Lumileds designs, develops, manufactures, and markets high-brightness light-emitting diodes. Complaint ¶5, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

7. Lumileds' evolved from the Optoelectronics Division of Hewlett-Packard Company ("HP"). Complaint ¶7, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

8. In 1999, Hewlett-Packard's optoelectronics group was spun off and became Agilent Technologies, Inc. Complaint ¶7, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

9. In November 1999, Agilent joined with Koninklijke Philips Electronics N.V. to form Lumileds. Complaint ¶7, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

10. In August 2005, Philips announced its intention to purchase Agilent's share in Lumileds. Complaint ¶7, at 2; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

11. In November 2005, Philips purchased Agilent's share in Lumileds. Motion to Amend Complaint, at 2; Motion to Amend Complaint Ex. C ¶7, at 2-3; Epistar Rebuttal to Lumileds' Proposed Findings of Fact at 1-4.

12. United Epitaxy Company was formed in September of 1993. Chen Tr. 1209.

13. Taiwan's Industrial Technology Research Institute ("ITRI") provided technology and training to UEC. Chen Tr. 1209.

14. ITRI is a partially government supported research organization engaged in developing new technology for Taiwan's industry employing approximately 4,000-5,000 researchers. Lee Tr. 935.

15. Dr. Chen, who was vice president of UEC at the time, initiated the development of UEC's high-brightness Metal Bond ("MB") and Glue Bond ("GB") products. Chen Tr. 1210-1211.

16. Development of the MB and GB products started around the end of 1998 and the beginning of 1999. Chen Tr. 1212.

17. UEC spent about [ ] on the development of the MB and GB products. Chen Tr. 1212-1213.

18. UEC published articles related to the research and development of the MB product and was also issued a U.S. patent (No. 6,319,778). Chen Tr. 1213-1215.

19. When Epistar was formed in 1996, and Epistar received technology from ITRI through a technology transfer. Lee Tr. 935.

20. Epistar is a publicly traded company listed with the Taiwan stock exchange since 2001. Lee Tr. 933.

21. Epistar currently has a market value of approximately US$1 billion . Lee Tr. 933.

22. Epistar has five manufacturing plants in Taiwan and one in China employing more than [ ] Organometallic Vapor Phase Epitaxy ("OMVPE") reactors. Lee Tr. 933-934.

23. Epistar currently employs approximately 1,650 people. Lee Tr. 934.

24. Epistar currently employs about [ ] researchers in the Research and Development Center. Hsieh Tr. 1273.

II. IMPORTATION AND SALE

25. Epistar admits that some sales have occurred. Moreover, Epistar does not contest the fact that the importation or sale requirement of section 337 is satisfied. Epistar's Prehearing Statement at 10; Epistar Post-Hearing Brief at 70-71.

III. CLAIM CONSTRUCTION

26. Dr. Dupuis is a chaired professor in electrical and computer engineering and materials science at the Georgia Institute of Technology and a Georgia Research Alliance Eminent Scholar. Dupuis Tr. 500.

27. Dr. Dupuis received his Bachelor of Science and Engineering Degree, his Masters Degree in electrical engineering, and his PhD. in electrical and computer engineering from the University of Illinois, Urbana-Champaign. Dupuis Tr. 501.

28. Dr. Dupuis was offered and accepted as an expert on light emitting diodes in

investigation. 08/03/06 Hr'g Tr. (Dupuis) at 506:23-507:4

29. Dr. Gerald Stringfellow has a Bachelors degree from the University of Utah and a Masters and Ph.D. degree from Stanford University in Material Science and Engineering. 08/09/06 Hr'g Tr. (Stringfellow) at 1390:23-1391:1.

30. Dr. Stringfellow is currently a distinguished professor of material science and engineering and electrical and computer engineering, and is also an adjunct professor of physics at the University of Utah. 08/09/06 Hr'g Tr. (Stringfellow) at 1401:1-21.

31. Dr. Stringfellow was offered and accepted as an expert in semiconductor materials, light emitting diodes, and LED fabrication. 08/09/05 Hr'g Tr. (Stringfellow) at 1405:1-9.

32. Dr. Philip E. Garrou has a Bachelor in Science in chemistry from North Carolina State University, a Ph.D. in chemistry from Indiana University, and then did a post-doctoral year at the University of Delaware. 08/10/06 Hr'g Tr. (Garrou) at 1588:21-25.

33. Dr. Garrou currently works as a consultant on matters relating to how to find applications for materials in the microelectronic industry and for electronic companies in terms of the appropriate materials that exist for use in their products. 08/10/06 Hr'g Tr. (Garrou) at 1589:6-13.

34. Dr. Garrou was offered and accepted as an expert witness in the field of BCB and its applications. 08/10/06 Hr'g Tr. (Garrou) at 1594:14-1595:9.

35. Dr. Nan Marie Jokerst received her Bachelors degrees in physics and mathematics from Creighton University in 1982, a Masters degree in electrical engineering from the University of Southern California in 1984, and a Ph.D. degree in electrical and computer engineering from the University of Southern California in 1989. 08/10/06 Hr'g Tr. (Jokerst) at 1639:18-25.

36. Dr. Jokerst is the JA Jones Distinguished Professor of Electrical and Computer

Engineering at Duke University, and is also the executive director of the Shared Materials Instrumentation Facility.

37. Dr. Jokerst is also the director of graduate studies in the electrical and computer engineering department at Duke. Dr. Jokerst is one of eight professors who holds an endowed chair on the engineering faculty at Duke. 08/10/06 Hr'g Tr. (Jokerst) at 1640:1-1642:3.

38. Dr. Jokerst was offered and accepted as an expert witness in the field of design, fabrication, integration, and bonding of optoelectronic devices. 08/10/06 Hr'g Tr. (Jokerst) at 1645:21-1646:4.

IV. INFRINGEMENT DETERMINATION

A. U.S. Patent No. 5,008,718

1. Technical Analysis

39. United States Patent No. 5,008,718 ("'718 patent") issued April 16, 1991 to Robert M. Fletcher, Chiping Kuo, Timothy Osentowski, and Virginia Robbins. CX-2 at LL ITC 00000002.

40. Application number 452,809 which became the '718 patent was filed on December 18, 1989. CX-2 at LL ITC 00000002.

41. Crystalline semiconductors are made of arrays of atoms with regular spacing, called a lattice. Dupuis Tr. 713:13-714:24.

42. Fabrication of an AlGaInP LED typically begins by putting a wafer, such as a three-inch gallium arsenide wafer, into a MOCVD reactor, where additional layers are grown onto the wafer in a crystal growth process known as "epitaxial growth." Dupuis Tr. 509:19-510:14, 539:5-13.

43. Epitaxial growth involves laying down atoms layer-by-layer, *e.g.*, by a chemical vapor

deposition process on a crystalline lattice that matches the template of the underlying substrate. Dupuis Tr. 780:1-12, 991:9-21.

44. A film of epitaxial layers is sometimes called an "epi," or "epi layers." Fletcher Tr. 1332:14-1333:7.

45. Epitaxial growth results in a chemical bond between the atomic layers. Dupuis Tr. 992:4-15.

46. Epitaxial growth does not result in a wafer bond. Dupuis Tr. 992:1-15.

47. "Deposition" in the context of forming layers generally refers to growing some material, whether in amorphous, crystalline, or polycrystalline form. Dupuis Tr. 992:16-993:4.

48. "Growing" means the layers get thicker over time. Dupuis Tr. 993:5-16.

49. "Lattice matching" means that a layer of material is grown onto a material that has the same spacing between the atoms (the lattice), such that their chemical bonds are arranged as if they were one continuous material rather than two materials. Dupuis Tr. 713:13-714:14.

50. Lattice matching results in the growth of nearly defect-free layers. Craford Tr. 134:13-135:14.

51. Gallium arsenide (GaAs) is typically used as the growth substrate in AlGaInP LEDs because it is lattice-matched to AlGaInP, which results in the growth of nearly defect-free light-emitting layers. Craford Tr. 138:9-23; Robbins Tr. 218:1-11; Dupuis Tr. 709:19-710:6.

52. A lattice mismatch means that the spacing of atoms, or lattice, of the grown material is different than that of another material. Craford Tr. 134:13-135:14; Dupuis Tr. 715:5-716:24.

53. Gallium phosphide (GaP), for example, is lattice mismatched, *i.e.*, not lattice matched,

with AlGaInP. Craford Tr. 138:18-139:13; Robbins Tr. 214:22-215:4, 216:21-217:5.

54. Growth of a lattice mismatched material upon another is referred to as "hetero-epitaxy." Dupuis Tr. 538:17-539:17, 716:19-24, 991:22-992:3.

55. Hetero-epitaxial growth of lattice mismatched materials, *e.g.*, growing gallium phosphide on AlGaInP, typically creates a high density of threading and other dislocations or defects in the crystalline layers at or near the heterojunction. Craford Tr. 134:15-135:14; 137:24-138:5; Robbins Tr. 214:18-218:19; Dupuis Tr. 538:17-539:17, 717:4-718:23; Chen Tr. 1256:25-1257:8.

56. The high density of threading and other dislocations at a heterojunction can degrade the performance of the LED. Craford Tr. 134:15-135:14; 137:24-138:5; Robbins Tr. 214:18-218:19; Dupuis Tr. 538:17-539:17, 717:4-718:23; Chen Tr. 1256:25-1257:8.

57. When a lattice mismatch results in a missing layer of atoms at and parallel to the interface of two materials, that defect is called an "edge dislocation." Dupuis Tr. 716:13-19.

58. A dislocation that extends up into the layer, *i.e.*, perpendicular to the interface, is referred to as a "threading dislocation." Dupuis Tr. 716:7-13, 718:20-23; Chen Tr. 1256:6-1258:6 (discussing CX-401 at LLITC 16126, Figure 5).

59. An amorphous material does not have a crystalline structure or lattice. Dupuis Tr. 993:21-25.

60. The point of novelty of the invention in the '718 Patent is the addition of a transparent, conductive semiconductor window layer to an AlGaInP LED to spread current laterally across the surface of the device ("current spreading") while allowing a significant amount of light to pass through the window layer without being absorbed. Dupuis Tr. 524:19-525:13, 529:14-530:14, 649:21-650:13, 1102:12-24, 1106:2-1107:8, 1115:14-1116:19; Robbins Tr. 327:16-23; Fletcher Tr. 1341:21-1342:16; CX-2 at col.

2:11-19; Stringfellow Tr. 1565:5-9.

61. "Current crowding," also known as localization of current flow, means that the current does not spread laterally away from the area below the electrical contact but "crowds" directly under the top contact. Dupuis Tr. 525:14-527:17; Robbins Tr. 225:5-226:5; Fletcher Tr. 1333:18-1335:19. CX-2 at col. 1:36-43; CX-64.

62. As a result of current crowding, light is emitted primarily underneath the top metal contact (14) in the prior art LED configurations of Figure 1. Dupuis Tr. 525:14-527:17; Fletcher Tr. 1333:18-1335:19; CX-2 at col. 1:41-46; CX-64.

63. The '718 patent is focused on AlGaInP LEDs. Stringfellow Tr. 1568:14-19.

64. The '718 Patent discloses the use of a double heterostructure but does not attach any specific significance to the use of that particular structure. Robbins Tr. 327:24-328:12.

65. The '718 Patent states that active structures other than double heterostructures, *e.g.*, homojunctions, may be used as well. Robbins Tr. 328:4-12; CX-2 at col. 5:16-24.

66. Figure 3 of the '718 Patent is an example of a double heterostructure AlGaInP LED in which the gallium arsenide (GaAs) growth substrate was removed after growth of the gallium phosphide (GaP) current-spreading window layer and replaced with a second epitaxially grown transparent window. Robbins Tr. 231:13-23 (discussing CX-2, Figure 3).

67. Dr. Dupuis admitted that the layers below the metal layers in the OMA I and OMA II products provide structural support so the chip does not fall apart, and work as a heat sink to remove heat from the device while it is in operation. 08/03/06 Hr'g Tr. (Dupuis) at 545:1-10.

68. Lumileds' '718 patent requires a semiconductor substrate. 08/09/06 Hr'g Tr. (Stringfellow) at 1498:15-19.

69. Lumileds' '718 patent requires active p-n junction layers over the substrate for emitting light. 08/09/06 Hr'g Tr. (Stringfellow) at 1499:4-7.

70. The active p-n junction layers of Lumileds' '718 patent are the cladding layer, the MQW layer, and the bottom cladding layer. 08/09/06 Hr'g Tr. (Stringfellow) at 1499:10-14.

71. The '718 patent particularly identifies these layers as the active layers. 08/09/06 Hr'g Tr. (Stringfellow) at 1499:12-13.

72. The "substrate" in Epistar's products is the [ ] for OMA I, OMA II, MB I and MB II and the [ ] for GB I and GB II. 08/09/06 Hr'g Tr. (Stringfellow) at 1487:4-13; *id.* at 1504:2-8; *id.* at 1509:16-24.

73. Epistar's MB product has an [ ] semiconductor [ ] substrate. 08/09/06 Hr'g Tr. (Stringfellow) at 1506:25-1507:2

74. Epistar's MB product has an electrical contact to the substrate. 08/09/06 Hr'g Tr. (Stringfellow) at 1507:2-4.

75. Epistar's MB product has a p-n junction. 08/09/06 Hr'g Tr. (Stringfellow) at 1507:4-5.

76. Epistar's MB II product has an [ ] semiconductor [ ] substrate. 08/09/06 Hr'g Tr. (Stringfellow) at 1502:14-15.

77. Epistar's MB II product has an electrical contact to the substrate. Stringfellow Tr. 1506:20-1507:10.

78. Epistar's MB II product has active layers. 08/09/06 Hr'g Tr. (Stringfellow) at 1502:20-22.

79. Epistar's OMA products do not have an electrical contact to the substrate. Instead, both of the contacts are on the topside of this device, so there is no contact to the silicon substrate. 08/09/06 Hr'g Tr. (Stringfellow) at 1498:25-1499:4.

80. The substrate of Epistar's GB II product consists of [ ] which is a single crystalline

[ ] and acts as an insulator. 08/09/06 Hr'g Tr. (Stringfellow) at 1504:2-10.

81. Epistar's GB II product has no semiconductor substrate, and has no electrical contact to the substrate. 08/09/06 Hr'g Tr. (Stringfellow) at 1504:10-13.

82. In Epistar's GB II product, both contacts are on the topside of the device. 08/09/06 Hr'g Tr. (Stringfellow) at 1504:14-15.

83. Epistar's GB II product has an active p-n junction over the substrate. 08/09/06 Hr'g Tr.

84. The window layer (*e.g.*, gallium phosphide) on top of the AlGaInP light-emitting layers is often referred to as a current-spreading window layer. Robbins Tr. 228:18-230:19, CX-2, col. 3:14-30.

85. Figure 2 of the '718 Patent depicts the addition of a transparent semiconductor window layer (24) to a double heterojunction AlGaInP LED. Dupuis Tr. 526:14-529:13 (discussing CX-2, Figure 2 and CX-64); Robbins Tr. 231:5-12 (discussing CX-2, Figure 2); CX-2 at col. 2:48-3:5.

86. A transparent window layer, such as gallium phosphide (GaP), spreads the current laterally out from under the top electrical contact and across the surface of the active layers. Robbins Tr. 226:6-228:7; Dupuis Tr. 525:14-527:17; Fletcher Tr. 1338:23-1339:25; CX-2 at col. 3:6-13, Figures 1-2; CX-630C at LLITC 01329116; CX-64.

87. The current-spreading transparent window layer improves the brightness, or efficiency, of the device by allowing light to be generated across the active layers and escape through the window layer, rather than producing light primarily under the opaque top metal contact. Dupuis Tr. 524:19-530:14, 649:21-650:13; Robbins Tr. 226:6-227:15; CX-2 at col. 3:10-13; CX-64.

88. The outermost electrons in an atom are called the valence electrons. Dupuis Tr.

513:9-10.

89. The conduction band is a band of electron energy states higher than the valence band. Dupuis Tr. 513:14-18.

90. Electrons in the conduction band conduct electricity. Dupuis Tr. 513:16-18.

91. The band gap is the energy difference between the valence band and the conduction band. Dupuis Tr. 603:5-12.

92. The color of light an LED emits is determined by the bandgap of the light-emitting material used in the LED. Stringfellow Tr. 1413-14.

93. A material is transparent to photons of light when the photons have an energy less than the bandgap of the material. Stringfellow Tr. 1474.

94. Photons cannot excite carriers in the material from the valence band into the conduction band when the photons have an energy less than the bandgap of the material. Stringfellow Tr. 1474.

95. Metals generally have no bandgap at all. Dupuis Tr. 512, 516.

96. Metals are opaque. Dupuis Tr. 512, 516.

97. Metals are highly conductive. Dupuis Tr. 512:15-23, 516:9-19.

98. Insulators, such as glass, have a large bandgap energy. Dupuis Tr. 511, 514-15, 628-29.

99. Insulators with a large band gap energy are generally transparent. Dupuis Tr. 511, 514-15, 628-29.

100. Insulators are electrically insulating because electrons cannot get to the conduction band by thermal excitation at room temperature. Dupuis Tr. 511:13-19, 514:5-18, 628:21-629:11.

101. A semiconductor is a nonmetallic solid that may conduct electricity by excitation of electrons across an energy gap. Dupuis Tr. 624, 628-29; Kish Tr. 332.

102. A semiconductor is a nonmetallic solid that may conduct electricity by introducing dopants to provide conduction electrons or holes. Dupuis Tr. 624:14-20, 629:12-630:1; Kish Tr. 332:6-10.

103. In a pure semiconductor, like silicon or germanium, some electrons can be excited from the valence band to the conduction band by thermal energy. Dupuis Tr. 513:20-514:9.

104. Semiconductors can be made of a wide variety of or combinations of materials. Dupuis Tr. 211-12, 515:19-516:5.

105. Semiconductors can have a wide range of physical properties. Dupuis Tr. 211-12, 515-16.

106. Different semiconductors may have different band gap energies. Dupuis Tr. 211-12, 515-16.

107. Semiconductors may be transparent. Dupuis Tr. 211-12,515-16.

108. Semiconductors may be opaque. Dupuis Tr. 211-12,515-16.

109. Semiconductors may become more conductive at higher temperatures. Dupuis Tr. 211-12,515-16.

110. Silicon, the most well-known semiconductor, is an elemental semiconductor because it consists of one element. Robbins Tr. 213:20-22; Dupuis Tr. 517:3-7, 518:20-25.

111. Compound semiconductors are composed of multiple elements. Robbins Tr. 213:18-214:4; Dupuis Tr. 517:3-519:15.

112. A binary semiconductor, such as gallium phosphide ("GaP"), combines two elements. Dupuis Tr. 518:25-519:2.

113. A ternary semiconductor combines three elements, such as gallium indium phosphide ("GaInP") or aluminum indium phosphide ("AlInP"). Dupuis Tr. 519:2-4; Crawford Tr. 126:9-13.

114. A quaternary semiconductor, such as AlGaInP, combines four elements, such as aluminum, gallium, indium, and phosphorus. Dupuis Tr. 519:4-15; Craford Tr. 126:9-17.

115. III-V compounds are composed of elements from column III and column V of the periodic table. Kish Tr. 347:24-348:12; Robbins Tr. 213:18-214:4.

116. The column number in the periodic table corresponds to the number of valence electrons, *e.g.*, a column III element has three valence electrons; column IV has four valence electrons; and column V has five valence electrons. Dupuis Tr. 517:3-20.

117. Column III of the periodic table includes indium, gallium, and aluminum. Dupuis Tr. 517:13-17, 518:7-19.

118. Column IV includes silicon. Kish Tr. 347:25; Dupuis Tr. 517:6-7.

119. Column V includes arsenic and phosphorus. Dupuis Tr. 517:13-518:9.

120. AlGaInP is a III-V semiconductor comprising some combination of aluminum and/or gallium with indium (III) and phosphorus (V). Kish Tr. 349:1-11; Dupuis Tr. 517:3-518:19.

121. AlGaInP semiconductor alloys can emit green, yellow, orange, or red light, depending on the band gap light emitting layers, which is determined by the relative concentration of the elements. Kish Tr. 335:24-336:3; Dupuis Tr. 603:5-605:23; CX-2 at col. 3:43-58.

122. An AlGaInP LED with no aluminum emits the color red. Robbins Tr. 250:11-24; CX-2 at col. 3:43-45, 58-59.

123. An AlGaInP LED with a relatively low proportion of aluminum to gallium emits the color yellow. CX-2 at col. 3:43-45, 59-60; Robbins Tr. 250:11-24.

124. An AlGaInP LED with a relatively high ratio of aluminum to gallium emits the color green. Robbins Tr. 250:11-24; CX-2 at col. 3:43-45 and 60-61.

125. Dopants are impurities added to a material to add charge carriers such a electrons or

holes. Dupuis Tr. 519-522.

126. The conduction properties of a semiconductor, *e.g.*, silicon, can be tailored by the addition of a dopants. Dupuis Tr. 519:16-523:15.

127. A p-type semiconductor material has a large concentration of "holes," or positive charge carriers. Dupuis Tr. 507:14-509:5, 523:7-15.

128. A p-type semiconductor material can be produced by replacing atoms of one element with atoms of another element having fewer valence electrons, *e.g.*, replacing a silicon atom (from column IV of the periodic table of elements) with a boron atom (column III), which results in one less electron (or one extra hole). Dupuis Tr. 519:16-522:15, 630:2-632:7.

129. An n-type semiconductor material has a large concentration of electrons, or negative charge carriers. Dupuis Tr. 507:14-509:5, 523:7-15.

130. An n-type semiconductor material can be created by replacing atoms of one element with atoms of another element having more valence electrons, *e.g.*, replacing a silicon atom (column IV) with a phosphorus atom (column V) results in one more electron. Dupuis Tr. 519:16-522:15, 630:2-632:7.

131. A high concentration of impurity atoms causes a high concentration of electrons (n-type) or holes (p-type) in a semiconductor. Dupuis Tr. 540:5-541:20.

132. A degenerately doped semiconductor, or degenerate semiconductor, has a high concentration of dopant atoms and has a relatively high conductivity. Dupuis Tr. 540:5-541:20; Robbins Tr. 272:10-273:15.

133. A degenerately doped semiconductor, or degenerate semiconductor, can form an electrically conductive interface. Dupuis Tr. 540-41; Robbins Tr. 272-73.

134. Indium tin oxide is referred to as ITO. Stringfellow Tr. 1526:17-20.

135. ITO is a degenerate semiconductor. CX 102; Stringfellow Tr. 1552:25-1553:22; Dupuis

Tr. 540:7.

136. ITO is degenerately doped. Dupuis Tr. 11-12.

137. ITO has a high concentration of impurity atoms. Dupuis Tr. 14-15.

138. ITO is a semiconductor different from AlGaInP. Dupuis Tr. 603:1-3, 624:10-625:1, 628:3-15, 646:3-10, 649:25-651:12.

139. Indium oxide is a semiconductor material. Dupuis Tr. 633.

140. When indium oxide is doped with tin, it becomes an n-type semiconductor known as indium-tin oxide (ITO). Dupuis Tr. 633:2-25, 637:2-23, 643:15-644:5 (discussing CX-566); Dupuis Tr. 2078:13-25.

141. A donor/acceptor impurity in a semiconductor compound is, for example, a column IV element or a column VI element that replaces a column III element because the column IV or VI element provides either an acceptor or a donor. Dupuis Tr. 2079:23-2080:7.

142. Tin is a column IV element. Dupuis Tr. 2081:16-17.

143. Indium is a column III element. Dupuis Tr. 2081:14-16.

144. Tin is a donor impurity material in indium oxide. Dupuis Tr. 2078:13-1261:25.

145. Tin is a donor impurity in indium oxide because tin (a column IV element) replaces indium (a column III element). Dupuis Tr. 2078:16-18, 2081:12-17.

146. When a tin atom replaces an indium atom, it donates an electron to the conduction band. Dupuis Tr. 2081:17-21.

147. Just because ITO is a conductor does not mean that it is not a semiconductor. Dupuis Tr. 1925:4-24.

148. A degenerately doped semiconductor is a semiconductor doped with a lot of impurities. Dupuis Tr. 1928:20-1929:5.

149. ITO can be doped as an N-type semiconductor. Dupuis Tr. 1926:22-25.

150. ITO is indium oxide that is heavily doped with tin. Dupuis Tr. 1926:22-1928:19.

151. Numerous articles and books refer to ITO as a semiconductor. Jokerst Tr. 1849:15-19; Stringfellow Tr. 1550-1551.

152. The semiconductor conductivity range may be extended upward by increasing the concentration of impurity atoms. Stringfellow Tr. 1547:7-18; RX-140.

153. Semiconductors are electronic conductors with electrical resistivity values. Stringfellow Tr. 1547:19-1548:6; Dupuis Tr. 1925:25-1926:18; RX-140.

154. Gallium phosphide is a semiconductor and also a good conductor. Dupuis Tr. 1929:12-1930:10 (Discussing CX-2 at col. 4:54-55).

155. A material may be both a semiconductor and a good conductor because the two terms are not mutually exclusive. Dupuis Tr. 1930:8-14.

156. The resistivity of a material has no bearing on whether it is a semiconductor. Dupuis Tr. 1932:25-1933:18.

157. Dr. Stringfellow acknowledges that numerous people of ordinary skill in the art refer to indium tin oxide (ITO) as a semiconductor. Stringfellow Tr. 1554:19-1555:8.

158. Dr. Stringfellow performed a search that found 100 papers calling ITO a semiconductor. Stringfellow Tr. 1554:19-1555:1.

159. According to a 1985 review paper in the Journal of Applied Physics ("the 1985 review paper"), heavily doping indium oxide with tin increases the concentration of electrons in the conduction band and produces an n-type degenerate (heavily doped) transparent semiconductor with high conductivity, *i.e.*, low resistivity. Dupuis Tr. 637:2-641:20, 643:3-645:2 (discussing CX-566, Figures 27A, 27B; *see also* CX-102; CX-232).

160. The 1985 review paper described indium-tin oxide as being in the class of doped oxide semiconductors with a variety of useful properties, among them being a high optical

transparency. Dupuis Tr. 634:16-25 (discussing CX-566).

161. The use of the term "doping" in the art does not imply or require an upper limit (*e.g.*, one percent) on the percentage of atoms that could be used in the doping process. Dupuis Tr. 638:13-640:16.

162. Epistar admits that its MB I products satisfy the '718 Patent claim 1 limitation of "bandgap greater than the bandgap of the active layers." Stringfellow Tr. 1508:16-19.

163. Epistar admits that its MB I products satisfy the '718 patent claim 1 limitation of "resistivity lower than the active layers." Stringfellow Tr. 1509:13-15.

164. The top ITO layer in the MB I product is transparent. Stringfellow Tr. 1534:4-11.

165. The top ITO layer in the MB I product is about [.] CX 43 C, at 7.

166. The current spreads through the ITO layer on the MB product: "[

]" Stringfellow Tr. 1430:21-1431:20.

167. Epistar's MB I products have an upper indium tin oxide (ITO) degenerately doped semiconductor current-spreading window layer. Dupuis Tr. 681:25-682:3, 683:9-24.

168. Epistar's products with the top ITO layer spread current laterally [

] in the MB I products. Stringfellow Tr. 1569:21-1570:9.

169. Epistar admits that its MB II products satisfy the '718 Patent claim 1 limitation of "bandgap greater than the bandgap of the active layers." Stringfellow Tr. 1503:4-6.

170. Epistar admits that its MB II products satisfy the '718 Patent claim 1 limitation of "resistivity lower than the active layers." Stringfellow Tr. 1503:7-9.

171. Epistar's MB II products have a transparent ITO layer over the active layers, which corresponds to the "transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers

and a resistivity lower than the active layers" required by claim 1. Dupuis Tr. 689:18-690:3.

172. ITO is a semiconductor different from AlGaInP, has a band gap greater than that of the active layers in the MB II products, and a resistivity less than that of the active layers in the MB II products. Dupuis Tr. 689:18-690:3.

173. Epistar's products with the top ITO layer spread current laterally from the bonding pad to [ ] in the MB II products. Stringfellow Tr. 1569:21-1570:9.

174. According to a 1985 review paper in the Journal of Applied Physics ("the 1985 review paper"), heavily doping indium oxide with tin increases the concentration of electrons in the conduction band and produces an n-type degenerate (heavily doped) transparent semiconductor with high conductivity, *i.e.*, low resistivity. Dupuis Tr. 637:2-641:20, 643:3-645:2 (discussing CX-566, Figures 27A, 27B; *see also* CX-102; CX-232).

175. The 1985 review paper described indium-tin oxide as being in the class of doped oxide semiconductors with a variety of useful properties, among them being a high optical transparency. Dupuis Tr. 634:16-25 (discussing CX-566).

176. Epistar admits that its OMA I products satisfy the '718 patent claim 1 limitation of "bandgap greater than the bandgap of the active layers." Stringfellow Tr. 1500.

177. The upper ITO window layer in the OMA I product has a bandgap greater than that of the active layers (specifically, the multiple quantum well) and is thus transparent to the emitted light. Dupuis Tr. 602:5-607:1, 653; *see also* CX-607C (Shen) at 67:13-70:15 (verifying formula for calculating band gap).

178. According to Mr. Lu of Epistar, the ITO layer in the OMA I products transmits at least [ ] of the light emitted by the multiple quantum well. Dupuis Tr. 607:9-608:3 (discussing CX-605C (Lu)).

179. Epistar admits that its OMA I products satisfy the '718 Patent claim 1 limitation of "resistivity lower than the active layers." Stringfellow Tr. 1500:15-19.

180. Resistivity is an intrinsic property of a material. Stringfellow Tr. 1417:9-10.

181. The overlying ITO layer in the OMA I product has a resistivity lower than that of the active layers, specifically, the n-type cladding layer. Dupuis Tr. 602:15-19, 653:5-15.

182. Mr. Lu of Epistar testified that the upper ITO layer has a resistivity of [ ], which is lower than the resistivity of all of the AlGaInP layers in the OMA I product. CX-605C (Lu) at 126:4-127:4.

183. Based on information provided by Epistar, Dr. Dupuis calculated the resistivity of the overlying ITO current-spreading layer in the OMA I products to be [ ]. Dupuis Tr. 647:13-648:6.

184. Based on information provided by Epistar and in the technical literature, Dr. Dupuis calculated the resistivity of the upper confining layer in the OMA I products to be [ ]. Dupuis Tr. 648:7-18.

185. The resistivity of the overlying ITO current-spreading in the OMA I products is less than the resistivity of the upper confining layer. Dupuis Tr. 648:18-20.

186. The electrical contact overlying the ITO current-spreading layer in the OMA I products corresponds to the "metal electrical contact over a portion of the transparent layer" in claim 1 of the '718 patent. Dupuis Tr. 651:13-652:8.

187. Epistar admits that its OMA II products satisfy the '718 patent claim 1 limitation of "bandgap greater than the bandgap of the active layers." Stringfellow Tr. 1500:12-14, 1501:10-18.

188. Epistar admits that its OMA II product satisfies the '718 patent claim 1 limitation of "resistivity lower than the active layers." Stringfellow Tr. 1500:15-19, 1501:10-18.

189. The OMA II products, like the OMA I products, have "a transparent window layer of semiconductor different from AlGaInP over the active layers and having a bandgap greater than the bandgap of the active layers and a resistivity lower than the active layers," comprising the upper transparent current-spreading ITO layer. Dupuis Tr. 658:16-24.

190. The top ITO layer spreads current laterally from the bonding pad to the [ ]in the OMA II products. Stringfellow Tr. 1569:21-1570:9.

191. The top ITO layer in the OMA II product is a current spreading layer. Hsieh Tr. 13011:10-1312:6; CX-439, p. 2.

192. The ITO current spreading layer in the OMA II enables a current injected from the n-electrode to effectively spread laterally in the ITO layer to the [ ]. Hsieh Tr. 13011:10-1312:6; CX-439, p. 2.

193. The OMA II products, like the OMA I products, have "a metal electrical contact over a portion of the transparent layer," comprising the n-electrode connected to the upper transparent current-spreading ITO layer. Dupuis Tr. 658:21-24.

194. Epistar admits that its GB I products satisfy the '718 patent claim 1 limitation of "bandgap greater than the bandgap of the active layers." Stringfellow Tr. 1510:11-13.

195. Epistar admits that its GB I products satisfy the '718 patent claim 1 limitation of "resistivity lower than the active layers." Stringfellow Tr. 1510:18-20.

196. The top ITO layer spreads current laterally from the bonding pad to the [ ] in the GB I products. Stringfellow Tr. 1569:21-1570:9.

197. Epistar's GB I products have a round [ ] n-type electrode, which corresponds to the "metal electrical contact over a portion of the transparent layer" required by claim 1 of the '718 patent. Dupuis Tr. 662:13-663:7, 666:15-18.

198. Epistar admits that its GB II products satisfy the '718 patent claim 1 limitation of "bandgap greater than the bandgap of the active layers." Stringfellow Tr. 1505:3-5.

199. Epistar admits that its GB II products satisfy the '718 patent claim 1 limitation of "resistivity lower than the active layers." Stringfellow Tr. 1505:10-12.

200. The GB II products have a transparent window layer of ITO oxide over the active layers, which is a semiconductor different from AlGaInP and has a band gap greater than that of the active layers and a resistivity below that of the active layers. Dupuis Tr. 671:19-25; CX-460C at EC 145930.

201. Epistar's products with the top ITO layer spread current laterally from the bonding pad to [ ] in the GB II products. Stringfellow Tr. 1569:21-1570:9.

202. The GB II products have "a metal electrical contact over a portion of the transparent layer," as required by claim 1, comprising the [ ]contact on top of the ITO transparent current-spreading window layer. Dupuis Tr. 672:1-7; CX-460C at EC 145930.

203. Claim 6 of the '718 patent states that resistivity of the transparent window layer in the light-emitting diode of claim 1 must be at least an order of magnitude less than the resistivity of the outermost AlGaInP cladding layer. Dupuis Tr. 653:22-654:8.

204. Dr. Dupuis calculated the resistivity of the upper confining layer in Epistar's MB products is [,] which is significantly more than the resistivity of the upper ITO layer. Dupuis Tr. 648:21-649:13.

205. The resistivity of the ITO layer is [ ]. Dupuis Tr. 654:9-655:8.

2. Licensing Defense for MB and OMA Products

206. On June 30, 2004, Lumileds Lighting, U.S. LLC and Epistar Corporation settled litigation that was pending in the Northern District of California. A copy of that settlement

agreement is contained in CX-300C.

207. [

]. CX-300 at 1.4, 2.1, 3.1; Lee Tr. 965-966.

208. The "Licensed Field" delineated in the settlement agreement is as follows:

[

]

CX-300C at 1.2, 1.7; Dadok Tr. 1190.

209. [

]. Dadok Tr. 1194, 1198-1201.

210. Lumileds' expert, Dr. Dupuis, testified at the hearing that AlInGaP LEDs are commonly discussed in terms of whether they have an [

]. He pointed to several examples of such terminology in patents and industry publications, including printed material from Epistar. Dupuis Tr. 692-695, 1949-1952.

211. [

] Dupuis Tr. 693-695, 699-700, 1950-1952; Dadok Tr. 1168-1169, 1949-1950.

212. During the deposition of Epistar's Dr. Chen, he provided the following testimony:

[

]

CX-589C (Chen Dep.)(cited in Epistar's Reply Brief at 16-17).

213. At the hearing, Dr. Chen described improvements to the accused OMA and MB products, as follows:

[

]

Chen Tr. 1227 (emphasis added).

B. U.S. Patent No. 5,376,580

214. U.S. Patent No. 5,376,580 is entitled "Wafer Bonding of Light Emitting Diode Layers" (the "580 Patent"). CX-3, at 1.

215. Fred A. Kish is a named inventor of the 580 Patent. CX-3, at 1.

216. Frank M. Steranka is a named inventor of the 580 Patent. CX-3, at 1.

217. Dennis C. DeFevere is a named inventor of the 580 Patent. CX-3, at 1.

218. Virginia M. Robbins is a named inventor of the 580 Patent. CX-3, at 1.

219. John Uebbing is a named inventor of the 580 Patent. CX-3, at 1.

220. The 580 Patent was filed with the USPTO on March 19, 1993. CX-3, at 1.

221. The 580 Patent was issued by the USPTO on December 27, 1994. CX-3, at 1.

222. Lumileds is the owner, by assignment, of the 580 Patent. Complaint ¶10, at 3; Complaint Ex. 4.

223. Lumileds is the owner, by assignment, of all foreign counterparts to the 580 Patent. Complaint ¶10, at 3; Complaint Ex. 4.

224. The 580 Patent is directed to the use of wafer bonding to improve the performance, reliability, and mechanical integrity of AlGaInP LEDs. Kish Tr. 363:4-9, 425:15-18; *see also* CX-3 at col. 3:3-14; col. 4:3-13; col. 4:67-5:12.

225. Wafer bonding a layer to the AlGaInP LED layers results in few, if any, defects or dislocation at the interface, which is a great advantage over hetero-epitaxial growth. Dupuis Tr. 717:20-720:1.

226. By using wafer bonding, engineers and scientists can select substrate materials based on their ability to enhance the performance of the LED, without being limited by the need to maintain a constant lattice parameter at the interface. Dupuis Tr. 719:17-720:1.

227. For example, a performance-enhancing substrate may be more transparent or electrically conductive than a growth substrate. CX-3 at col. 3:3-10, 43-47; col. 10:16-36, discussed at Dupuis Tr. 819:18-820:15.

228. The innovation of the 580 and 316 Patents made it possible to use wafer bonding to attach a transparent layer to the AlGaInP active layers and thereby avoid the difficulties of epitaxial growth. Dupuis Tr. 702:14-704:7, 707:20-709:10; Kish Tr. 365:11-25.

229. It is not practical to grow AlGaInP active layers on a transparent substrate because it can lead to defects in the active layers that make the LED very inefficient or even inoperative. Kish Tr. 366:1-367:12.

230. Forming a transparent substrate by epitaxial growth is a slow, difficult, and expensive process. Kish Tr. 365:11-25; Dupuis Tr. 707:20-709:10.

231. Figure 1 of the 580 Patent depicts a prior art homojunction LED on an absorbing gallium arsenide substrate. Robbins Tr. 265:18-266:8 (discussing CX-3, Figure 1).

232. Figure 3 of the 580 Patent depicts a prior art heterojunction LED on a transparent substrate, where the transparent substrate (24) was formed by epitaxial growth. Kish Tr. 363:10-20; CX-3 at col. 1: 61-67 and Fig. 3.

233. Figure 6 of the 580 Patent discloses a transparent-substrate LED formed by wafer bonding. Kish Tr. 364:12-365:10; CX-3 at col. 7:24-47.

234. Wafer bonding a transparent substrate to the thin LED layers is much quicker and much less expensive than epitaxially growing the transparent substrate. Dupuis Tr. 707:20-709:10.

235. The 580 Patent discloses wafer bonding a mirror to an AlGaInP LED to improve light extraction by reflecting light that was directed downward from the active layers and otherwise would have been absorbed by the substrate. Kish Tr. 368:15-24, 372:15-373:1, 417:6-418:14; CX-3 at col. 4:67-5:7; col. 9:27-34 (discussing Figure 11).

236. The 580 Patent does not disclose specifically what an electrically conductive mirror should be made out of. Kish Tr. 418:3-14.

237. Figure 12 of the 580 Patent is a structure with multiple wafer-bonded LED structures. Kish Tr. 377:8-378:24; *see also* CX-3 at col. 9:64-col. 10:15; Robbins Tr. 272:10-273:15.

238. Stacking multiple LED layers in an LED device can lead to a more efficient diode and may make it possible to combine colors. Kish Tr. 378:3-24.

239. Figure 17 of the 580 Patent describes an LED device in which patterns, or cavities, are formed on the surfaces of the layers. Kish Tr. 379:6-380:4; CX-3 at col. 11:50-64.

240. The patterns or cavities can route current around in the device to alter light emissions. Kish Tr. 379:6-380:4; CX-3 at cols. 5:13-14; 12:25-31.

241. Wafer bonding was such an exciting breakthrough because this method allows bonding two lattice mismatched semiconductor materials, without the need to introduce foreign materials into the device. Because the lattice of both structures is already developed and solid, the lattice structure is not going to change except at the bonded interface, where there may be edge dislocations. The edge dislocations are preferred to the threading dislocations that would have occurred if, for example, the AlGaInP LED layers were grown on the transparent substrate because edge dislocations do not significantly affect the light output, for this reason, wafer bonding freed the fabrication of LEDs from the limitations of having lattice matched substrate and LED layers. As a result, the device can be mechanically robust, electrically conductive and optically transparent. 08/10/06 Hr'g Tr. (Jokerst) at 1654:15-1657:27; RDX-701, RDX-702, RDX-703, *and* RDX-802.

242. Direct wafer bonding refers to semiconductor to semiconductor bonding. RX-0320, Kish Depo. (4/26/06) at 91:14-92:1.

243. The semiconductor-to-semiconductor wafer bonding process includes the further steps of (1) bringing the surfaces together, (2) applying pressure to the wafers, (3) raising temperature to 800° to 1000° C, and (4) then lowering the temperature. 08/10/06 Hr'g Tr. (Jokerst) at 1650:13-17; *id.* at 1654:7-1655:9; RDX-703.

244. Wafer bonding provides a mechanically robust, optically transparent and good ohmic contact bond, because the structures being bonded are lattice structures. 08/10/06 Hr'g Tr. (Jokerst) at 1657:1-7.

245. Each semiconductor solid surface has a lattice structure, and so any dislocations because of the mismatched lattice structure of the surfaces being bonded is at the edge, parallel to

the bonding interface and called edge dislocations, as distinct from threading dislocations that may be created by epitaxial growth methods. 08/10/06 Hr'g Tr. (Jokerst) at 1654:15-1655:4; *id.* at 1655:10-1656:1.

246. The semiconductor-to-semiconductor wafer bonding process includes the further steps of (1) bringing the surfaces together, (2) applying pressure to the wafers, (3) raising temperature to 800° to 1000° C, and (4) then lowering the temperature. 08/10/06 Hr'g Tr. (Jokerst) at 1650:13-17; *id.* at 1654:7-1655:9; RDX-703.

247. Edge dislocations never reach the active layer, and so the high quality lattice structure of the active layer is unaffected by the bonding. Therefore, the bonding of a transparent substrate different from and/or in place of the absorbing one on which the active layers are grown, allows the LED device to enjoy all the benefits of growing the high quality lattice structure plus the benefit of having a transparent substrate and maintaining the entire lattice structure. Wafer bonding maintains the integrity of the device, and by adding a transparent substrate for the substrate needed to grow the active layers the performance of the LED is improved. 08/10/06 Hr'g Tr. (Jokerst) at 1656:2-22.

248. Edge dislocations are much less destructive to the performance of the device than threading dislocations, which are created by epitaxial growth. 08/10/06 Hr'g Tr. (Jokerst) at 1870:8-15.

249. [

]. 08/10/06 Hr'g Tr. (Jokerst) at 1659:17-25.

250. Glue bonding creates an insulating bond. 08/10/06 Hr'g Tr. (Jokerst) at 1660:14-16.

251. In glue bonding, there are also no dislocations, as the glue has no lattice structure. 08/10/06 Hr'g Tr. (Jokerst) at 1663:8-10.

252. The '580 and '316 patents at the time of their filing did not teach glue bonding to one of

ordinary skill in the art. 08/10/06 Hr'g Tr. (Jokerst) at 1661:6-11.

253. The '580 and '316 patents do not make any reference to glue bonding. 08/10/06 Hr'g Tr. (Jokerst) at 1661:12-14.

254. The '580 and '316 patents do not teach one of skill in the art at the time of their filing to do bonding with spin-on-glass. 08/10/06 Hr'g Tr. (Jokerst) at 1661:18-21.

255. For glue bonded devices, further processing and operating temperatures are limited to less than 400° C. 08/10/06 Hr'g Tr. (Jokerst) at 1660:20-15.

256. Metal-to-metal bonding involves vacuum evaporating metals onto the two wafers and then bringing them together and adhering them with heat and optionally pressure. 08/10/06 Hr'g Tr. (Jokerst) at 1653:11-25.

257. In metal bonding, there are no dislocations because it is not a crystalline material. 08/10/06 Hr'g Tr. (Jokerst) at 1663:3-7.

258. The '580 patent provides no parameters of the type of metals or conditions under which those metals could be annealed to form a robust wafer bond. 08/11/06 Hr'g Tr. (Dupuis) at 2053:16-22.

259. The function and result of the wafer bonding taught and claimed in the '580 and '316 patents of providing an optically transparent bond is neither served nor achieved in the metal-to-metal bonding of the MB products.

260. The function and result of the wafer bonding taught and claimed in the '580 and '316 patents of providing an optically transparent bond is neither served nor achieved in the metal-to-metal bonding of the MB products.

261. Metal-to-metal bonding does not create an optically transparent interface. Jokerst Tr. 1666:8-9.

262. Dr. Dupuis testified that the "wafer bonding" in the OMA I and OMA II products occurs

at [ ]. 08/07/06 Hr'g Tr. 839:22-840:2.

263. [ ]. 08/10/06 Hr'g Tr. (Garrou) at 1592:3-12; 08/10/06 Hr'g Tr. (Jokerst) at 1659:17-21.

264. [ ] is an amorphous polymer. 08/10/06 Hr'g Tr. (Garrou) at 1595:14-20.

265. Current cannot flow through materials that are joined together with [ ] because [ ] is an insulating material. 08/10/06 Hr'g Tr. (Garrou) at 1611:14-17. The conductive path in the OMA products is "U" shaped. *See, e.g.*, RDX-900; 08/10/06 Hr'g Tr. (Jokerst) at 1694:16-1695:12.

266. The use of [ ] to glue bond the two surfaces is not only a different way of bonding from that which the patent claimed and taught, but the OMA I achieves the generating and emission of light differently. The light is generated by a conduction path in the form of a "U" created by [ ], and this path limits the amount of current and therefore limits the amount of light emitted. This path is approximately [ ] smaller than the path disclosed in the '580 and '316 patents, and as a result, the light generated and emitted is substantially less than that structure claimed in the patent. 08/10/06 Hr'g Tr. (Jokerst) at 1685:16-1688:10; RDX-900; 08/10/06 Hr'g Tr. (Jokerst) at 1694:10-1695:16.

267. The noninfringement analyses for OMA II regarding claims 1-3 are the same as for OMA I. 08/10/06 Hr'g Tr. (Jokerst) at 1696:7-20.

268. In the OMA products, the [ ] mirror is not wafer bonded to the LED layers, it is [ ]. 08/10/06 Hr'g Tr. (Jokerst) at 1693:19-25; *id.* at 1697:16-17.

269. Further, in the OMA II product, the [ ] mirror is not bonded to the structure containing the LED layers; instead it is [ ] on that structure. 08/10/06 Hr'g Tr. (Jokerst) at 1698:9-12.

270. Dr. Dupuis agrees that the process of depositing layers of materials is not considered wafer bonding. 08/07/06 Hr'g Tr. (Dupuis) at 994:21-995:6.

271. Dr. Dupuis admits that a complete mirror is not wafer bonded to the LED layers in the OMA I product. 08/07/06 Hr'g Tr. 1063:10-14.

272. In the OMA I and OMA II products, [ ] and with the [ ] bonding, which will not form a low resistance connection. 08/10/06 Hr'g Tr. (Jokerst) at 1693:19-25; *id.* at 1697:8-14.

273. In the GB products, the [ ] layers are not directly bonded to the LED layers, as required by claims 1-3, 25, 27 and 28. Instead, they are [ ]. 08/10/06 Hr'g Tr. (Jokerst) at 1700:9-13; *id.* at 1709:13-14.

274. In the GB products, there is no wafer bonding. [ ]by glue bonding. 08/10/06 Hr'g Tr. (Jokerst) at 1700:14-15; *id.* at 1706:11-16; *id.* at 1708:10-14.

275. In the GB products, there is no bonding of a transparent layer to the LED layers. 08/10/06 Hr'g Tr. (Jokerst) at 1700:15-16; *id.* at 1709:13-14.

276. In the GB products, the [, being insulating, prevent current from traveling through the structure of the LED, just like in the OMA products. 08/10/06 Hr'g Tr. (Jokerst) at 1702:13-20.

277. In the GB products, neither the[ ]nor the LED layers are patterned, as required by claims 25, 27 and 28. 08/10/06 Hr'g Tr. (Jokerst) at 1706:2-5.

278. In the GB products, the[ ] is insulating and cannot spread current, as required by claim 27. 08/10/06 Hr'g Tr. (Jokerst) at 1707:19-21.

279. In the MB products, the permanent substrate is optically absorbing. 08/10/06 Hr'g Tr. (Jokerst) at 1722:11-20; *id.* at 1730:1-2.

280. In the MB products, there is no bonded interface between the permanent substrate and the

LED layers, as required by claims 8 and 9. 08/10/06 Hr'g Tr. (Jokerst) at 1722:3-10; *id.* at 1731:3-4.

281. In the MB products there is no wafer bonding. Wafer bonding was an emerging technology at the time of the application of the '580 and '316 patents, but metal bonding as used in the MB products was well known. 08/10/06 Hr'g Tr. (Jokerst) at 1726:6-15; *id.* at 1722:20; *id.* at 1730:13-1731:2.

282. In the MB products, the mirror [ ]. 08/10/06 Hr'g Tr. (Jokerst) at 1723:21-25; *id.* at 1734:13-14.

283. Claim 8 of the '580 patent expressly limits the "LED layers" to epitaxially grown layers. 08/08/06 Hr'g Tr. (Dupuis) at 1077:22-1078:4

284. ITO is not an epitaxially grown layer, and is not an "LED layer" for purposes of claim 8. 08/10/06 Hr'g Tr. (Jokerst) at 1730:3-25.

285. In the MB products, the mirror is not wafer bonded to the LED layers; nor is it on the second substrate when the two are being bonded, as required by claim 18. 08/10/06 Hr'g Tr. (Jokerst) at 1727:1-5; *id.* at 1734:15-17.

286. In the MB II product, the metal layers that are bonded are [ ]on the layers underneath them. 08/10/06 Hr'g Tr. (Jokerst) at 1730:13-1731:2.

287. According to Dr. Dupuis, in the MB products the bonding occurs when the [ ] layers are pressed together and heated. 08/08/06 Hr'g Tr. (Dupuis) at 1079:8-12.

288. In the MB products, no wafer bonding occurs between the LED layers and the [ ] layers. 08/08/06 Hr'g Tr. (Dupuis) at 1079:13-16.

289. In the MB products, the LED layers are [ ] 08/08/06 Hr'g Tr. (Dupuis) at 1078:12-4.

290. In the MB products, none of the [ ] layers are attached

by wafer bonding. 08/08/06 Hr'g Tr. (Dupuis) at 1079:8-11.

291. Dr. Dupuis claims that the [ ] layer in the MB I and MB II products is part of the mirror, but admits that the[ ] layer is not wafer bonded to the LED layers. 08/08/06 Hr'g Tr. (Dupuis) at 1079:17-1080:15.

292. In the MB products, there is no bonding of a transparent substrate to one side of the LED layers. 08/10/06 Hr'g Tr. (Jokerst) at 1732:3-11.

293. The permanent silicon substrate in the MB products is not wafer bonded to the LED layers. 08/08/06 Hr'g Tr. (Dupuis) at 1083:9-18.

294. Dr. Dupuis admits that glue bonding and metal bonding can not result in wafer bonding directly to the LED layers. 08/08/06 Hr'g Tr. (Dupuis) at 1087:2-7.

C. U.S. Patent No. 5,502,316

295. U.S. Patent No. 5,502,316 is entitled "Wafer Bonding of Light Emitting Diode Layers" (the "580 Patent"). CX-4, at 1.

296. Fred A. Kish is a named inventor of the 316 Patent. CX-4, at 1.

297. Frank M. Steranka is a named inventor of the 316 Patent. CX-4, at 1.

298. Dennis C. DeFevere is a named inventor of the 316 Patent. CX-4, at 1.

299. Virginia M. Robbins is a named inventor of the 316 Patent. CX-4, at 1.

300. John Uebbing is a named inventor of the 316 Patent. CX-4, at 1.

301. The 316 Patent is a continuation of Patent Application Serial No. 298,691. CX-4, at 1.

302. Patent Application Serial No. 298,691 was filed with the USPTO on August 31, 1994. CX-4, at 1.

303. Patent Application Serial No. 298,691 was abandoned. CX-4, at 1.

304. Patent Application Serial No. 298,691 was a division of Patent Application Serial No. 36,532. CX-4, at 1.

305. Patent Application Serial No. 36,532 was filed with the USPTO on March 19, 1993. CX-4, at 1.

306. Patent Application Serial No. 36,532 issued as the 580 Patent. CX-4, at 1.

307. The 316 Patent was issued by the USPTO on March 26, 1996. CX-4, at 1.

308. Lumileds is the owner, by assignment, of the 316 Patent. Complaint ¶10, at 3; Complaint Ex. 4.

309. Lumileds is the owner, by assignment, of all foreign counterparts to the 316 Patent. Complaint ¶10, at 3; Complaint Ex. 4.

V. VALIDITY

310. Epistar's exhibit RX-118 is a copy of Japanese patent application 61-183986 (with a certified translation), which was published on August 16, 1986, and identifies Toshiba Corp. as the applicant.

311. Temperatures near 850 or 1000°C are in the range of temperatures used to make the robust bonds with the types of materials disclosed in the Toshiba application. Jokerst Tr. 1879; Dupuis Tr. 1974 ("heating silicon carbide to make anything happen chemically at the surface requires temperatures well above 900 centigrade"), 1976 (ohmic bond between silicon carbide wafers cannot be achieved at temperatures below 950°C), 1977-1978 (direct wafer bonding of silicon carbide occurs reliably above 950°C for a 60 minute bonding process).

312. The Toshiba application is largely directed to producing lasers of aluminum allium arsenide with improved mode control, current confinement and heat sinking. Dupuis Tr. 1969-1970.

313. The Toshiba application does not disclose removing a gallium arsenide substrate from an LED, it only discloses forming a structure on a gallium arsenide substrate which remains

on the device. Dupuis Tr. 1981:14-1982:2 (Discussing RDX-729); CX-426 at Fig. 3 and EC188238.

314. The LED disclosed in the Toshiba application is made to generate light for communications purposes to couple light to an optical fiber. Dupuis Tr. 1985:4-6.

315. The purpose of the Toshiba reference as applied to LEDs is to limit and confine current to a small region of the LED so as to direct the light to an optical fiber. Dupuis Tr. 1983.

316. The communications LED disclosed in the Toshiba reference is not made to generate light in the same way that TS AlGaInP illumination LEDs are used or made. Dupuis Tr. 1981:14-1982:14

317. RX-162 contains a copy of an article by I. Pollentier entitled "Fabrication of High-Radiance LEDs by Epitaxial Lift-Off," which was published in 1990.

318. RX-4 contains a copy of United States Patent No. 4,883,351, entitled "Lift-Off and Subsequent Bonding of Epitaxial Layers," issued to Gmitter et al. on November 28, 1989

319. The Gmitter patent discloses Van der Waals and adhesive or glue bonding, rather than the type of bonding required by the '580 patent. RX-4 at 10:5-8, 4:66-67.

320. RX-164 contains a copy of an article entitled, "1-3 μm InGaAsP Ridge Waveguide Laser on GaAs and Silicon Substrates by Thin-Film Transfer," by C. L. Hsieh et al. ("Hsieh"), which was published in May 1991.

321. There is a lack of evidence concerning any possible motivation to combine teachings from the Pollentier and Hsieh articles. *See, e.g.*, Jokerst Tr. 1781-1782, 1889 (Pollentier (RX-104) is not in fact referenced in Hsieh (RX-164)).

322. The need for high-brightness visible LEDs existed as far back as 1962. Dupuis Tr. 2004:13-2005:4.

323. The story of light emitting diodes begins in 1962 with the first ternary semiconductor

grown by Nick Holonyak at General Electric. Dupuis Tr. 1915:10-13.

324. The first high-volume commercial LED products were introduced in the late 1960s by Monsanto Company and Hewlett-Packard Company. Craford Tr. 120.

325. The LEDs available in the 1960s and 1970s had low efficiency and light output (about 1 lumen per watt of energy), which proscribed their use for outdoor applications and limited their usefulness to a few applications, *e.g.*, indicator lights. Craford Tr. 116-17, 120-124, 130-32; CX-630C at LLITC at 1329092.

326. People have speculated since the 1970s that LEDs would eventually be used in a wide variety of applications, such as computers, electronic equipment, and televisions. Craford Tr. 116-17, 120-124, 130-32; CX-630C at LLITC at 1329092.

327. LEDs use ten times less power than incandescent lights. Stringfellow Tr. 1403.

328. Since the 1960s, LED research has focused on increasing the generation and extraction of light from LEDs. Craford Tr. 116-117.

329. Gallium arsenide phosphide LEDs emit a dim (not bright) red light. Stringfellow Tr. 1561.

330. Previous commercial LEDs, such as those used in traffic signals, were generally made from AlGaAs (aluminum gallium arsenide), which is unreliable, emits only a deep red color, and tends to degrade in high humidity environments due to the oxidation of the aluminum. Craford Tr. 156-57; Silkwood Tr. 457-58; Chen Tr. 1252:7-10; Dupuis Tr. 2005:19-25.

331. AlGaAs LEDs emitted little light after 1,000 hours of use due to their degradation. Silkwood Tr. 457-58.

332. In the 1980s, there was a need for new LEDs that were robust and emitted more colors than existing commercially-available AlGaAs LEDs. Chen Tr. 1252:17-22; Stringfellow

Tr. 1562-63.

333. In 1985, Hewlett-Packard began developing an absorbing-substrate aluminum gallium indium phosphide (AlGaInP) LED. Craford Tr. 140-43; RRX-0048C.

334. The inventions of the 718, 316 and 580 Patents allowed LEDs to enter the markets for traffic signals, the variable message sign market, automobile taillight and sidelight, outdoor advertising and other applications requiring higher brightness. Dupuis Tr. 2006:7-22.

335. In contrast to AlGaAs LEDs, AlGaInP LEDs are more robust and reliable, do not degrade in high humidity environments, are bright enough to be seen outdoors, and can emit a broader range of red, orange, and amber colors. Craford Tr. 157.

336. The performance of AlGaInP LEDs is essentially unchanged even after 1,000 hours of use. Silkwood Tr. 457-58.

337. The technology problems faced by Hewlett-Packard included developing an efficient light-emitting material and extracting the light out of the LED. Craford Tr. 145.

338. It took Hewlett-Packard about four years, until 1989, to develop an absorbing-substrate AlGaInP LED. Craford Tr. 140-43, 158 (discussing CX-621C at LLITC at 15324).

339. Hewlett-Packard's absorbing-substrate AlInGaP LEDs emitted about 10 lumens per watt in 1990. Craford Tr. 154-155 (discussing CX-630C at LLITC 1329092).

340. Between 1985 and 1989, Hewlett-Packard also tried a variety of contact schemes (*e.g.*, mesh contacts, distributed contacts) to spread current throughout the LED, so that light would not be generated primarily under the opaque metal contact. Craford Tr. 146-147.

341. Even after the invention of the '718 patent had led to the first commercial AlGaInP LEDs, Hewlett-Packard continued to improve the efficiency and performance of AlGaInP LEDs by developing the first transparent-substrate AlGaInP LED, which had superior

performance to absorbing-substrate AlGaInP LEDs. Craford Tr. 141-43, 162-63, 168.

342. On May 19, 1994, Hewlett-Packard issued a press release announcing the commercial release of its first transparent-substrate AlGaInP LED. Dupuis Tr. 733 (discussing CX-557C at LLITC 91856).

343. The first transparent-substrate AlGaInP LED produced about 30 lumens per watt, which was about twice the light output of an absorbing-substrate LED and more efficient than the incandescent and halogen lamps available at that time. CX 557C; Kish Tr. 357-59.

344. Transparent-substrate (TS) AlGaInP LEDs are much brighter and about twice as efficient as absorbing-substrate LEDs, and thus in much greater demand. CX 620 at LLITC 1328595; Silkwood Tr. 452, 459-60, 466-67.

345. Transparent-substrate LEDs are among the brightest LED technologies in the world, use less power, and have lower energy costs. Silkwood Tr. 450, 454, 457-58, 460-61.

346. Transparent-substrate LEDs are particularly robust for exterior applications, such as traffic signals. Silkwood Tr. 450.

347. Hewlett-Packard's transparent-substrate AlGaInP LED gave it a commercial advantage over competing LED products. Craford Tr. 168.

348. The following exhibits bear on the issue of long felt need: CX-401, CX-620 and CX-630. Dupuis Tr. 2007:12-2008:22.

349. At the time Virginia Robbins came up with her idea of wafer bonding LEDs, there were no teachings to combine AlGaInP LEDs with any type of substrate by wafer bonding. Dupuis Tr. 2009:5-17.

350. The idea of bonding gallium phosphide to an AlGaInP LED was "crazy" because the gallium phosphide bond is difficult to break. Dupuis Tr. 2009:17-2010:8.

351. One skilled in the art would not know that applying pressure and temperature to gallium

phosphide and AlGaInP would lead to a successful bond. Dupuis Tr. 2010:9-19.

352. Epistar stipulated to the financial data submitted in the Expert Report and Rebuttal and Supplemental Expert Report of Lumileds' expert, Paul K. Meyer. Coyle Tr. 435:4-9, 436:5-10; 439:19-440:11, 783:6-17, 787:10-11.

353. Lumileds and its predecessor Hewlett-Packard have earned [ ] in revenue from AlGaInP LEDs, [ ]. Silkwood Tr. 467:11-468:5.

354. [ ]. Silkwood Tr. 451:21-452:6, 467:24-468:5.

355. From 1994 to 2006, the market for automotive sales of AlGaInP LEDs has grown from $100 million to approximately $500 million. Craford Tr. 170-171.

356. A 120-150 watt incandescent red traffic signal bulb can be replaced with a 10-25 watt transparent-substrate LED technology, which results in substantial energy savings. Silkwood Tr. 455-56.

357. Transparent-substrate AlGaInP LEDs reduce maintenance costs because they do not need to be replaced as often as incandescent bulbs. Silkwood Tr. 455-56.

358. From 1992 through 2005, Lumileds (and its predecessor entities) has generated over [ ]. Tr. 438:13-438:7; Tr. 434:15-440:11; Tr. 786:19-787:11; CX-338C.

359. For Lumileds fiscal year end of October 31, 2005, Lumileds earned total company (all products) operating profits of approximately [ ]. Tr. 438:13-438:7; Tr. 434:15-440:11; Tr. 786:19-787:11; CX-339C.

360. For the six years ending October 31, 2005, Lumileds total company (all products) operating profits were approximately [ ](not including deductions for research and development expenditures). Tr. 438:13-438:7; Tr. 434:15-440:11; Tr. 786:19-787:11; CX-339C.

361. Lumileds has earned positive gross profit margins since 1993. Tr 438:13-438:7; Tr. 434:15-440:11; Tr. 786:19-787:11; CX-340.

362. In 1997, shortly after Hewlett-Packard introduced its first transparent-substrate AlGaInP LEDs, Compound Semiconductor magazine listed high-brightness LEDs as some of the new and exciting technologies to watch. Silkwood Tr. 462-63.

363. Dr. Kish has been recognized and received a number of awards for his development of the transparent-substrate AlGaInP LED. Craford Tr. 168.

364. Hewlett-Packard has been recognized in numerous articles for its development of the transparent-substrate AlGaInP LED and the markets and energy savings created by this technology. Craford Tr. 168-73; CX-620, CX-185, CX-186, CX-187A, CX-187B, CX-187C.

365. In the 1990s, when the articles in CX-620 were written, Hewlett-Packard was the sole manufacturer of transparent-substrate AlGaInP LEDs. Silkwood Tr. 464, 468.

366. In 1992, Dr. Chen co-authored an article (CX-401) entitled "AlGaInP green light emitting diode," which cited articles written by the inventors of the 718 Patent (CX-618). Chen Tr. 1254:6-1255:16, discussing CX-401, CX-618.

367. Dr. Chen considered the 1994 article by Dr. Kish, Dr. Robbins, et al. on wafer bonding (CX-483) to be a significant advance over previous technology and cited it in his patents. Chen Tr. 1259: 10-25, 1263:20-1264:7 (discussing CX-483).

368. A UEC presentation cited the 1994 Kish, Robbins article, which disclosed a

wafer-bonded transparent substrate AlGaInP LED as a major advance in wafer bonding. CX-167C at EC 3758, citing CX-483.

369. Lumileds has received widespread industry recognition for the subject matter of the patents-in-suit. CX-26, CX-170, CX-171, CX-185-187(A-C), CX-196, CX-197, CX-403C and CPX 1. Tr. 2012.

VI. DOMESTIC INDUSTRY

A. Technical Analysis

370. The parties stipulated to the fact that Lumileds practices at least one claim of the '718 patent. Tr. 533-534.

371. With respect to the '580 patent, Lumileds expert, Dr. Dupuis, provided testimony concerning the manufacture of Lumileds' AlGaInP LEDs to show that it practices at least claims 1 and 5. Dupuis Tr. 744-746.

372. Dr. Dupuis relied on much of the same information used by Lumileds' Chief Technical Officer, Dr. George Craford, when he testified about currently manufactured products. The technical aspects of Dr. Dupuis' testimony as related to domestic industry have not been disputed, nor was any basis shown at the hearing to call into question the evidentiary foundation of his analysis. Craford Tr. 164-169. No opposing evidence or expert analysis was offered by Epistar concerning Lumileds' products.

373. With respect to the '316 patent, Dr. Dupuis provided a detailed analysis of Lumileds' practice of claim 12. Dupuis Tr. 732-739.

374. Much of the evidence that Dr. Dupuis relied upon was also the subject of Dr. Craford's testimony concerning Lumileds' current manufacturing process. While Dr. Craford's testimony shows that there have been minor adjustments in Lumileds' manufacturing process since 1994, there is no evidence that such changes would materially affect the

analysis performed by Dr. Dupuis. Craford Tr. 164-168, 193-195. Indeed, Epistar offered no evidence or expert analysis in opposition to the testimony of Dr. Dupuis.

B. Economic Analysis

375. Epistar has stipulated to the financial figures in the expert report of Lumileds' expert, Mr. Meyers, which include [

] Lumileds Post-Hearing Brief at 67-68; Tr. 437-438.

CONCLUSIONS OF LAW

1. The Commission has personal jurisdiction over the parties, and subject matter jurisdiction over this investigation.

2. The Epistar GB and GB II products at issue in this investigation are not found to infringe claims 1 and 6 of the '718 patent.

3. The Epistar MB and MB II products at issue in this investigation are found to infringe claims 1 and 6 of the '718 patent.

4. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 1 and 6 of the '718 patent.

5. Epistar has not proven that its OMA and MB products are licensed under the '718 patent.

6. The Epistar GB and GB II products at issue in this investigation are not found to infringe claims 1-3 of the '580 patent.

7. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 1-3 of the '580 patent.

8. The Epistar MB and MB II products at issue in this investigation are not found to infringe claims 8-9 of the '580 patent.

9. The Epistar MB and MB II products at issue in this investigation are not found to infringe claims 16 and 18 of the '580 patent.

10. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 16 and 18 of the '580 patent.

11. The Epistar process of making the GB product at issue in this investigation is not found to infringe claims 25, 27 and 28 of the '580 patent.

12. The Epistar GB and GB II products at issue in this investigation are not found to

infringe claims 12-14 and 16 of the '316 patent.

13. The Epistar OMA and OMA II products at issue in this investigation are not found to infringe claims 12-14 and 16 of the '316 patent.

14. It is not found by clear and convincing evidence that claims 1-3, 8-9, 16, 18, 25, 27 and 28 of the '580 patent are invalid for lack of written description and enablement under 35 U.S.C. ¶ 112.

15. It is not found by clear and convincing evidence that claims 1-3, 8-9, 16, 18, 25, 27 and 28 of the '580 patent are invalid as anticipated.

16. It is not found by clear and convincing evidence that claims 1-3, 8-9, 16, 18, 25, 27 and 28 of the '580 patent are invalid as obvious.

17. It is not found by clear and convincing evidence that claims 12-14 and 16 of the '316 patent are invalid for lack of written description and enablement under 35 U.S.C. ¶ 112.

18. It is not found by clear and convincing evidence that claims 12-14 and 16 of the '316 patent are invalid as anticipated..

19. It is not found by clear and convincing evidence that claims 12-14 and 16 of the '316 patent are invalid as obvious.

20. Lumileds has satisfied the economic prong of the domestic industry requirement with respect to the '718, '580 and '316 patents.

21. Lumileds has satisfied the technical prong of the domestic industry requirement with respect to the '718, '580 and '316 patents.

INITIAL DETERMINATION AND ORDER

Based on the foregoing opinion, findings of fact, conclusions of law, the evidence, and the record as a whole, and having considered all pleadings and arguments, including the proposed findings of fact and conclusions of law, it is the Administrative Law Judge's INITIAL DETERMINATION ("ID") that there is a violation of section 337 of the Tariff Act of 1930, as amended, in the importation into the United States, the sale for importation, or the sale within the United States after importation of certain high-brightness light emitting diodes or products containing same by reason of infringement of one or more of claims 1 and 6 of U.S. Patent No. 5,008,718, claims 1-3, 8-9, 16, 18, and 23-28 of U.S. Patent No. 5,376,580, and claims 12-16 of U.S. Patent No. 5,502,316.

The Administrative Law Judge hereby CERTIFIES to the Commission this ID, together with the record of the hearing in this investigation consisting of the following:

1. The transcript of the hearing, with appropriate corrections as may hereafter be ordered by the Administrative Law Judge; and further,

2. The exhibits accepted into evidence in this investigation as listed in the attached exhibit lists.

In accordance with 19 C.F.R. § 210.39(c), all material found to be confidential by the Administrative Law Judge under 19 C.F.R. § 210.5 is to be given *in camera* treatment.

The Secretary shall serve a public version of this ID upon all parties of record and the confidential version upon counsel who are signatories to the Protective Order (Order No. 1) issued by the Administrative Law Judge in this investigation, and upon the Commission investigative attorney.

To expedite service of the public version, each party is hereby ORDERED to file by no later than January 18, 2007 a copy of this ID with brackets that show any portion considered by the party (or its suppliers of information) to be confidential, accompanied by a list indicating each page on which such a bracket is found. At least one copy of such a filing shall be served upon the Administrative Law Judge, and the brackets shall be marked in red. If a party (and its suppliers of information) consider nothing in the ID to be confidential, and thus make no request that any portion be redacted from the public version of this ID, then a statement to that effect shall be filed in lieu of a document with brackets.

Pursuant to 19 C.F.R. § 210.42(h), this ID shall become the determination of the Commission unless a party files a petition for review pursuant to § 210.43(a) or the Commission, pursuant to § 210.44, orders on its own motion a review of the ID or certain issues herein.

Sidney Harris
Administrative Law Judge

Issued: January 8, 2007

CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

CERTIFICATE OF SERVICE

I, Marilyn R. Abbott, hereby certify that the attached **Order** has been served on upon Thomas S. Fusco, Esq. and upon the following parties via first class mail, and air mail where necessary on June 11, 2007.

Marilyn R. Abbott

Marilyn R. Abbott, Secretary
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CERTAIN HIGH-BRIGHTNESS LIGHT EMITTING DIODES AND PRODUCTS CONTAINING SAME

Inv. No. 337-TA-556

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(PARTIES NEED NOT SERVE COPIES ON LEXIS OR WEST PUBLISHING)