UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

GERTRUDE NEUMARK ROTHSCHILD Plaintiff, v. CREE, INC. Defendant.	)	CIVIL ACTION NO. 10-10133-WGY

MEMORANDUM AND ORDER

YOUNG, D.J. May 13, 2010

I. INTRODUCTION

In the present case, the plaintiff Gertrude Neumark Rothschild charges the defendant Cree, Inc. with infringement of her U.S. Patents Nos. 4,904,618 (the "'618 Patent") and 5,252,499 (the "'499 patent"). This memorandum and order addresses various motions brought by the parties, including a motion to dismiss for lack of standing, motions for claim construction, and motions for summary judgment.

II. BACKGROUND

A. Facts

1. The Patents-in-Suit

Rothschild owns two patents on methods of producing light emitting diodes ("LEDs"), which are at issue in this case:

The '618 Patent, entitled Process for Doping Crystals of Wide Band Gap Semiconductors, issued February 27, 1990, on an application filed August 22, 1988; and

the '499 Patent, entitled Wide Band Gap Semiconductors Having Low Bipolar Resistivity and Method of Formation, issued October 12, 1993, on an application filed August 15, 1988.

2. Introduction to the Technology

a. What are LEDS?

LEDs are used in a number of electronic devices ranging from display panels to billboards and even traffic lights. From a technological standpoint, LEDs are essentially p-n (positive-negative) junctions of wide band gap semiconductor materials. A semiconductor, as the name implies, is a material whose electrical conductivity is in the intermediate range between insulators and conductors. This means semiconductor material can conduct electricity under certain conditions, but not others. This characteristic makes the semiconductor a good medium for the control of electrical current.

b. Constructing Semiconductors

The semiconductors used to form the p-n junctions of LEDs are crystalline solids. The crystalline solid is a crystal lattice consisting of two types of atoms. Semiconductors can be made from either of two types of materials (1) a II-VI compound or (2) a III-V compound. To understand their differences, consider the periodic table of elements. The periodic table is arranged such that elements with similar properties fall into the same columns or groups. When an element from Group II of the periodic table, such as zinc (“Zn”) or cadmium (“Cd”), having two electrons in its outer shell, is combined with an element from Group VI, such as selenium (“Se”) or tellurium (“Te”), having six electrons in its outer shell, a compound having a normal eight electrons in its outer shell, such as zinc selenide (“ZnSe”), is formed. A crystal lattice consisting of a Group II element and a Group IV element is chemically stable. This type of compound is called a II-VI compound. Likewise, a semiconductor may be formed by combining an element from Group III, such as gallium (“Ga”), having three electrons in its outer shell, with an element from Group V, such as arsenic (“As”), having five electrons in its outer shell. Again, this compound is also chemically stable. This type of compound is called a III-V compound.

c. n-type Semiconductors, p-type Semiconductors and the Concept of Doping

Doping is the process of intentionally introducing impurities into a semiconductor material (II-VI compound or III-V compound) to change its electrical properties. Likewise, a "dopant," as defined in Rothschild v. Cree, Inc., No. 05-5939, 2007 WL 1314619 (S.D.N.Y. May 3, 2007) ("Rothschild I"),[1] "means an impurity added to a semiconductor material to alter its electronic properties." Rothschild I at *3. If a dopant is incorporated into a semiconductor material, either during or after crystal growth, the electrical properties of the material may be changed in a useful manner. For example, if a II-VI compound such as ZnSe is doped with an element from Group V of the periodic table, such as nitrogen ("N"), having five electrons in its outer shell, the N atoms displace some of the Se atoms in the crystal lattice, thereby creating electron acceptors or "holes" in the crystal, making it a "p-type" material. Essentially, atoms with five electrons in their outer shell are introduced into the crystal and replace some of the existing atoms in the crystal lattice with six electrons in their outer shell. The result is that there is a deficit of electrons, and since compounds strive to have eight electrons in their outer

[1] On May 3, 2007, Judge Conner filed an Opinion and Order construing certain disputed terms of the claims of the two patents in suit.

shell, the compound wishes to accept electrons. Conversely, if the dopant is an element from Group III, such as Ga, having three electrons in its outer shell, its atoms displace some of the Zn atoms in the lattice, creating an excess of electrons in the crystal, making it an “n-type” material. Essentially, atoms with three electrons in their outer shell are introduced into the crystal and replace some of the existing atoms in the crystal lattice with two electrons in their outer shell. The result is that there is a surplus of electrons, and since compounds strive to have eight electrons in their outer shell, the compound desires to lose electrons.

d. Applying Voltage to the p-n Junction and the Emission of Light

A p-n junction consists of an n-type semiconductor at one end, a gap, and a p-type semiconductor at the other end. When a voltage is applied across the junction, electrons will move from the n-type material to fill the holes in the p-type material (flowing from negative to positive). As the electrons jump across the gap, the energy they lose in dropping from the conduction band (n-type material) to the valence band (p-type material) is released in the form of light. The wavelength or color of the light depends on the width of the gap between those bands in the particular material. For example, if the band gap is between 1.65 and 2.00 electron volts (“eV”), red light is produced; if it is below 1.65 eV, invisible infrared light or

heat is produced. If the band gap is between 2.51 and 2.76 eV, blue light is produced; if it is above that range, violet or ultraviolet light is produced.

e. Difficulties in Doping, and the Concept of "Compensation"

Semiconductor materials with wide band gaps are more difficult to dope because they more readily become "compensated." To understand the concept of compensation, it is important to realize that, in practice, semiconductor materials contain internal impurities even before other impurities are introduced externally via doping. Compensation refers to the phenomenon in which impurities in the material itself supply the electrons to fill the holes in p-type material or supply the acceptors to receive the electrons in n-type material. In other words, if these internal impurities can satisfy the electro-chemical needs of the n-type or p-type semiconductor material, it is no longer necessary to incorporate the external dopants. Hence, the occurrence of compensation reduces the incorporation of the dopants into the crystal lattice and thereby increases the resistivity of the semiconductor. When there is high resistivity, electrons have difficulty jumping across the gap in the p-n junction, especially when it is very wide. This phenomenon explains why red LEDs (with narrow band gaps) were much more easily produced and more commonly used than blue LEDs

(with wide band gaps), which have been called the long-sought Holy Grail of LED technology.

3. Asserted Claims of the ’618 Patent

The Abstract of the ’618 Patent describes the invention as follows:

> Non-equilibrium impurity incorporation is used to dope hard-to-dope crystals of wide band gap semiconductors, such as zinc selenide and zinc telluride. This involves incorporating into the crystal a compensating pair of primary and secondary dopants, thereby to increase the solubility of either dopant alone in the crystals. Thereafter, the secondary more mobile dopant is removed preferentially, leaving the primary dopant predominant. This technique is used to dope zinc selenide p-type by the use of nitrogen as the primary dopant and lithium as the secondary dopant.

’618 Patent.

Rothschild charges Cree with infringement of Claims 1, 4, and 5 of the ’618 Patent. Claims 1 and 5 are the only independent claims of the patent. Claim 1 reads:

> 1. A process for the non-equilibrium incorporation of a dopant into a crystal of a wide band gap semiconductor comprising the steps of treating the crystal in the presence of first and second compensating dopants of different mobilities for introducing substantially equal amounts of the two dopants into at least a portion of the crystal such that the concentration of the less mobile of the two dopants in said portion of the crystal is in excess of the solubility therein of the less mobile dopant in the absence of the more mobile of the two dopants, and then heating the crystal to remove therefrom preferentially the more mobile of the two dopants whereby there is left a non-equilibrium concentration of the less mobile dopant in said portion of the crystal.

’618 Patent col.5 ll.11-24.

Claim 5 reads:

> 5. The process of forming a p-n junction diode in a crystal of a wide band gap semiconductor comprising the steps of preparing a crystal of the semiconductor of one conductivity type and growing on a surface of the crystal an epitaxial layer that includes a compensating pair of primary and secondary dopants in substantially equal amounts, such that the concentration of the primary dopant in the layer is in excess of the solubility of the primary dopant in the layer in the absence of the secondary dopant, where the primary dopant is characteristic of the conductivity type opposite that of said crystal and is less mobile than the secondary dopant, and removing selectively the secondary dopant from the layer to leave it of the opposite conductivity type, where the dopant remaining in the layer is predominantly the primary dopant in a non-equilibrium concentration.

'618 Patent col.6 ll.10-28.

4. Asserted Claims of the '499 Patent

The Abstract of the '499 Patent summarizes the invention as follows:

> A wide band-gap semiconductor, such as a II-VI semiconductor having low bipolar resistivity and a method for producing such a semiconductor. To form this semiconductor, atomic hydrogen is used to neutralize compensating contaminants. Alternatively, the semiconductor dopant and hydrogen are introduced into the undoped semiconductor together, and later, the hydrogen is removed leaving an acceptably compensation free wide band-gap semiconductor.

'499 Patent.

Rothschild charges Cree with infringement of Claims 10, 12-14, and 16-20 of the '499 Patent. Of these claims, only Claim 10 is an independent claim, upon which all of the others are directly or indirectly dependant. Claim 10 reads:

> 10. A method of forming a low resistivity semiconductor from a wide band-gap semiconductor substrate that has a tendency to become compensated when it is doped, comprising selectively doping the semiconductor substrate with an effective amount of dopant to induce acceptable conductivity, together with an effective amount of atomic hydrogen to act as a compensator and block unacceptably high occurrences of other compensators, then removing an effective amount of the added hydrogen to reduce the resistivity of the semiconductor, the hydrogen removed under conditions to limit other movement within the semiconductor.

'499 Patent col.6 l.63-col.7 l.6.

B. Jurisdiction

Ordinarily, this Court would have jurisdiction pursuant to 28 United States Code Section 1338(a). The Federal Circuit, however, has stated that "[t]he question of standing to sue is a jurisdictional one." Rite-Hite Corp. v. Kelley Co., 56 F.3d 1538, 1551 (Fed. Cir. 1995). Accordingly, if Rothschild lacks standing to sue Cree for patent infringement, this Court also lacks jurisdiction over the dispute.

C. Venue

This case initially commenced in the Southern District of New York and was drawn to Judge Stephen C. Robinson, but was reassigned to Judge William C. Conner by notice of case reassignment dated September 13, 2005. By notice of case reassignment dated July 23, 2009, this case was assigned to this Court, sitting by designation in the Southern District of New York. On January 15, 2010, the parties filed a joint motion to

change venue to the District of Massachusetts. This Court granted the motion and this case was transferred to the United State District Court for the District of Massachusetts by order dated January 19, 2010.

III. DISCUSSION

A. Summary Judgment Standard

A motion for summary judgment is to be granted if "there is no genuine issue as to any material fact and . . . the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(c). In evaluating the record to decide whether there is a genuine issue of material fact, "[t]he evidence of the non-movant is to be believed, and all justifiable inferences are to be drawn in his favor." Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 255 (1986). Further, the moving party bears the initial burden of "identifying those portions of the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, which it believes demonstrate the absence of a genuine issue of material fact." Celotex Corp. v. Catrett, 477 U.S. 317, 323 (1986) (internal citation omitted). Where the ultimate burden of persuasion rests on the non-moving party, and the moving part has met its initial burden, the burden then shifts to the non-moving party to show that a trier of fact could reasonably find in the non-moving party's favor. Id. at 324.

B. Standing

1. Treating Motion to Dismiss for Lack of Jurisdiction as Motion for Summary Judgment

Cree filed a motion to dismiss for lack of standing [Doc. No. 122] based on the argument that Rothschild conceived of the invention while employed at Philips Lumileds Lighting Company L.L.C., making Philips the rightful owner of the patent. In a motion to dismiss, the court may look outside the pleadings to determine if jurisdictional facts exist. Aversa v. United States, 99 F.3d 1200, 1210 (1st Cir. 1996); see also Exchange Nat'l Bank of Chicago v. Touche Ross & Co., 544 F.2d 1126, 1130-31 (2d Cir. 1976). Jurisdictional facts are facts that support a proper basis for courts to exercise subject-matter jurisdiction over the dispute. If jurisdictional facts are so intertwined with the merits of the case that resolution of the jurisdictional question is dependent on factual issues going to the merits, the court should employ the standard applicable to a motion for summary judgment. Id. Applying the summary judgment standard, Cree would prevail only if material jurisdictional facts are not in dispute and it is entitled to prevail as matter of law. If that standard is not met, the jurisdictional facts must be determined at trial by a jury, with the ultimate legal determination remaining with the Court.

2. Relevant Facts

Rothschild worked for Philips from 1962 through 1985, where she was employed as a research scientist. Cree Standing 56.1 Statement ¶ 52; Rothschild Standing Counterstatement of Facts ¶ 52. Paragraph 3 of Philips' Employee Agreement states that Philips' employees "hereby assign and agree to assign . . . to [Philips] . . . all inventions and technical or business innovations developed or conceived by [the employee], alone or with others, while [the employee] is employed." Radulescu Decl. Supp. Mot. Dismiss Ex. 5, Employee Agreement ¶ 3. Towards the end of 1978, Rothschild and Dr. Brian Fitzpatrick, also an employee at Philips, submitted to Philips' Patent Department an Invention Disclosure bearing Disclosure No. 154-10-1377 (the "1377 Invention Disclosure"). Radulescu Decl. Supp. Mot. Dismiss Ex. 3. The 1377 Invention Disclosure expressly identifies Rothschild and Fitzpatrick as the inventors of the method, and states that the "invention relates to [i]mproving the conductivity of large gap semiconductors." Id. It also states that the "[p]urpose of the [i]nvention is to improve the conductivity (n-and/or p-type) of large band gap semiconductors, so that better p-n junctions and devices (for example, light emitting diodes, lasers) can be obtained from such materials." Id.

The patents-in-suit were filed in 1988. Cree Standing 56.1 Statement ¶ 1; Rothschild Standing Counterstatement ¶ 1. Both the ’618 Patent and the ’499 Patent list Rothschild as the sole inventor. Cree Standing 56.1 Statement ¶ 2; Rothschild Standing Counterstatement ¶ 2. In a letter to Rothschild in 1995, Philips appeared to acknowledge Rothschild’s ownership of the ’618 and ’499 Patents by seeking to obtain one or more non-exclusive licenses under the patents. Ladow Decl. Opp’n Mot. Dismiss Ex. 7.

Much of the parties’ arguments on ownership center around the 1377 Invention Disclosure and the laboratory notebooks of Fitzpatrick and Rothschild. Throughout 2005, 2006, and most of 2007, the 1377 Invention Disclosure was withheld under a claim of privilege. Cree Standing 56.1 Statement ¶ 35; Rothschild Standing Counterstatement ¶ 35. The original defendants, Cree and Philips, first became aware of the 1377 Invention Disclosure near the end of the discovery process. Philips then sought approval from the Court to file a motion to compel production of the withheld documents. Cree Standing 56.1 Statement ¶ 38; Rothschild Standing Counterstatement ¶ 38. Judge Conner subsequently ordered Rothschild to produce the documents. Cree Standing 56.1 Statement ¶ 39; Rothschild Standing Counterstatement ¶ 39. Cree also subpoenaed Philips for production of notebooks and records from the late 1970s and 1980s

relating to Philips' ZnSe Research Program. Cree Standing 56.1 Statement ¶ 43; Rothschild Standing Counterstatement ¶ 43. Included in Philips' document production were the actual 30-year-old laboratory notebooks of Rothschild, Fitzpatrick, Dr. Ramesh Bhargava, and other members of the group at Philips that worked on the program. Cree Standing 56.1 Statement ¶ 44; Rothschild Standing Counterstatement ¶ 44.

After Judge Conner ordered Rothschild to produce the 1377 Invention Disclosure and related documents, the parties entered into settlement negotiations. In January 2008, Rothschild entered into settlement and license agreements with Philips. Cree Standing 56.1 Statement ¶ 63; Rothschild Standing Counterstatement ¶ 63. The Settlement Agreement executed by Philips and Rothschild included the following representation: "Philips represents that it has abandoned and relinquished any claim to right, title, interest in or ownership of the [patents-in-suit]." Cree Standing 56.1 Statement ¶ 65; Rothschild Standing Counterstatement ¶ 65.

3. Patent Owner has Standing to Sue for Infringement

The Patent Act provides that a "patentee" shall have remedy by civil action for patent infringement. 35 U.S.C. § 281. The term "'patentee' includes not only the patentee to whom the patent was issued but also the successors in title to the patentee." 35 U.S.C. § 100(d). Taking these provisions

together, "one seeking money damages for patent infringement must have held legal title to the patent at the time of the infringement." Rite-Hite Corp. v. Kelley Co., Inc., 56 F.3d 1538, 1551 (Fed. Cir. 1995) (citing Crown Die & Tool Co. v. Nye Tool & Machine Works, 261 U.S. 24, 40-41 (1923)). Cree argues that Rothschild lacks standing to bring her infringement suit because she is not the owner of the patents-in-suit.

Specifically, Cree argues that conception of the patented inventions occurred entirely while Rothschild was employed at Philips and, as a result, the patents-in-suit automatically were assigned to Philips pursuant to Rothschild's Employment Agreement with Philips. Cree Mem. Supp. Mot. Dismiss at 14-16. Rothschild, in response, argues that she did not entirely conceive of the patented inventions while she worked at Philips, so the Employment Agreement does not apply to them. Rothschild Mem. Opp'n Mot. Dismiss at 15-16.

4. Effect of the Employee Agreement

Paragraph 3 of Philips' Employee Agreement states that the employee "**hereby assign[s]** and agree[s] to assign . . . to [Philips] . . . all inventions and technical or business innovations developed or conceived by me, alone or with others, while I am employed . . . ." Radulescu Decl. Supp. Mot. Dismiss Ex. 5 ¶ 3 (emphasis added). There is a distinction between an agreement that automatically assigns the patent as soon as the

invention comes into being, and an agreement that merely creates an obligation to assign the patent in the future. DDB Technologies, L.L.C. v. MLB Advanced Media, L.P., 517 F.3d 1284, 1290 (Fed. Cir. 2008). "Although state law governs the interpretation of contracts generally, the question of whether a patent assignment clause creates an automatic assignment or merely an obligation to assign is intimately bound up with the question of standing in patent cases." Id. (citation omitted). Accordingly, the Federal Circuit treats the matter as one of federal law. Id. Under federal law, the language of the contract determines whether assignment of the invention is automatic such that "no further act is required once an invention comes into being, and the transfer of title [occurs] by operation of law." Id. (quoting Filmtec Corp. v. Allied-Signal Inc., 939 F.2d 1568, 1573 (Fed. Cir. 1991)) (quotation marks omitted).

Where language of present assignment is used, an automatic assignment takes place once the invention comes into being. For example, the Filmtec court ruled that the words "agrees to grant and does hereby grant" all rights in future inventions created an automatic assignment. 939 F.2d at 1573. Similarly, the DDB Technologies court ruled that an employment contract in which the employee "agrees to and does hereby grant and assign" all rights in future inventions "was not merely an agreement to assign, but an express assignment of rights in future inventions." 517 F.3d

at 1290. By contrast, in Arachnid, Inc. v. Merit Indus., Inc., 939 F.2d 1574, 1576 (Fed. Cir. 1991), a contractor agreed that any inventions it conceived "shall be the property of [the client], and all rights thereto **will** be assigned [to the client]." 939 F.2d at 1576 (emphasis added). The Arachnid court regarded the promise as "an agreement to assign, not an assignment." Id. at 1580.

In light of its present tense language ("hereby assign"), Paragraph 3 of the Employee Agreement has the effect of automatically assigning a patent to Philips as soon as an invention comes into being, so long as it was conceived by an employee, alone or with others, while he or she was employed at Philips. Rothschild does not seem to dispute the effect of the Employee Agreement. Instead, she emphasizes that the Employee Agreement applies only to inventions conceived during her employment at Philips. Rothschild Mem. Opp'n Mot. Dismiss at 16. Rothschild argues that since the patented inventions "were not conceived of by [her] while she worked at Philips," the assignment clauses "do not govern the inventions" and "did not assign any right, title or interest in the '618 or '499 Patents to Philips as a matter of law." Id.

Rothschild's argument that conception did not take place at Philips is based on the definition of conception as "the formation in the mind of the inventor, of a definite and

permanent idea of the **complete** and operative invention, as it is hereafter to be applied in practice." University of Pittsburgh v. Hedrick, 573 F.3d 1290, 1298 (Fed. Cir. 2009) (quoting Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223, 1228 (Fed. Cir. 1994)) (quotation marks omitted) (emphasis added). In other words, conception must include every feature of the claimed invention. Coleman v. Dines, 754 F.2d 353, 359 (Fed. Cir. 1985). The determinative issue for standing purposes is therefore whether every single element of the inventions embodied in the '618 and '499 Patents were conceived of while Rothschild was working at Philips.

5. Genuine Dispute of Material Jurisdictional Facts

Rothschild points to one key element in each invention that was conceived of after she left Philips: (1) the "substantially equal" element of the '618 Patent and (2) the "the role of atomic hydrogen in acting as a compensator and blocking unacceptably high occurrences of other compensators" element of the '499 Patent. Rothschild's Mem. Opp'n Mot. Dismiss at 3-4, 15 (citing the 1377 Disclosure and Rothschild's deposition testimony). Cree, on the other hand, argues that every feature of the patented inventions was conceived at Philips. Cree Reply Mem. Supp. Mot. Dismiss at 3-7. These arguments and supporting evidence raise genuine issues of material jurisdictional fact as to whether the inventions were entirely conceived during

Rothschild's employment at Philips. The Court notes that Rothschild submitted sufficient evidence in the form of the settlement agreement with Philips to establish that she owned the patents as of January 11, 2008. The Supreme Court, however, has said that "standing is to be determined as of the commencement of suit." Lujan v. Defenders of Wildlife, 504 U.S. 555, 571 n.5 (1992).

Thus, the jury will determine standing based on the facts surrounding the inventive process itself, not on the subjective understandings of the parties regarding ownership of the patented inventions and the representations made on the basis of those understandings. Accordingly, representations by Philips in its September 1995 letter and in the Settlement Agreement suggesting that Rothschild is the owner of the patents cannot substitute for analysis of when conception took place. Cree's motion to dismiss is denied and the jurisdictional facts must be determined at trial.

6. Burden of Proving Standing at Trial

As the plaintiff, Rothschild bears the burden of establishing standing. Whitmore v. Arkansas, 495 U.S. 149, 154 (1990) ("It is well established . . . that before a federal court can consider the merits of a legal claim, the person seeking to invoke the jurisdiction of the court must establish the requisite standing to sue."); see also Sicom Sys., Ltd. v. Agilent Techs.,

Inc., 427 F.3d 971, 976 (Fed. Cir. 2005) ("The party bringing the action bears the burden of establishing that it has standing."). Specifically, Rothschild must show that at least one aspect of each patented invention was conceived of after she left Philips, such that the Employer Agreement does not apply to the '499 and '618 Patents.

The simple proposition that the plaintiff bears the burden of establishing standing has been needlessly complicated by Rothschild's references to the "presumption of ownership," which in her view shifts the burden of persuasion to Cree. This Court is unable to find a statutory basis for an evidentiary presumption of ownership in favor of the named inventor with the effect of shifting the burden of persuasion to the party challenging ownership. The Patents Act places the burden of persuasion on the person challenging a patent's **validity** because a patent is presumed valid. See 35 U.S.C. § 282. As discussed infra in Section III.H.1., Section 282 provides the statutory basis for the presumption of inventorship because inventorship has a bearing on patent validity. 35 U.S.C. § 102; Trovan Ltd. v. Sokymat SA, Irori, 299 F.3d 1292, 1301 (Fed. Cir. 2002) ("[B]ecause a patent is presumed valid, 35 U.S.C. § 282, there follows a presumption that the named inventors on a patent are the true and only inventors.") (citations omitted). By contrast, the question of who owns a patent has no bearing on its validity.

Accordingly, Section 282 cannot be the basis for a presumption of ownership. Furthermore, lucrative commercial patents are assigned numerous times during their two-decade life-span; it seems illogical for a court to presume that the named inventor still holds legal title and has standing to enforce a patent over a decade after it was issued, as is the case here.[2]

It is true that Federal Circuit case law sometimes speaks of a presumption of ownership. In Teets v. Chromalloy Gas Turbine Corp., 83 F.3d 403 (Fed. Cir. 1996), the court stated that as part of the law's reward to individuals for contributing to the progress of science and the useful arts, "an invention presumptively belongs to its creator." Id. at 407. The Federal Circuit went on to state that:

> Consistent with the presumption that the inventor owns his invention, an individual owns the patent rights even though the invention was conceived and/or reduced to practice during the course of employment. At the same time, however, the law recognizes that employers may have an interest in the creative products of their employees.
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> . . . .
>
> [C]ontract law allows individuals to freely structure their transactions and employee relationships. An employee may thus freely consent by contract to assign all rights in inventive ideas to the employer.

Id. at 407 (citations omitted).

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[2] The '618 Patent was issued on February 27, 1990 and the '499 Patent was issued on October 12, 1993. Rothschild filed her complaint on June 27, 2005.

It is not clear from the above passage that the Teets court intended for the "presumption" to shift either the burden of going forward, Fed. R. Evid. 301, or of persuasion, 35 U.S.C. § 282, to the party challenging the patentee's "presumptive" ownership. The court may have been using "presumption" loosely to refer to the rule that an inventor initially owns the patent, but may assign it to someone else, such as an employer. Further, the true nature and effect of the "presumption" was not revealed in Teets because the court ruled on the basis of "undisputed facts," without reference to which party bore the burden of persuasion. Id. at 409.

Moreover, "inventorship is a question of who actually invented the subject matter claimed in a patent. Ownership, however, is a question of who owns legal title to the subject matter claimed in a patent, patents having the attributes of personal property." Beech Aircraft Corp. v. Edo Corp., 990 F.2d 1237, 1248 (Fed. Cir. 1993) (citing 35 U.S.C. § 261). The two concepts can be confused because they are related and often discussed together. As the Federal Circuit explained further, "[a]t the heart of any ownership analysis lies the question of who **first invented** the subject matter at issue, because the patent right initially vests in the inventor who may then, barring any restrictions to the contrary, transfer that right to another, and so forth." Id. (emphasis added).

Outside the Federal Circuit, the Southern District of New York has boldly asserted that "issuance of a patent by the PTO is prima facie proof of the patentee's legal title." Leighton Techs. LLC v. Oberthur Card Systems, S.A., 531 F. Supp. 2d 591, 593 (S.D.N.Y. 2008) (quotation marks omitted). The two Federal Circuit cases cited in Leighton Technologies, however, do not support this bold proposition. First, Beech Aircraft merely stands for the proposition that "the patent right initially vests in the inventor." 990 F.2d at 1248. Second, footnote two in Arachnid makes no mention of prima facie proof of legal title and merely states that "[t]he entity to whom the grant of a patent is made by the PTO [or that entity's successor in title] holds the 'legal title' to the patent." 939 F.2d at 1578 n.2 (alteration in original). Rothschild is unable to point to any Federal Circuit case ruling that patent issuance is prima facie proof of the patentee's legal title. See Rothschild Mem. Opp'n Mot. Dismiss at 7.

In essence, the so-called presumption of ownership is a misnomer. When the Federal Circuit refers to the inventor as the "presumptive owner," it actually means that the inventor named in a patent application is the "initial" owner of a patent. The word "presumptive" does not create a legal presumption that shifts the burden of persuasion for proving legal ownership of a patent. As the party seeking jurisdiction of this Court,

Rothschild, as the plaintiff, still bears the burden of showing standing by proving her ownership of the patents-in-suit.

C. Motion to Clarify Certain Construction Issues as to the ’499 Patent

Certain non-infringement positions that Cree takes with regard to the ’499 Patent are based on its construction of the language in Claim 10. In response, Rothschild filed a motion seeking to clarify these construction issues [Doc. No. 139]. Before turning to the issues themselves, it is helpful to review the non-infringement positions that give rise to them.

Cree’s first non-infringement position is that the ’499 Patent’s requirement of “selectively doping” the substrate with atomic hydrogen and the desired dopant is not satisfied with respect to the accused processes because “there is nothing ‘selective’ about the supposed atomic hydrogen doping.” Cree Mem. Supp. Non-infringement at 17. As Cree goes on to explain:

> [A]ny atomic hydrogen [in the accused processes] is uncontrollably produced as a [sic] unwanted by-product throughout the entire growth process, it is a contaminant present not just in the Mg-doped GaN-based layers, but other epitaxial layers (e.g., doped and undoped semiconductor layers not accused of infringement) as well.

Id. at 18. Rothschild requests this Court to clarify the meaning of “selectively doping” in Claim 10 of the ’499 Patent. Rothschild Mem. Supp. Mot. Clarify Claim Construction at 8-10.

Cree’s second non-infringement position centers around the term “semiconductor substrate” in Claim 10 of the ’499 Patent.

Cree argues that in all but one accused recipe (Recipe No. 4, which is used to make Cree's ETCR product), the uppermost Mg-doped gallium nitride ("GaN") layer cannot, by definition, be a "substrate" within the Court's current construction of the term. Cree Mem. Supp. Non-infringement at 17; see also Rothschild I at *12 (construing the term "substrate" to mean "an underlying base on which an epitaxial layer is grown."). Specifically, since the Mg-doped GaN layer is the last layer grown epitaxially in twenty of the twenty-one accused processes, it cannot be a base "on which an epitaxial layer is grown." Cree Mem. Supp. Non-infringement at 17. Rothschild, on the other hand, argues that a "semiconductor substrate" should not require an overlying layer and should be defined as "the semiconductor material of interest." Rothschild Mem. Supp. Mot. Clarify Claim Construction at 17-19. The second construction issue is thus whether this Court ought revisit Judge Conner's definition of "substrate."

Cree's third non-infringement position also concerns the meaning of "substrate." This time, Cree takes issue with the Mg-doped aluminum gallium nitride ("AlGaN") layer (as opposed to the GaN layer) produced in all its accused processes. Although the Mg-doped AlGaN layer is underneath another layer, Cree argues that it is "simply too thin and fragile to support another epitaxial layer or even itself" and accordingly falls outside the

court's definition of "substrate." Rothschild Mem. Opp'n Non-infringement at 19. The third construction issue is whether Judge Conner intended to import a mechanical support requirement into the definition of "substrate."

1. "Selectively Doping"

The term "selectively doping" was not identified by the parties as a disputed term in connection with the Markman proceedings before Judge Conner. Cree Mem. Opp'n Mot. Clarify Claim Construction at 14 n.6. Since the parties never sought a construction of "selectively doping," Judge Conner did not issue a construction for that term. In any event, the parties real disagreement concerns whether the "selectively doping" limitation is present in Cree's accused processes, rather than the definition of "selectively doping."

The parties' experts provided similar definitions for "selectively doping." Cree's expert, H. Craig Casey, explained that "[a]t the time the application for the '499 Patent was filed, the phrase 'selectively doped' had a customary meaning in the compound semiconductor field and refers to a 'doping step where an impurity is added to selected portions of a semiconductor.'" Ladow Decl. Opp'n Invalidity Ex. 3, Casey Rebuttal Rep. ¶ 165. Casey also stated that selective doping is where "a crystal grower could be 'selective' in doping the various layers formed during epitaxial growth." Id. ¶ 166.

Similarly, Rothschild's expert, Professor James R. Shealy, described "selectively doping" as "putting the impurities where you want them in the structure . . . based on the device structure you're trying to build in the layer stack." Ladow Decl. Opp'n Invalidity Ex. 6, Shealy Dep. 720:25-722:23, Sept. 24-26, 2009. In its memorandum supporting its motion for summary judgment of non-infringement, Cree appears to adopt Shealy's definition. Cree Mem. Supp. Non-infringement at 17. Similarly, in its memorandum opposing Rothschild's motion to clarify, Cree again relies on Shealy's remarks on selective doping. Cree Mem. Opp'n Mot. Clarify Claim Construction at 17. Rothschild also endorses Shealy's definition:

> Plaintiff, citing Prof. Shealy's testimony on [selectively doping], clearly stated that the proper construction of this term is choosing the desired dopant and placing it (as well as atomic hydrogen) where desired, such as in a particular layer of a structure (e.g., in a p-type layer).

Rothschild Reply Supp. Mot. Clarify Claim Construction at 9.

The definitions provided by the parties' experts suggest that selective doping means being discriminative or selective about where dopants are placed in the semiconductor. The definitions also conform to Judge Conner's understanding of selective doping. In particular, Judge Conner mentioned that "the specification of the '499 Patent (at 3:48-51 and 4:33-36) teaches that [] selective doping may be achieved by shielding from the hydrogen the side of the substrate that has good

conductivity so that there will be 'no or minimal diffusion of hydrogen into that side.'" Rothschild v. Cree, Inc., No.05-5939, 2007 WL 1944327, at *2 (S.D.N.Y. July 3, 2007) ("Rothschild II").[3] The concept of shielding the atomic hydrogen dopant from a side of the substrate that already has good conductivity further suggests that selective doping has a spacial selectivity connotation. Since the parties are largely in agreement on the definition of "selectively doping," there is no need to clarify its meaning. The parties' real disagreement lies in whether the "selectively doping" limitation is present in Cree's accused processes, which is the second step in the infringement analysis and a matter of fact for the jury. See IMS Tech. Inc. v. Haas Automation, Inc., 206 F.3d 1422, 1429 (Fed. Cir. 2000) ("An infringement analysis requires two steps: (1) claim construction to determine the scope and meaning of the asserted claims, and (2) a comparison of the properly construed claims with the allegedly infringing device or method to determine whether the device or method embodies every limitation of the claims.")

2. Revising the Definition of "Substrate"

In Rothschild I, Judge Conner construed "substrate" to mean "an underlying base on which an epitaxial layer is grown." Rothschild I at *12. Rothschild asks the Court to revisit Judge

[3] On July 2, 2007, Judge Conner filed a supplemental Opinion and Order modifying the Court's construction of one of the terms and confirming the construction of another term.

Conner's allegedly "faulty" definition and to simply define "semiconductor substrate" as "the semiconductor material of interest." Rothschild Mem. Law Supp. Mot. Clarify Claim Construction at 17. In essence, Rothschild wants a definition of substrate that does not require an overlying layer, so that the uppermost Mg-doped GaN layers in twenty of the twenty-one accused processes would be infringing. This is not the first time Rothschild has proposed such an extraordinary definition for the term "substrate." In Rothschild I, Rothschild's proposed definition for "substrate" as "any semiconductor material" was expressly rejected by Judge Conner, who referred to Rothschild's reasoning as a "bewildering non-sequitur." Rothschild I at *9. For the reasons given below, this Court finds no need to revisit the construction of "substrate" or "semiconductor substrate" and denies Rothschild's request.

In support of its position, Rothschild refers to Shealy's expert report on the meaning of "semiconductor substrate" in Claim 10 of the '499 Patent. See Ladow Decl. Supp. Mot. Clarify Claim Construction Ex. 7, Shealy Opening Rep. ¶¶ 32-33. Shealy opines that one of ordinary skill in the art would recognize that, "even if the term is not used in its most common manner . . . . the term semiconductor substrate is . . . synonymous with the semiconductor material of interest." Id. ¶ 33. Shealy relies on the absence of any discussion in the patent documentation "to the

effect that the semiconductor material . . . necessarily must be an underlying base layer for another layer." Id. Further, Shealy states that "no additional epitaxial layer on top of the semiconductor layer of interest is needed, or even relevant to, carrying out the method disclosed and claimed in the patent." Id. In other words, since the claimed method could be applied to any layer, and not just a layer underneath another layer, the term substrate should essentially be read out of the term "semiconductor substrate."

This Court rejects Shealy's reasoning because in the absence of a clearly disclosed special meaning, claim language must be given its customary meaning to a person of ordinary skill in the art. See Markman v. Westview Instruments, Inc., 52 F.3d 967, 980 (Fed. Cir. 1995), aff'd, 517 U.S. 370 (1996) ("[A]ny special definition . . . must be clearly defined in the specification."); Merck & Co. v. Teva Pharm. USA, Inc., 395 F.3d 1364, 1370 (Fed. Cir. 2005). First, the '499 Patent does not contain any special definitions for "substrate" or "semiconductor substrate." In Rothschild's deposition, she admitted that the '499 Patent expressed no intention to use the term "substrate" in any way other than its customary meaning in the art. Cree Supplemental Claim Construction Br. Ex. 4, Rothschild Dep. 140:16-21, Feb. 5, 2007. Second, Shealy conceded in his expert report that, in common usage, the term "'semiconductor substrate' . . . could

mean an underlying base on which an epitaxial layer is grown." Shealy Opening Rep. ¶ 33. At his deposition, Shealy even admitted that neither he, nor anyone in the semiconductor field, would refer to the **topmost** layer in his own semiconductor device as a "substrate." Shealy Dep. 39:13-23. Rothschild also testified that "the most customary usage" of the term "substrate" was to refer to "a slice of semiconductor material used as a base" or "something you deposited something else on." Rothschild Dep. 136:21-137:11. When writing the patent, Rothschild had the opportunity to define semiconductor substrate any way she desired. See Markman, 52 F.3d 967 at 980 ("[A] patentee is free to be his own lexicographer. The caveat is that any special definition given to a word must be clearly defined in the specification.") (citation omitted). Since Rothschild did not avail herself of that opportunity, the term "semiconductor substrate" must be given its customary meaning to a person of ordinary skill in the art, which requires an overlying layer. Accordingly, this Court rejects Rothschild's contention that "semiconductor substrate" is synonymous with the semiconductor material of interest.

3. Whether the Definition of "Substrate" Has a Mechanical Support Requirement

Cree argues that by using the term "supporting base," Judge Conner imposed a requirement that a "substrate" must provide mechanical support for itself and the layer grown on its surface.

Cree Mem. Supp. Non-infringement at 19; Cree Reply Mem. Supp. Non-infringement at 13. Cree's argument centers around the following passage in Rothschild I:

> [C]onsistent with what was said above in discussing the term "epitaxial layer" in the '618 Patent, if, but only if, an epitaxial layer serves as a supporting base for another epitaxial layer grown on its upper surface, the underlying epitaxial layer may properly be described as a "substrate" for the layer above.

Rothschild I at *11.

Cree should not place such significance on a single phrase in Judge Conner's discussion concerning the meaning of substrate. The discussions solely focused on the issue whether epitaxial layers should be expressly excluded from the definition of substrate. As Judge Conner stated, Rothschild's "real interest is in obtaining for the term 'substrate' a construction broad enough to cover epitaxial layers," while "Cree takes the diametrically opposite position that a 'substrate' cannot be an epitaxial layer, and that it should be given its plain and ordinary meaning." Rothschild I at *9-10. The purpose of the passage was to emphasize that an epitaxial layer can only be a substrate if there is "another epitaxial layer grown on its upper surface," and was directed towards Rothschild's proposed definition of substrate as "any semiconductor material," regardless of whether there is an overlaying layer. Further, Judge Conner's declared construction makes no mention of "supporting base" but instead uses the term "underlying base."

Rothschild I at *12. The term "underlying base" carries with it no thickness or mechanical support connotations. Moreover, Judge Conner's explanation of this definition shows no intention to impose a mechanical support requirement. As Judge Conner explained: "in defining the term 'substrate,' we do not believe it appropriate, as advocated by Cree, either to specifically exclude epitaxial layers or to do so impliedly by use of the word 'slice,' which is appropriate only with reference to bulk crystals." Id. at 11. By rejecting Cree's exclusionary construction, and adopting a construction that makes no mention of "supporting base," Judge Conner surely intended that all epitaxial layers that serve as an "underlying base on which an epitaxial layer is grown" are "substrates," regardless of their thickness or ability to offer mechanical support. Finally, in defining "substrate," Judge Conner was mindful not to "exclude epitaxial layers or **to do so impliedly**." Id. (emphasis added). Importing a mechanical support or thickness requirement into "substrate" would impliedly exclude some or all epitaxial layers because an "epitaxial layer" is, by definition, "thin." Rothschild I at *7 (defining "epitaxial layer" as "a thin layer formed by epitaxial growth on a crystalline base"). It would make no sense for Judge Conner to include epitaxial layers that act as an underlying base in the definition of "substrate" only to impliedly exclude them.

For all the foregoing reasons, this Court rules that Judge Conner's definition of "substrate" as "an underlying base on which an epitaxial layer is grown" does not have any mechanical support or thickness connotations.

D. Additional Claim Construction for the '618 Patent

In its motion for partial summary judgment of no anticipation by Crowder, Rothschild argued that the term "wide band gap semiconductor" in Claim 1 of the '618 Patent actually means "hard-to-dope wide band gap semiconductor." At the request of the Court, the parties briefed the issue and appeared for a Markman hearing on February 16, 2010.

1. Relevant Facts

In the previous Markman hearing held before Judge Conner, the parties agreed that "wide band gap" meant "a band gap of at least 1.4 [electron volts]." Rothschild I at *3. This agreed-upon definition most likely stemmed from the specification of the '618 Patent, where Rothschild wrote:

> With many potentially useful semiconductive crystals, particularly those in which **the host material is a wide band-gap semiconductor (a band gap of at least 1.4 electron volts)**, such as zinc selenide, it has been difficult to incorporate into the crystal lattice in reproducible fashion adequate amounts of both types of dopant to provide good p-n junctions, i.e., both n-type and p-type conductivity.

The '618 Patent col.1 l.19-26 (emphasis added).

In her claim construction brief arguing that "hard to dope" should be inserted into the construction of the claim 1 of the

‘618 Patent, Rothschild explained that certain semiconductor material is easy to dope well conducting, such as n-type ZnSe or p-type ZnTe. In contrast, p-type ZnSe and n-type ZnTe are hard to dope well conducting. Rothschild’s Mem. Supp. Claim Construction ‘618 at 1.

2. Legal Standard

The words of a claim are given their ordinary meaning to a person of skill in the art at the time of the invention. Phillips v. AWH Corp., 415 F.3d 1303, 1312-13 (Fed. Cir. 2005). The court does not assume that the person of ordinary skill reads the claim term in a vacuum. Rather, “the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” Id. at 1313.

3. The Claim Language

Rothschild argues that the term “wide band gap semiconductor” in Claim 1 of the ‘618 Patent is referring to the material that is hard to dope well conducting, such as p-type ZnSe or n-type ZnTe. Rothschild’s Mem. Supp. Claim Construction ’618 at 1-2. Cree responds that the term should be given its ordinary and customary meaning. Cree points out that the term “semiconductor” is not itself in dispute; Cree agrees with Rothschild’s definition in her opening brief that a

"semiconductor is a material . . . whose conductivity is greater than that of an insulator and less than that of a conductor." Cree Mem. Opp'n Claim Construction '618 at 7 (quoting Rothschild Mem. Supp. Claim Construction '618 at 2) (quotation marks omitted). Cree argues that because the parties do not disagree on the construction of "wide band gap" and do not disagree on the meaning of "semiconductor," those two concepts should be combined to give the plain meaning of the term "wide band gap semiconductor" as a "semiconductor having a band gap of at least 1.4 eV." Id. Where the ordinary meaning of claim language as understood by a person of skill in the art is readily apparent, claim construction may involve "little more than the application of the widely accepted meaning of commonly understood words." Phillips, 415 F.3d at 1314. In this case, the "readily apparent" meaning combines the two agreed upon definitions.

Cree argues also that defining "wide band gap semiconductor" as a "hard-to-dope wide band gap semiconductor" makes no sense based on the claimed process. Cree Mem. Opp'n Claim Construction '618 at 18. Cree explains that the process begins with a wide band gap semiconductor, such as ZnSe, which is then doped with two dopants and heated to remove one of the dopants, creating the hard-to-dope wide band gap semiconductor, such as p-type ZnSe. Id. Thus, Cree's argument is that if the Court accepted Rothschild's position, the process would begin with a specific

“type” of semiconductor, such as p-type ZnSe. But, since the goal of the process is to create the hard-to-dope wide band gap semiconductor, it would be defining the starting point as the goal.

In refuting this argument, Rothschild states that Cree is attempting to mislead the Court into believing that Claim 1 of the ’618 Patent is limited to doping a pre-existing crystal, but in fact, the described process can occur during crystal growth. Reply Supp. Claim Construction ’618 at 7. Rothschild’s argument is well taken, particularly upon a close reading of Claim 1. Claim 1 appears to begin with an overview of the entire claim: “[a] process for the non-equilibrium incorporation of a dopant into a crystal of a wide band gap semiconductor comprising the steps of . . . .” The ’618 Patent col.5 ll.11-13. Read in this light, “wide band gap semiconductor” could be construed as a “hard-to-dope wide band gap semiconductor” because the introductory phrase of the claim is providing an overview of the process of creating or growing a particular type of semiconductor, and it is possible that the claimed process could be limited to creating or growing that type of semiconductor that is hard to dope well-conducting, such as n-type ZnSe or p-type ZnTe. Under this logic, the phrase “wide band gap semiconductor” is the end result – it contains a non-equilibrium incorporation of a dopant – and is thus either p-type or n-type.

This understanding, however, is contradicted by the use of the term "wide band gap semiconductor" in Claim 5. The introductory phrase in Claim 5 reads, "The process of forming a p-n junction diode in a crystal of a wide band gap semiconductor comprising the steps of . . ." Id. at col.6 ll.10-12. If the Court construes "wide band gap semiconductor" using the same logic as used for Claim 1 – that the introductory phrase is an overview of the process described in the claim where "wide band gap semiconductor" refers to the end result – it would define "wide band gap semiconductor" in Claim 5 as a "p-n junction diode wide band gap semiconductor." Thus, the term "wide band gap semiconductor" would have a different construction in Claims 1 and 5. The Federal Circuit has ruled, however, that a term must carry the same definition throughout the claims. "[I]f a claim term appears in more than one claim it should be construed the same in each." Dayco Prods., Inc. v. Total Containment, Inc., 329 F.3d 1358, 1371 (Fed. Cir. 2003).

4. The Specification

While the claim terms should generally be given their ordinary and customary meaning, a patentee may assign a unique definition to a term if the patent clearly expresses that intent in the specification. Phillips, 415 F.3d at 1316. Rothschild argues that the specification clearly explains that the invention

is limited to "hard-to-dope wide band gap semiconductors" as indicated by the following excerpts:

- "There is needed a better understood technique, amenable to good control, for doping hard-to-dope wide band gap semiconductors, such as zinc selenide, zinc sulphide, cadmium sulphide, cadmium selenide, zinc telluride and diamond." '618 Patent col.1 l.53-57.

- "I believe that energy and solubility considerations for the basic difficulty in incorporating particular dopants into crystals of the kind under discussion." Id. at col.1 l.60-62. Where Rothschild argues that "the kind under discussion" refers to "hard-to-dope wide band gap semiconductors" as discussed in the previous quote. Rothschild Mem. Supp. Claim Construction '618 at 9.

- Prior art "techniques for achieving a non-equilibrium concentration have been of limited usefulness, particularly with respect to wide-band gap materials that are difficult to make 'well conducting.'" '618 Patent col.2 l.20-23.

Based on these quotes, Rothschild argues that "the precise and only point of the invention is to provide a method to address the doping of hard-to-dope semiconductors." Rothschild Mem. Supp. Claim Construction '618 at 10.

There are some problems with Rothschild's argument. First, Cree similarly picked out specific quotes to argue that the limitation was not intended. For example, Rothschild wrote that "[i]t should be evident that the basic principles described can be extended to various other systems of wide band gap materials and should be of special interest to materials that are normally difficult to dope adequately." '618 Patent col.4 l.45-49. Similarly, in distinguishing other techniques, she wrote that

"these techniques . . . have been of limited usefulness, particularly with respect to wide-band gap materials that are difficult to make 'well-conducting.'" Id. at col.2 ll.20-23. Most importantly, the specification seems to define "wide band-gap semiconductor" by placing the explanatory phrase "a band gap of at least 1.4 electron volts" in parenthesis following the word "semiconductor" rather than the word "gap." Id. at col.1 ll.21-22.

Second, Rothschild's specification does not disavow the ordinary and customary meaning of "wide band gap semiconductor." Reading the entire specification, one could infer that Rothschild intended to patent a method directed at doping hard-to-dope wide band gap semiconductors. This Court then faces the problem of deciding whether relying upon this inference would involve impermissibly reading a limitation from the specification into the claim or permissibly using the specification to interpret the meaning of the claim. See Phillips, 415 F.3d at 1323 (recognizing the fine line between "using a specification to interpret the meaning of a claim and imparting limitations from the specification into a claim."). But as explained above, the ordinary and accustomed meaning of the claim term is fairly clear.

To prevail in limiting the claim, Rothschild must establish that she "demonstrate[d] an intent to deviate from the ordinary

and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." Epistar Corp. v. Int'l Trade Comm., 566 F.3d 1321, 1334 (Fed. Cir. 2009) (quotation marks omitted) (alteration in original); see also Martek Biosciences Corp. v. Nutrinova, Inc., 579 F.3d 1363, 1382 (Fed. Cir. 2009) ("[A]bsent a clear disclaimer of particular subject matter, the fact that the inventor may have anticipated that the invention would be used in a particular way does not mean that the scope of the invention is limited to that context.") (internal quotations omitted). While the specification may infer a limitation to hard-to-dope material, there is no clear disavowal of the use of the method on easy-to-dope material. Shealy, Rothschild's expert, opines that "a person skilled in the art would understand that there is no need for or reason to use the claimed method on easy-to-dope materials since they are already so highly conductive that a device would not be improved by further improvement of conductivity." Shealy Reply Decl. Supp. Claim Construction '618 ¶ 4. Nonetheless, he does not disavow the use of the technique to create an easy-to-dope wide band gap semiconductor.

5. Patent Prosecution History

While the specification is the "single best guide to the meaning of a disputed term" and construing it in light of the

specification is usually dispositive, Phillips, 415 F.3d at 1315, the patent prosecution history is part of the intrinsic evidence that a court should consider first when construing claim terms. Id. at 1317. "For a prosecution statement to prevail over the plain language of the claim, the statement must be clear and unmistakable such that the public should be entitled to rely on any 'definitive statements made during prosecution.'" Elbex Video, Ltd. v. Sensormatic Elecs. Corp., 508 F.3d 1366, 1373 (Fed. Cir. 2007) (quoting Omega Engineering, Inc. v. Raytek Corp, 334 F.3d 1314, 1324 (Fed. Cir. 2003)).

Rothschild argues that the patent prosecution history supports her limitation of the claim to hard-to-dope material because the Examiner rejected the originally-filed claims of the '618 Patent based on references discussing p-type ZnSe, which is hard-to-dope. Rothschild Claim Construction Statement '618 at 14. A review of the history provided by Rothschild does not lead necessarily to the conclusion that the Examiner rejected the originally-filed claims because those references described creating hard-to-dope wide band gap semiconductors. The Examiner stated that Claims 1, 2, and 5 were rejected as anticipated by an article authored by Rothschild because the first and second paragraphs of the experimental section of that article stated "Li and N doped layer is grown by LPE on substrate and then it is subjected to heat treatments." Ladow Decl. Supp. Claim

Construction Statement ’618 Ex. 2. This was the only explanation given by the Examiner. There simply is insufficient evidence in the patent prosecution history to support Rothschild’s argument that the Examiner understood the patent was limited to hard-to-dope wide band gap semiconductors. Even if the Examiner intended his statement to imply that the patent was limited to hard-to-dope wide band gap semiconductors, the Examiner’s statement is not clear or unmistakable enough to notify the public of the intention to overcome the ordinary and customary meaning of the claim term itself.

6. Conclusion

For the reasons explained above, the Court will not read the limitation “hard-to-dope” into the term “wide band gap semiconductor” in Claim 1 of the ’618 Patent.

E. Patent Invalidity

In its motion for summary judgment based on patent invalidity [Doc. No. 103], Cree makes three arguments as to the ’618 Patent and two arguments as to the ’499 Patent. Cree argues that the ’618 Patent is invalid because: (1) it was anticipated by the Crowder reference, (2) it was based on prior work done at Philips and failed to name Fitzpatrick as a co-inventor, and (3) it did not enable the patent. Similarly, Cree argues that the ’499 Patent is invalid because it was based on prior work done at

Philips and failed to name Fitzpatrick as a co-inventor, and it did not enable the patent.

1. Invalidity of the ’618 Patent

The Court denies the motion for summary judgment of invalidity of the ’618 Patent as there are disputed issues of material fact. As explained in Section III.I, disputes of material fact regarding whether Fitzpatrick was a co-inventor of the ’618 Patent preclude summary judgment. The denial as to the other two arguments is explained below.

a. The Crowder Reference

(1) Relevant Facts

In this case, Cree moved for summary judgment of patent invalidity on the grounds that Claims 1 and 4 of the ’618 Patent were anticipated by an article written in 1969 entitled, “EPR and Luminescense Studies of Er^{+3} in Acceptor-Doped ZnTe,” by Billy L. Crowder (“Crowder”). Cree Mem. Supp. Invalidity at 10-11. The Crowder article discloses a method for making zinc telluride (ZnTe), which is a wide band-gap semiconductor with a band-gap of around 2.4 eV. Cree Invalidity 56.1 Statement ¶ 16. The Crowder reference, however, discloses only a method for making p-type ZnTe. Rothschild Response to Cree Invalidity 56.1 Statement at 10. Cree asserts in its Statement of Undisputed Facts that the article described producing a semiconductor of ZnTe by co-doping with erbium (“Er”) and lithium (“Li”) during crystal growth and

then heating the crystal to remove Li. Cree Invalidity 56.1 Statement ¶ 13. Rothschild disputes this description, responding that "Crowder fail[ed] to disclose removal of Li from the sample," explaining that the article stated simply that "thermal treatments were used to remove Li from the electrically active centers of ZnTe." Rothschild Response to Cree Invalidity 56.1 Statement at 8. According to Cree, the article explained that as a result of the co-doping method, the ZnTe had at least a 10-fold higher concentration of the erbium than when doped with erbium alone. Cree Invalidity 56.1 Statement ¶ 13. Again, this "fact" is disputed by Rothschild who contends that Crowder had no basis to conclude that the solubility of Er increased in the crystal. Rothschild Response Cree Invalidity 56.1 Statement at 8.

(2) Evidentiary Support

The only evidence that Cree initially provided to support its motion, other than the Crowder article itself, was the deposition testimony of Shealy, Rothschild's expert. The Federal Circuit has laid down very clear steps regarding what is necessary to show anticipation by a given reference:

> Typically, testimony concerning anticipation must be testimony from one skilled in the art and must identify each claim element, state the witnesses' interpretation of the claim element, and explain in detail how each claim element is disclosed in the prior art reference.

Koito Mfg. Co. v. Turn-Key-Tech, LLC, 381 F.3d 1142, 1152 (Fed. Cir. 2004) (quoting Schumer v. Lab. Computer Sys., Inc., 308 F.3d

1304, 1315-16 (Fed. Cir. 2002)). In an attempt to meet these requirements through the use of Rothschild's expert, Cree submitted a table as an appendix to its memorandum, which has a column for "Claim Limitation," a column for "Disclosure in the Crowder Article," and a column for "Dr. Shealy's Testimony Establishing the Crowder Article Discloses Each Limitation." Radulescu Oct. 10, 2009 Decl. Supp. Invalidity App. C.

Cree's attempt to satisfy the anticipation requirements with Rothschild's expert is insufficient as matter of law. As the above quote from Koito makes clear, the steps must all be done by the same witness – a person skilled in the art – not by a party's attorney. Thus, before a trier of fact may accept a witness's testimony on anticipation, that witness must first identify each claim element and state his interpretation of the element. That witness must then "explain in detail how each claim element is disclosed in the prior art reference." Koito, 381 F.3d at 1152.

While it may theoretically be possible for a party to establish anticipation through the deposition testimony of an opposing party's expert, Cree did not satisfy the required steps in this case. There was no evidence that Shealy identified each claim element or that Shealy stated an interpretation of each claim element. With respect to the final requirement, the questions and answers provided in the deposition do not rise to

the level of "expl[anations] in detail." Examples of the testimony relied upon include:

> Q: Did [Crowder] grow zinc telluride crystals?
> A: I believe so.
> Q: Is zinc telluride a wide-band gap semiconductor?
> A: Yes.

Shealy Dep. 315:5-10.

> Q: Does Crowder disclose introducing erbium atoms into zinc telluride during growth?
> A: Yes.
> Q: Does Crowder disclose introducing lithium atoms into zinc telluride during growth?
> A: I don't think he's describing it as lithium alone. But in the experimental section he's introducing erbium and lithium together in there.

Shealy Dep. 316:7-17. While these questions and answers may have elicited testimony explaining that Crowder disclosed each limitation of Claims 1 and 4 as identified by Cree's counsel, the testimony does not provide enough detail to meet the standard required of expert testimony on the issue of anticipation. For instance, in response to the question whether Crowder discloses introducing erbium atoms into zinc telluride during growth, Shealy merely responded "Yes." A sufficiently detailed explanation would have pointed to the page or pages of the reference, at the very least.

This Court stated in NewRiver, Inc. v. Newkirk Prods., Inc., 674 F. Supp. 2d 320, 336 (D. Mass. 2009), that "at the earliest possible moment when an expert opinion is proffered on the issues of obviousness, anticipation, written description, or doctrine of

equivalents, the Court sua sponte, will rule on its adequacy." Id. at *12. Shealy's deposition testimony cannot establish anticipation by the Crowder reference and because this is the sole evidence that Cree used to support its motion initially, the Court necessarily must consider entering summary judgment on this issue sua sponte against Cree.

(3) Summary Judgment Sua Sponte Against Cree

"[D]istrict courts are widely acknowledged to possess the power to enter summary judgments sua sponte, so long as the losing party was on notice that she had to come forward with all of her evidence." Celotex Corp., 477 U.S. at 326. The law in this circuit is well established: a party that moves for summary judgment runs the risk that if it makes a woefully inadequate showing, not only might its own motion for summary judgment be denied, the court may grant summary judgment sua sponte against the movant. See Berkovitz et al. v. Home Box Office, Inc. et al., 89 F.3d 24, 29-30 (1st Cir. 1996); Sanchez, et al. v. Triple-S Mgmt. Corp., 492 F.3d 1, 7-9 (1st Cir. 2007). The Second Circuit holds likewise. Coach Leatherware Co. v. Ann Taylor, Inc., 933 F.2d 162, 167-68 (2d Cir. 1991) (recognizing that there is no need for notice when entering summary judgment against the moving party because the movants have "significant incentive to put forward any compelling evidence in support of their summary judgment motion since the law prevent[s] the

district court from drawing favorable inferences on their behalf"). In a recent opinion, this Court discussed the patent bar's common practice of overloading courts with summary judgment motions. See Ambit v. Delta, No. 09-10217, 2010 WL 1172629, at *3-4 (D. Mass. Mar. 23, 2010). In that opinion, I warned the patent bar to ensure that in making a motion for summary judgment upon an issue as to which they bear the burden of proof, they "lay every bit of evidence before the court - once." Id. at *4.

Before granting summary judgment sua sponte, certain conditions must be met. Specifically, to "ensure that the targeted party has an adequate opportunity to dodge the bullet," the Court may only enter summary judgment sua sponte if: (1) fact discovery is sufficiently advanced that the parties enjoyed a reasonable opportunity to glean the material facts; and (2) the targeted party has appropriate notice and a chance to present its evidence on the essential elements of the claim. Berkovitz, 89 F.3d at 29. As to the first element, the Court inherited this case from a district judge in the Southern District of New York and does not know all of the specifics about discovery in the case. Nonetheless, the case was filed in 2005 and it is fair to assume that discovery is "sufficiently advanced" at this point. As to the second element, the Court issued an order on March 9, 2010, notifying the parties that it was considering entering summary judgment sua sponte against Cree and provided Cree with

ten days to submit additional support for its motion. Cree - wisely recognizing that its forlorn hope had foundered, now wheeled its heavy batteries onto the field – appropriately responding to the Court's Order by submitting its own expert report in support of its anticipation argument. This expert report by Dr. Eric Bretschneider includes an Appendix E which provides details on how each claim element is disclosed in the Crowder reference, including quotes and page numbers.[4] With the submission of this expert report, Cree provided sufficient evidence to demonstrate issues of material fact such that the Court cannot enter summary judgment sua sponte against Cree.

Nonetheless, there remain disputes of issues of material fact such that the Court cannot grant summary judgment in favor of Cree. To be anticipatory, a prior art "reference must disclose each and every element of the claimed invention, whether it does so explicitly or inherently." In re Gleave, 560 F.3d 1331, 1334 (Fed. Cir. 2009). This Court has ruled that the claim covers all wide-band gap semi-conductors, yet it is in dispute as

[4] It is clear to this Court that Cree is guilty of precisely the practice the Court inveighed against in Ambit – propounding a weak motion for summary judgment on an issue as to which it bears the burden of proof in order to burden Rothschild and smoke out its position in anticipation of a second round of summary judgment motions. This is too slick by half. Had this Court given adequate notice of its requirements as detailed in NewRiver and Ambit before entertaining the initial summary judgment filing, it would have had no hesitancy to sanction Cree by excluding the issue of anticipation based on the Crowder reference from the case.

to whether Crowder anticipates such broad coverage. In addition, there appears to be some dispute as to whether Crowder adequately describes certain claim elements, such as "substantially equal amounts" and "dopants of different mobilities."

b. Enablement of the '618 Patent

Cree provides three bases for its argument that the '618 Patent is invalid due to lack of enablement. First, the patent does not enable the full scope of its claims. Specifically, the '618 Patent does not enable making a III-V semiconductor. Moreover, since Rothschild asserted extremely broad coverage of her claims, the patent must describe a method that is a generic solution to making the covered semiconductors in order to enable the full scope of the claims. Second, the paper examples described in the patent do not work such that one skilled in the art could follow the examples to practice the claims. Finally, Cree argues that one skilled in the art must engage in undue experimentation to practice the asserted claims.

To enable a patent, the specification must describe "the manner and process of making and using [the invention], 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 invention]." 35 U.S.C. § 112. Whether a claim satisfies the enablement requirement is, like obviousness, matter of law based on underlying facts. In re

Wands, 858 F.2d 731, 735 (Fed. Cir. 1988). The party asserting lack of enablement of a patent bears the burden of proving the point by clear and convincing evidence. AK Steel Corp. v. Sollac, 344 F.3d 1234, 1238-39 (Fed. Cir. 2003). The "enablement requirement is satisfied when one skilled in the art, after reading the specification, could practice the claimed invention without undue experimentation." Id. at 1244. Other than pointing to the specification itself in arguing that the patent is not enabled, Cree relies solely on evidence demonstrating that Rothschild was never able to practice the patent and that she does not know of anyone who has successfully practiced the examples in her patent. Cree Mem. Supp. Invalidity at 17. To accept Cree's argument, the Court must determine the qualifications of one skilled in the art and whether Rothschild meets those qualifications. Questions of material fact remain regarding both parts of that initial determination.

The difficulty in ruling on this issue begins with the lack of agreement between the parties on a definition of one skilled in the art. See, e.g., General Elec. Co. V. Nintendo Co., 179 F.3d 1350, 1363 (Fed. Cir. 1999) ("There are . . . genuinely disputed issues of material fact as to . . . the background knowledge held by one skilled in the art at the time of the '899 filing."); cf. Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1372-74 (Fed. Cir. 1999) (describing evidence in record

that substantiated district court's assessment of the level of skill in the art and district court's decision that inventor and research associates met that level of skill). Cree never proffered a definition for one skilled in the art, but notes that "[Rothschild] has taken at least three different positions about the level of ordinary skill in the art in this case." Cree Mem. Supp. Invalidity at 18 n.7. In his expert report, Cree's expert, Bretschneider, opines that a person of ordinary skill in the field "would have a Ph.D. in material science, electrical engineering or applied physics, or an equivalent filed [sic] of study, and at least several years of experience with the growth and doping of wide band-gap semiconductor materials." Bretschneider Mar. 19, 2010 Decl. Supp. Invalidity Ex. 1, Bretschneider Rep. ¶ 82.

Even if the Court were to adopt Bretschneider's definition of one skilled in the art, there is a dispute as to whether Rothschild qualifies as that skilled person because it is unclear what her experience is in the "growth and doping of wide band-gap semiconductor materials." Rothschild argues that she is not such a person because she does not have the necessary growth and doping experience. Rothschild Opp'n Invalidity at 19. Cree has not submitted any evidence regarding Rothschild's experience growing and doping semiconductors.

By relying solely on evidence related to Rothschild's failure to practice the patent, Cree assumed the extra burden for itself of establishing the definition of one skilled in the art and showing that Rothschild meets that definition. Since Cree did not satisfy this burden, its motion for summary judgment of invalidity of the '618 Patent due to lack of enablement is denied.

2. Invalidity of the '499 Patent

The Court also denies Cree's motion for summary judgment of invalidity of the '499 Patent. As explained elsewhere, disputes of material fact regarding whether Fitzpatrick was a co-inventor of the '499 Patent preclude summary judgment. Cree again makes numerous arguments regarding the enablement of the '499 Patent that are dependent on Rothschild assuming the role of a person of ordinary skill in the field. As to the argument that the '499 Patent is not enabled because it teaches against the use of metal organic chemical vapor deposition, Cree makes sound arguments but fails to support these arguments with sufficient evidence.

a. Teaching Away

Where a specification discourages an embodiment, it is said to "teach away" from that embodiment. See AK Steel, 344 F.3d at 1244. The '499 Patent states, "[c]onsiderable effort has been expended to develop wide band-gap semiconductors having low bipolar resistivity . . . efforts have included metal organic

chemical vapor deposition ("MOCVD") but again this procedure is extremely expensive and has not produced suitable results reliably." '499 Patent col.1 ll.52-63. The patent does not mention the MOCVD procedure again, and the example in the specification uses a temperature below that which would be used for MOCVD during crystal growth. Cree Mem. Supp. Invalidity at 14; Rothschild 56.1 Response Invalidity at 3. Rothschild counters that, as her expert testified in his rebuttal report, the statement in the patent was in the past tense and that "a person skilled in the art would recognize MOCVD as 'the preferred technique to carry out the method of [C]laim 10 of the patent." Rothschild Mem. Opp'n Invalidity at 12-13; Ladow Decl. Opp'n Invalidity Ex. 5, Shealy Rebuttal Invalidity ¶ 15. Moreover, she argues that the statement disparaging MOCVD does not legally give rise to a disavowal of claim scope because a disavowal requires "expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." Rothschild Mem. Opp'n Invalidity at 13 (quoting Epistar Corp. v. ITC, 566 F.3d 1321, 1336 (Fed. Cir. 2009)).

Rothschild confuses the legal argument on this point. The issue presented by Cree is not whether Rothschild disavowed the claim scope.[5] Rather, Cree's argument is that because Rothschild

[5] According to Cree, "[Rothschild] alleges that Cree's MOCVD growth processes infringe the asserted claims of the '499 Patent." Cree Mem. Supp. Invalidity at 14. Thus, at this point,

taught against the use of MOCVD in her specification, she failed to enable the use of MOCVD to practice her patent. See, e.g., AK Steel Corp., 344 F.3d at 1244 (holding that the patent was not enabled where the claims covered Type 1 and Type 2 aluminum coating, but the specification only described use of Type 2 aluminum coating and warned that Type 1 aluminum coating caused coating problems).

b. Evidentiary Support

The problem with Cree's argument is that it is not supported by evidence of what a person of ordinary skill in the art would understand. As stated above, the "enablement requirement is satisfied when one skilled in the art, after reading the specification, could practice the claimed invention without undue experimentation." Id. at 1244. In its argument that the patent teaches away from MOCVD, Cree relies solely on the language of the patent. This is fine for the first step of determining whether a specification teaches away from a technique so as to fail the enablement requirement. The fact that the specification teaches away from using MOCVD, however, only suggests that "a significant amount of experimentation" would have been necessary to use that technique in practicing the patent. Id. While the Court agrees that the language of the patent appears to teach

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neither party appears to argue that the relevant claims of the '499 Patent do not cover the use of MOCVD.

away from MOCVD, it is not clear whether a person skilled in the art would have read the ’499 Patent and determined that it taught against the technique such that it would have required **undue experimentation** to practice the patent using MOCVD.[6] By failing to provide such evidence, Cree does not meet its burden. Cf. Sitrick v. Dreamworks, LLC, 516 F.3d 993, 1000 (Fed. Cir. 2008) (“Defendants supported their motion for summary judgment of invalidity by reference to the teachings of the specifications and the opinions of their two experts.”); Automotive Tech. Int’l, Inc. v. BMW of North America, Inc., 501 F.3d 1274, 1284 (Fed. Cir. 2007) (relying on the language of the specification and expert testimony to find the patent invalid due to lack of enablement); Leibel-Flarsheim Co. v. Medrad, Inc., 481 F.3d 1371, 1375, 1379 (Fed. Cir. 2007) (relying on the language of the specification and various statements in the record regarding the knowledge of one skilled in the art to find the patent invalid due to lack of enablement); AK Steel Corp., 344 F.3d at 1244 (relying on the language of the specification teaching away from using Type 1 aluminum coating and pointing to the district court’s discussion of AK Steel’s undue experimentation in using

[6] To the extent that Cree later discusses that undue experimentation was necessary to practice the ’499 Patent, Cree fails to provide sufficient evidence because it relies solely on Rothschild’s failed experiments without establishing the skill level of a person of ordinary skill in the field and whether she meets that definition. See supra, Section III.E.1.b.

Type 1 aluminum coating and ultimate success two years after filing the patent application to find the patent invalid due to lack of enablement). Thus, Cree's motion for summary judgment of invalidity of the '499 Patent based on lack of enablement is denied.

F. No Anticipation of Claims 1 and 4 of the '618 Patent Based on the Crowder References

Rothschild's motion for partial summary judgment on the issue of lack of anticipation of Claims 1 and 4 of the '618 Patent based on the Crowder reference [Doc. No. 97] is denied.

G. No Anticipation of Claim 10 of the '499 Patent Based on the Pearton Article

Rothschild filed a motion for partial summary judgment that S.J. Pearton et al., Hydrogen in Crystalline Semiconductors, 25 Appl. Phys. A 153 (1987) (the "Pearton Article") did not anticipate Claim 10 of the '499 Patent [Doc. No. 129].

1. Relevant Facts

Rothschild asserts that one limitation of Claim 10 of the '499 Patent is that a dopant is introduced together with atomic hydrogen to the semiconductor during or after growth of the crystal. Rothschild Mem. Supp. No Anticipation Pearton at 1. In his 1987 article, Pearton summarized the findings in the field regarding the properties of atomic hydrogen in crystalline semiconductors. Ladow Decl. Supp. No Anticipation Pearton Ex. 2 at 153. Pearton wrote, "Hydrogen can be introduced into

semiconductors during crystal growth, by direct implantation, by exposure to a hydrogen-containing plasma, or by chemical reaction at the surface." Id. Rothschild asserts that all of the experiments described within the article, however, describe introducing atomic hydrogen into the crystal after it has been grown and doped. Rothschild Statement of Undisputed Facts Supp. No Anticipation ¶ 1. Cree disputes this fact, pointing to the quote above. Cree Response to 56.1 Statements Invalidity Defenses at 9.

Cree argues that its expert, Bretschneider, testified that "one of ordinary skill in the art would have understood that . . . atomic hydrogen and a dopant are incorporated into gallium arsenide during growth." Cree Mem. Opp'n Motions on Invalidity Defenses at 17. To make this argument, Cree's expert combined the introductory sentence at issue with an experiment described fourteen pages later, which did not incorporate the atomic hydrogen during growth. Ladow Dec. Supp. No Anticipation Pearton Ex. 2 at 153, 167; Rothschild Mem. Supp. No Anticipation Pearton at 6; see also Cree Mem. Opp'n Motions on Invalidity Defenses at 18 ("[T]hat Pearton may not expressly disclose a detailed experiment in which atomic hydrogen and a dopant were doped

together during semiconductor growth does not render Pearton non-anticipatory prior art.").[7]

2. Legal Standard

Although anticipation is a question of fact, this Court may rule on a summary judgment motion as to the anticipation issue where, drawing all reasonable factual inferences in favor of the non-movant, the evidence is such that the non-movant cannot prevail. Scripps Clinic & Research Found. v. Genentech, Inc., 927 F.2d 1565, 1576 (Fed. Cir. 1991). "To anticipate a claim, a single prior art reference must expressly or inherently disclose each claim limitation." Finisar Corp. v. DirecTV Group, Inc., 523 F.3d 1323, 1334-35 (Fed. Cir. 2008). While an alleged anticipating reference does not require actual performance or suggestions in a disclosure, it must "be enabling and describe the applicant's claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention." Arthrocare Corp. v. Smith & Nephew, Inc., 406 F.3d

[7] Cree also argues that the Pearton Article must anticipate because it teaches that "atomic hydrogen can be unintentionally incorporated together with a dopant during semiconductor growth," much like Cree's process where any atomic hydrogen incorporation is unintended. Cree Mem. Opp'n Motions on Invalidity Defenses at 18. In addition, Cree's manufacturing process incorporates atomic hydrogen after growth just like the description in the Pearton Article. Id. Thus, Cree argues if it infringes Rothschild's patent, then Pearton must anticipate. Id. at 19. While these arguments may be relevant to other motions or persuasive on the issue of infringement at trial, neither of the arguments affects the determination whether the Pearton Article anticipates the '499 Patent.

1365, 1371-72 (Fed. Cir. 2005) (quoting In re Paulsen, 30 F.3d 1475, 1479 (Fed. Cir. 1994)) (quotation marks omitted). To meet this requirement, the single prior art reference must disclose "all elements of a claimed invention **arranged as in the claim**." Finisar Corp., 523 F.3d at 1334 (emphasis added). Moreover, anticipation must be proven by clear and convincing evidence. Impax Labs, Inc. v. Aventis Pharm., Inc., 545 F.3d 1312, 1314 (Fed. Cir. 2008).

3. Arranged as in the Claim

While it is not always obvious what "arranged as in the claim" means for a patent, this case is a little easier than others. Claim 10 of the '499 Patent claims a method "comprising selectively doping the semiconductor substrate with an effective amount of dopant to induce acceptable conductivity, together with an effective amount of atomic hydrogen." '499 Patent col.6 l.63-col.7 l.7. The phrase "together with" was construed to mean "simultaneously with." Rothschild I at *12. Thus, "arranged as in the claim" means that any anticipating prior art reference must disclose that atomic hydrogen is added to a substrate simultaneously with a dopant.

Even if Cree is correct that a person of ordinary skill would know to read the introductory sentence and the later experiment together and to add both atomic hydrogen and a dopant during crystal growth, Cree fails to provide any evidence to

suggest that a person of ordinary skill in the art would know to introduce the elements simultaneously. Thus, Rothschild's argument that Pearton never specifically teaches co-doping or introducing dopants together during crystal growth is persuasive. Rothschild Reply Supp. No Anticipation Pearton at 8.

Moreover, Cree cannot put two separate concepts together to establish anticipation. In Ecolochem, Inc. v. Southern California Edison Co., 227 F.3d 1361 (Fed. Cir. 2000), the court reversed a holding of anticipation where the relevant article did not disclose all the claims in the same section. Id. at 1368. On the other hand, in Ortho-McNeil Pharm., Inc. v. Teva Pharma. Indus., Ltd., 344 Fed. Appx. 595 (Fed. Cir. Aug. 26, 2009), the court held that summary judgment was improper where there was a dispute about reading two consecutive examples together. Id. at 600. The Federal Circuit held that because "[w]hat a reference discloses is a question of fact," and because the parties dispute what one of skill in the art would have understood about the teachings of one example applying to another example, the court should not have resolved the issue on summary judgment. Id.

This case falls closer to the Ecolochem case. No one disputes that the example of gallium arsenide in the Pearton Article introduces atomic hydrogen after the semiconductor has already been doped. The one sentence referring to the introduction of atomic hydrogen during crystal growth is too

tenuous and too removed from the discussion of gallium arsenide to disclose the simultaneous introduction of atomic hydrogen and a dopant. Therefore, Rothschild's motion for summary judgment of no anticipation of Claim 10 of the '499 Patent based on the Pearton Article is granted.

H. No Anticipation of Claims 10, 12, and 16 of the '499 Patent Based on the Jacob, Ohki, and Stucheli References

Rothschild filed a Contingent Motion for Partial Summary Judgment Of No Anticipation Of Claims 10, 12, and 16 of the '499 Patent Based on the Jacob, Ohki, and Stucheli References (the "Contingent Motion"). The references are (1) U.S. Patent No. 4,144,116, Vapor Deposition of Single Crystal Gallium Nitride, issued Mar. 13, 1979, to G. Jacob et al. (the "Jacob '116 patent"); (2) G. Jacob et al., Effect of Growth Parameters on the Properties of GaN:Zn Epilayers, Journal of Crystal Growth, Vol. 42, 1977 at 136-143 (the "Jacob Article"); (3) A. Ohki et al., Nitrogen Doped p-Type ZnSe Layer Grown by Metalorganic Vapor Phase Epitaxy, Japanese Journal of Appl. Physics, Vol. 27, No.5, May, 1988 at L909-L912 (the "Ohki Article"); (4) N. Stucheli et al., p-ZnSe/n-GaAs Heterojunctions for Blue Electroluminescent Cells, The Physics of Semiconductors, Vol. 1 (Ed. O. Engstrom), August 1986, at 223-226 (the "Stucheli Article"). In the Contingent Motion, Rothschild proposes that if this Court affirms Judge Conner's construction of "substrate," it should also grant

partial summary judgment of no anticipation based on the Jacob '116 patent, the Jacob Article, the Ohki Article, and the Stucheli Article, with respect to Claim 10, as well as dependent Claims 12 and 16 of the '499 Patent. Rothschild Mem. Law Supp. Contingent Mot. at 1.

The references do not meet the "substrate" limitation because, as Cree's invalidity expert Bretschneider admits, in each of them the layer of interest is the topmost layer and not "an underlying base on which an epitaxial layer is grown." See Rothschild I at *12. Specifically, Bretschneider stated that the Jacob '116 patent "does not explicitly disclose any epitaxial layer grown on top of the zinc-doped GaN layer (labeled 3 in Fig. 1) and, accordingly, would not be a 'substrate' as that term has been construed by the Court." Bretschneider Decl. Opp'n Motions on Invalidity Defenses ¶ 29. The Jacob Article "discloses a process of forming a diode in a crystal of a wide band gap semiconductor." Id. ¶ 30. Bretschneider opined that the Zn-doped GaN layer grown as part of the process is the final layer grown epitaxially and is not a "substrate" as construed by the Court. Id. The Ohki Article discloses growing p-type ZnSe epitaxial layers. Id. ¶ 31. Bretschneider opined that "the p-type ZnSe layer grown by Ohki is not 'an underlying base on which an epitaxial layer is grown.'" Id. The Stucheli Article discloses a method of making p-type zinc selenide (ZnSe) by

chemical vapor deposition. Id. ¶ 32. Bretschneider opined that "as made by Stucheli, the p-type ZnSe layer is not 'an underlying base on which an epitaxial layer is grown.'" Id.

In order to demonstrate anticipation, Cree must show that "the four corners of a single, prior art document describe every element of the claimed invention." Net MoneyIN, Inc. v. VeriSign, Inc., 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quotation marks omitted) (quotation marks omitted). The Jacob '116 patent, the Jacob Article, the Ohki Article, and the Stucheli Article do not contain the "substrate" limitation and therefore do not anticipate Claims 10, 12, and 16 of the '499 Patent. Accordingly, Rothschild's Contingent Motion for Partial Summary Judgment of No Anticipation of Claims 10, 12, and 16 of the '499 Patent Based on the Jacob, Ohki, and Stucheli References is granted.

I. Cree's 35 U.S.C. § 102(f) Defense

Cree asserts a defense under 35 United States Code Section 102(f), contending that the '618 and '499 Patents are invalid because Fitzpatrick was not named a co-inventor of those patents. In response, Rothschild seeks summary judgment denying Cree's 35 United States Code Section 102(f) defense as matter of law. Rothschild Mot. § 102(f) Defense [Doc. No. 119]. Rothschild argues that in light of the evidence presented by both sides, Cree is unable to satisfy its burden of persuasion by presenting

clear and convincing evidence of Fitzpatrick's joint inventorship. Rothschild Mem. Supp. § 102(f) Defense at 2.

1. Legal Standard

Section 102(f) provides, in relevant part, that a "person shall be entitled to a patent unless . . . (f) he did not himself invent the subject matter sought to be patented." 35 U.S.C. § 102(f). "Patent issuance creates a presumption that the named inventors are the true and only inventors." Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d 1456, 1460 (Fed. Cir. 1998). The presumption of inventorship has its roots in the presumption of patent validity, found in Section 282 of the Patent Act. Trovan, Ltd. v. Sokymat SA, Irori, 299 F.3d 1292, 1301 (Fed. Cir. 2002) ("[B]ecause a patent is presumed valid [under] 35 U.S.C. § 282, there follows a presumption that the named inventors on a patent are the true and only inventors."); Sturtevant v. Van Remortel, 38 U.S.P.Q.2d 1134, 1137 (S.D.N.Y. 1995) ("Patents are entitled to a statutory presumption of validity. Under this theory, the inventors named in the patent are presumed to be the correct inventors.") (citations omitted). As is true elsewhere in patent law, see e.g., 35 U.S.C. § 282, the "presumption" of inventorship is not a true presumption at all as presumptions may be rebutted. Fed. R. Evid. 301. Rather, it operates as a procedural device that actually shifts the burden of proof to the party challenging inventorship. See In re Etter, 756 F.2d 852, 856 (Fed. Cir.

1985). Accordingly, in the present case, Cree bears the burden of proof to show that Rothschild is not the true and only inventor of the patents-in-suit. Cree "must meet the heavy burden of proving its case by clear and convincing evidence." Nartron Corp. v. Schukra U.S.A., Incorp., 558 F.3d 1352, 1356 (Fed. Cir. 2009) (quoting Eli Lilly & Co. v. Aradigm Corp., 376 F.3d 1352, 1358 (Fed. Cir. 2004)); see also Pannu v. Iolab Corp., 155 F.3d 1344, 1350 (Fed. Cir. 1998) ("When a party asserts invalidity under § 102(f) due to nonjoinder, a district court should first determine whether there exists clear and convincing proof that the alleged unnamed inventor was in fact a co-inventor.")

2. The Concept of a Joint Invention

A joint invention is the product of collaboration of two or more persons, each of whom work on the same subject matter and make some contribution to the inventive thought and to the final result. See Pannu, 155 F.3d at 1351. The Patent Act is the best place to begin a discussion of joint inventorship:

> Inventors may apply for a patent jointly even though (1) they did not physically work together or at the same time, (2) each did not make the same type or amount of contribution, or (3) each did not make a contribution to the subject matter of every claim of the patent.

35 U.S.C. § 116.

The significance of an alleged joint inventor's contribution may be assessed by asking whether the contribution helped to make

the invention patentable. Levin v. Septodont Inc., 34 Fed. Appx. 65, 72 (4th Cir. 2002) (stating that a "significant contribution to even a single claim of a patent is enough to qualify a person as a joint inventor"). As the Federal Circuit explained in Pannu:

> All that is required of a joint inventor is that he or she (1) contribute in some significant manner to the conception or reduction to practice of the invention, (2) make a contribution to the claimed invention that is not insignificant in quality, when that contribution is measured against the dimension of the full invention, and (3) do more than merely explain to the real inventors well-known concepts and/or the current state of the art.

155 F.3d at 1351.

3. Forms of Evidence in Proving Joint Inventorship

"To prove [ ] contribution, the purported co-inventor must 'provide corroborating evidence of any asserted contributions to the conception.'" Acromed Corp. v. Sofamor Danek Group, Inc., 253 F.3d 1371, 1378 (Fed. Cir. 2001) (quoting Fina Oil & Chem. Co. v. Ewen, 123 F.3d 1466, 1474 (Fed. Cir. 1997)). The sufficiency of corroboration is evaluated by a "rule of reason analysis," which requires that an "evaluation of all pertinent evidence must be made so that a sound determination of the credibility of the inventor's story may be reached." Price v. Symsek, 988 F.2d 1187, 1195 (Fed. Cir. 1993). "Documentary or physical evidence that is made contemporaneously with the inventive process provides the most reliable proof that the inventor's testimony has been corroborated." Sandt Tech., Ltd.

v. Resco Metal and Plastics Corp., 264 F.3d 1344, 1350-51 (Fed. Cir. 2001). The rationale is that contemporaneous documentary or physical evidence presents no "risk of litigation-inspired fabrication or exaggeration." Id. at 1351. By contrast, "post-invention oral testimony is more suspect, as there is more of a risk that the witness may have a litigation-inspired motive to corroborate the inventor's testimony, and that the testimony may be inaccurate." Id. See also Washburn & Moen Mfg. Co. v. Beat'Em All Barbed-Wire Co., 143 U.S. 275, 284 (1892) (noting the "forgetfulness of witnesses, their liability to mistakes, their proneness to recollect things as the party calling them would have them recollect them, aside from the temptation to actual perjury").

4. Contemporaneous Evidence

Cree presents documentary evidence made contemporaneously with the inventive process, which tends to suggest that Fitzpatrick is a co-inventor of the concepts embodied in the '618 and '499 Patents. Cree Mem. Opp'n Motions on Invalidity Defenses at 5. In response, Rothschild argues that the individuals who wrote the contemporaneous documents have denied that they have the meaning or significance that Cree and its experts attribute to them. Rothschild Reply Mem. § 102(f) Defense at 9-10.

a. Rothschild's 1978 Laboratory Notebook

Cree relies on Rothschild's October 1978 laboratory notebook, in which she disclosed discussing aspects of the

inventions with Fitzpatrick. Cree Mem. Opp'n Motions on Invalidity Defenses at 5 ("**In discussions with B. Fitzpatrick**, **we** realized that a good procedure for layer growth and subsequent treatment may be the following . . . [describing method].") (emphasis added).

In response, Rothschild argues that the notebook entry relates to the 1377 Invention Disclosure, which does not disclose every single element of the claims in the patents. Rothschild Reply Mem. Section 102(f) Defense at 10. Rothschild's argument can be criticized on two grounds. First, as discussed in relation to standing, there is a genuine factual dispute as to whether the 1377 Invention Disclosure discloses every element in the claims of the '618 or '499 Patents. Second, even if the 1377 Invention Disclosure does not cover the entire inventions embodied in the patents, Rothschild's argument still misses the point that to be a joint inventor, Fitzpatrick does not need to contribute to **every single element** of every single claim in the patents – "some" contribution is sufficient. 35 U.S.C. § 116; Pannu, 155 F.3d at 1351. Rothschild does not seem to dispute that the 1377 Invention Disclosure reveals at least some aspects of the '499 and '699 inventions. Accordingly, if Cree presents clear and convincing evidence that Fitzpatrick contributed to some aspects of the invention described in the 1377 Invention Disclosure, then Cree's 35 U.S.C. § 102(f) defense would succeed.

b. 1377 Invention Disclosure Submitted and Signed by Rothschild and Fitzpatrick

Towards the end of 1978, Fitzpatrick and Rothschild jointly submitted to Philips' Patent Department the 1377 Invention Disclosure. Radulescu Decl. Supp. Mot. Dismiss Ex. 3. The 1377 Invention Disclosure expressly identified both Rothschild and Fitzpatrick as the "inventors" of the method and was signed by both. Id. The signature of Bhargava, who supervised Rothschild and Fitzpatrick during their employment at Philips, also appears on the 1377 Invention Disclosure. Id.

In response, Rothschild again argues that since the 1377 Invention Disclosure does not disclose every single claim in the patents, being named joint inventor of the 1377 invention “does not relate to, let alone rebut, Dr. Fitzpatrick’s repeated denials that he is an inventor of either the ’618 or ’499 Patents.” Rothschild Reply Mem. Section 102(f) Defense at 11. Again, Rothschild misses the point that to be a joint inventor, Fitzpatrick only needs to have made some significant contribution to the patented inventions.

c. Record of Co-doping Experiments in Fitzpatrick’s Laboratory Notebook

Cree asserts that Fitzpatrick's laboratory notebooks recorded co-doping experiments on the method for making the particular semiconductor on which Rothschild and Fitzpatrick were then working: ZnSe. Cree's Mem. Opp’n Motions on Invalidity

Defenses at 5. In response, Rothschild contends that irrespective of the meaning of the notebook entries, Cree's expert, Bhargava, mistakenly attributes all of the ideas and concepts in Fitzpatrick's notebooks to him, even though Fitzpatrick admitted to being a "doer" and implementer. Rothschild Reply Mem. § 102(f) Defense at 11-12; see also Ladow's Decl. § 102(f) Defense Ex. 26, 2009 Fitzpatrick Decl. ("2009 Fitzpatrick Decl.") ¶ 9 ("I routinely kept certain laboratory notebooks, which I used to record my thoughts, ideas and experimental data, as well as the thoughts, ideas and experimental data of others, including Dr. Rothschild.").

Rothschild further argues that it is unsurprising for Fitzpatrick's notebooks to contain experimental data, because he was an experimentalist who attempted to implement Rothschild's inventive ideas. Rothschild Reply Mem. § 102(f) Defense at 11-12. This argument ignores case law suggesting that "experimental" contributions may also entitle a person to joint inventorship. Burroughs Wellcome, 40 F.3d at 1229 (emphasizing that "a person is not precluded from being a joint inventor simply because his contribution to a collaborative effort is experimental.")

5. Non-contemporaneous Evidence

a. Fitzpatrick's 2004 Affidavit

In a pre-litigation affidavit dated October 25, 2004, Fitzpatrick made several statements expressly denying his

involvement in the subject matter of the 1377 Invention Disclosure and also denying his contribution to the subject-matter of the ’618 Patent. Ladow's Decl. § 102(f) Defense Ex. 6, 2004 Fitzpatrick Aff. (“2004 Fitzpatrick Aff.”), ¶¶ 31, 56, 77. Rothschild, unsurprisingly, places significant reliance on Fitzpatrick’s denials. Rothschild Mem. Supp. § 102(f) Defense at 4; Rothschild Reply Mem. § 102(f) Defense at 11.

The statements from the 2004 Affidavit are as follows:

> 31. To the best of my recollection, after [Rothschild] had explained her idea to me on or before November 16, 1978, based on the level of my understanding of her idea at the time, I suggested to [Rothschild], as a possible example of her idea, that it might be possible to obtain a lower resistivity n-type gallium arsenide crystal by co-doping the crystal with selenium, as the primary donor dopant, and with beryllium, as the secondary acceptor dopant, so that the secondary dopant charge compensates the primary dopant and the amount of selenium that can be introduced into the gallium arsenide crystal during such co-doping is larger than the amount that can be introduced using conventional techniques available at the time.
>
> . . . .
>
> 56. From November 16, 1978 until the time I ceased to work at Philips Laboratories, I did not, directly or indirectly, perform any work on the subject matter of the 1377 Patent Disclosure, nor was I requested or encouraged by my management to perform such work.
>
> . . . .
>
> 77. Based on my understanding of what is described and claimed in ’618 Patent, I am able to state, without reservation, that I did not make any contribution to the invention defined by any of the claims of the ’618 Patent, and that I am, therefore, not an inventor of the invention defined by any of the claims of the ’618 Patent.

2004 Fitzpatrick Aff. ¶¶ 31, 56, 77. "Her idea" in paragraph 31 refers to the concept of "obtaining low-resistivity, p-type zinc selenide crystals, which were known to be hard-to-dope, by co-doping a zinc selenide crystal with phosophorus, as the acceptor dopant, and lithium." Id. ¶ 29.

b. Fitzpatrick's 2008 Deposition and Inconsistencies Therein

Despite Fitzpatrick's unreserved renunciation of any contributions to the '618 Patent in the 2004 Affidavit, Fitzpatrick made several conflicting statements in his subsequent deposition dated June 17, 2008. Bretschneider Decl. Opp'n Motions on Invalidity Defenses Ex. 9, Fitzpatrick Dep. ("2008 Fitzpatrick Dep."). In one passage, Fitzpatrick stated that he was properly named as an inventor of the 1377 Invention Disclosure:

> Q: Did you ever object to being named as an inventor on the 1377 Invention Disclosure?
> A: No.
> Q: Did anyone else object to you being named as an inventor?
> A: No.
> Q: Were you properly named as an inventor on the 1377 invention disclosure?
> A: To the best of my recollection, yes.

2008 Fitzpatrick Dep. 188:4-14. This passage conflicts with paragraphs 56 and 77 of the 2004 Affidavit. First, being "properly named as an inventor on the 1377 invention disclosure," 2008 Fitzpatrick Dep. 188:12-14, is incompatible with "not . . . perform[ing] any work on the subject matter of the 1377 Patent

Disclosure," 2004 Fitzpatrick Aff. ¶ 56. Second, as Fitzpatrick revealed in another part of his deposition, it was his understanding that the 1377 Invention Disclosure was "directed to the same invention that is described in the '618 Patent." 2008 Fitzpatrick Dep. 244:5-9. By stating that he was "properly named" an inventor on the 1377 Invention Disclosure, Fitzpatrick has impliedly admitted that he was an inventor of the '618 Patent because he held the view that the '618 Patent and the 1377 Invention Disclosure were "directed to the same invention." This implied admission also does not sit well with Fitzpatrick's earlier statement that "I am . . . not an inventor of the invention defined by any of the claims of the '618 Patent." 2004 Fitzpatrick Aff. ¶ 77.

Rothschild disputes the existence of these inconsistencies. She argues that the allegation that the 1377 Invention Disclosure and the '618 Patent were "directed to the same invention" is "deliberately vague," and contends that Fitzpatrick's answer does not indicate "anything more than that the 1377 Invention Disclosure and the '618 Patent are 'directed' to a similar objective, namely a doping methodology for improving the conductivity of certain semiconductors." Rothschild's Reply Mem. Section 102(f) Defense at 4.

Later during the deposition, Fitzpatrick admitted (allegedly with the 1377 Invention Disclosure in hand) that paragraph 56 of

the 2004 Affidavit was incorrect. Cree Mem. Opp'n Motions on Invalidity Defenses at 1. The relevant statement is as follows:

> Q: Turning to paragraph 56 [of the 2004 Affidavit], would you agree, now that you've had a chance to review your notebooks, that that statement is incorrect?
> A: Yes.

2008 Fitzpatrick Dep. 241:13-17.

After admitting that the 1377 Invention Disclosure is directed to the same invention that is described in the '618 Patent, and while the next question was pending, the deposition was interrupted to allow Fitzpatrick to speak to his lawyer. After a private discussion with his lawyer, Fitzpatrick resumed his position in the 2004 Affidavit that he made no "intellectual contribution that would be part of the '618 Patent." 2008 Fitzpatrick Dep. 244:10-278:24. The segment is as follows:

> Q: Turning to paragraph 77 of your affidavit, Exhibit 15, would you agree that the statement in paragraph 77 is not correct?
> A: Can I confer with counsel?
> MR. ZIRIN: Sure.
> MR. AYERS: Let me ask --
> Q: Are you worried about a disclosure of attorney-client communications?
> A: No. Not as of the date of this.
> MR. AYERS: I think in those circumstances --
> MR. ZIRIN: He wants to confer with his lawyer.
> MR. AYERS: -- we should have an answer to the question.
> MR. ZIRIN: I think he's entitled to confer with his lawyer, so let's go outside and confer.
> THE VIDEOGRAPHER: It's 6:13 p.m., and we're off the record.
> (A recess was taken.)
> THE VIDEOGRAPHER: It's now 6:19. We're back on the record.
> MR. AYERS: Would you read my question back to Dr. Fitzpatrick.
> (Requested portion of record read.)

> A: No. That statement was correct at the time. That's what I believed at the time. And reviewing the intermediate work that I did in my laboratory notebooks, it did not seem to me that I made any intellectual contribution that would be part of the '618 Patent; and if I did, I was actually a doer, implementer, in the lab, of ideas of Professor Neumark [Rothschild] on this.

Id. at 244:10-278:24

c. Fitzpatrick's 2009 Declaration

Accompanying Rothschild's motion for partial summary judgment on the Section 102(f) defense is a declaration by Fitzpatrick dated October 8, 2009 (the "2009 Declaration"). In the 2009 Declaration, Fitzpatrick stated that "[a]s I have previously stated in my Affidavit of October 25, 2004 and at my deposition, based on my reading and understanding of the '618 Patent I am neither an inventor nor a co-inventor of any of the subject matter claimed in the '618 Patent, including claims 1 and 5." 2009 Fitzpatrick Decl. ¶ 16. Further, Fitzpatrick stated that "I have never asserted to anyone that I am either an inventor or a co-inventor of the subject matter claimed in the '618 Patent, including claims 1 and 5." Id. ¶ 17. Fitzpatrick also stated that "[b]ased on my reading and understanding of the '499 Patent, I do not believe that I am either an inventor or a co-inventor of the subject matter claimed in the '499 Patent, including claims 1 and 10." Id. ¶ 12. In addition, Fitzpatrick denied having ever "asserted to anyone that I am either an inventor or a co-inventor of the subject matter claimed in the '499 Patent, including claims 1 and 10." Id. ¶ 13.

d. Fitzpatrick's 2009 Deposition

According to Rothschild, after she filed the motion for partial summary judgment on Cree's Section 102(f) defense, Cree deposed Fitzpatrick a second time on October 16, 2009 (the "2009 Deposition"). Rothschild's Reply Mem. Section 102(f) Defense at 6. In the 2009 Deposition, Fitzpatrick denied any "scientific contribution" to either the '499 or the '618 Patents. Id.

6. Fitzpatrick's Credibility Justifies Going to Trial

"Clearly, if the credibility of the movant's witnesses is challenged by the opposing party and specific bases for possible impeachment are shown, summary judgment should be denied and the case allowed to proceed to trial." 10A Federal Practice & Procedure Civil § 2726 (3d ed. 2010); see Sartor v. Ark. Natural Gas Corp. 321 U.S. 620, 627 (1994). The inconsistencies between the 2008 Deposition and his statements made elsewhere give rise to a genuine factual issue about Fitzpatrick's credibility as a witness. In addition to the inconsistent statements, Cree also points to another ground of impeachment: personal bias. Specifically, Cree states that Fitzpatrick testified that he is a "friend" of Rothschild (he socializes with her) and he was "pissed off" at Philips for firing him after seventeen years of employment. Cree's Mem. Opp'n Motions on Invalidity Defenses at 10.

Fitzpatrick is a key witness on the issue of joint inventorship because the only individuals with personal knowledge of who truly conceived the inventions and what conversations transpired between them are Rothschild and Fitzpatrick. Accordingly, Fitzpatrick should be examined and cross-examined at trial so the jury can observe his demeanor in order to evaluate his credibility. This alone provides sufficient basis for denying Rothschild's motion for partial summary judgment on Cree's Section 102(f) defense. In addition, the contemporaneous evidence raises its own issues of material fact regarding Fitzpatrick's role in the conception of the inventions.

J. Inequitable Conduct on the '618 Patent

Rothschild moves for partial summary judgment of no inequitable conduct as to the issuance of the '618 Patent [Doc. No. 126], addressing the numerous grounds for such a finding raised by Cree, to wit:

1. Rothschild failed to name Fitzpatrick as a co-inventor;

2. Rothschild did not inform the United States Patent and Trademark Office ("PTO") of her failed experiments;

3. Rothschild failed to disclose the Kroger and Longini references;

4. Rothschild failed to disclose the Zenith Trip Report;

5. Rothschild failed to disclose five n-type ZnSe prior art references;

6. Rothschild failed to disclose the Yasuda article; and

7. Rothschild mischaracterized the Dean, Kun, and Magnea references.

Of the grounds listed above, there are disputes of material fact regarding Rothschild's failure to name Fitzpatrick as a co-inventor and her failure to disclose the Yasuda article. Thus, the motion is denied as to those grounds. The motion is otherwise granted as discussed below.

1. Legal Standard

"Inequitable conduct is a judicially created doctrine designed to prevent fraudulent conduct before the PTO." Regents of Univ. of Cal. v. Dako North America, Inc., No. 05-3955, 2009 WL 1083446, at *18 (N.D. Cal. Apr. 22, 2009). "[I]nequitable conduct includes affirmative misrepresentation of a material fact, failure to disclose material information, or submission of false material information, coupled with an intent to deceive." ESpeed, Inc. v. BrokerTec USA, LLC, 480 F.3d 1129, 1135 (Fed. Cir. 2007) (quoting Pharmacia Corp. v. Par Pharm., Inc., 417 F.3d 1369, 1373 (Fed. Cir. 2005)) (quotation marks omitted). There are two separate elements to proving inequitable conduct: materiality and intent to deceive. Praxair, Inc. v. ATMI, Inc., 543 F.3d 1306, 1313 (Fed. Cir. 2008). Both elements must be shown by clear and convincing evidence. Digital Control, Inc. v. Charles Mach. Works, 437 F.3d 1309, 1313 (Fed. Cir. 2006).

"The first factor, materiality, may be judged by the 'reasonable examiner' standard." Dako North America, Inc., 2009 WL 1083446, at *22. In other words, "[m]ateriality . . . embraces any information that a reasonable examiner would substantially likely consider important in deciding whether to allow an application to issue as a patent." McKesson Information Solutions, Inc. v. Bridge Medical, Inc., 487 F.3d 897, 913 (Fed. Cir. 2007) (quoting Akron Polymer Container Corp. v. Exxel Container, Inc., 148 F.3d 1380, 1382 (Fed. Cir. 1998)) (quotation marks omitted).

As to the second factor, "because direct evidence of deceptive intent is rarely available, such intent can be inferred from indirect and circumstantial evidence." Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 537 F.3d 1357, 1366 (Fed. Cir. 2008). The indirect evidence must itself satisfy the clear and convincing standard. Id. Any "inference must not only be based on sufficient evidence and be reasonable in light of that evidence, but it must also be the single most reasonable inference able to be drawn from the evidence to meet the clear and convincing standard." Id. The Federal Circuit has suggested a three part test for inferring intent: "(1) highly material information is withheld; (2) 'the applicant knew of the information [and] . . . knew or should have known of the materiality of the information; and (3) the applicant has not

provided a credible explanation for the withholding.'" Praxair, Inc., 543 F.3d at 1313-14 (quoting Ferring B.V. v. Barr Labs., Inc., 437 F.3d 1181, 1191 (Fed. Cir. 2006)).

2. The Failed Experiments

In her motion, Rothschild argues that she did not commit inequitable conduct in withholding data of failed attempts to implement the claims of the '618 Patent because she wrote the examples in the patents to make it clear that she had not successfully implemented the claims. Rothschild Mem. Supp. No Inequitable Conduct '618 at 12-13. The Manual of Patent Examining Procedure § 608.01(p) allows "paper examples" or "prophetic examples" that are not phrased in the past tense and the Federal Circuit has recognized this practice as long as the examples are written as required by the manual. See Atlas Powder Co. v. E.I. Du Pont De Nemours & Co., 750 F.2d 1569, 1578 (Fed. Cir. 1984).

Cree argues that the data and results from her failed attempts to make semiconductors using the patented processes were inherently material and that her use of prophetic examples and assertions that the patented processes provide a solution to semiconductor doping problems raise an inference of intent. Cree Mem. Opp'n No Inequitable Conduct at 12.

There are very few cases dealing with prophetic examples in patents. More importantly, there are no cases saying that

despite using properly phrased paper examples, data of failed experiments is inherently material. Cf. Novo Nordisk Pharma., Inc. v. Bio-Tech. Gen. Corp., 424 F.3d 1347, 1359-61 (Fed. Cir. 2005) (holding inventor committed inequitable conduct in writing example in the past tense and failing to inform PTO of failed experiments). Even if this Court were to make such a rule, there is no evidence of an intent to deceive, and it would be improper to infer such an intent simply because Rothschild withheld the data. Therefore, Rothschild's motion for a declaration of no inequitable conduct for withholding data of failed experiments is allowed.

3. The Kroger and Longini References

Rothschild argues that she cannot be found to have committed inequitable conduct in prosecuting the '618 Patent because the specification discloses the existence of prior art for the concepts taught in Compounds Containing Two Types of Foreign Atoms, in The Chemistry of Imperfect Crystals 716 (F.A. Kroger ed., North-Holland Publishing Co. 1964) (the "Kroger Chapter") and R.L. Longini et al., Ionization Interaction between Impurities in Semiconductors and Insulators, 102 Phys. Rev. 992 (1956) (the "Longini Article"). Rothschild Mem. Supp. No Inequitable Conduct '618 at 14. Even though Rothschild did not specifically refer to the Kroger Chapter or Longini Article in her application, the specification of the patent discloses that,

"[a]s is also known, the solubility of a donor or an acceptor at a given temperature will increase with an increase in concentration of compensating species so that, in effect, compensation increases the solubility of a dopant." Id.; '618 Patent col.2 ll.1-5.

a. Materiality

Cree agrees that the Kroger Chapter and Longini Article could be considered the "known" sources for that point, explaining that the section Rothschild quotes from her patent teaches that "the solubility of one type of dopant can be increased by introduction of a compensating species," as is taught in Kroger and Longini. Cree Mem. Opp'n. No Inequitable Conduct at 17. Cree contends, however, that the Kroger Chapter also discloses the important first step of Claim 1 of introducing "**substantially equal amounts** of two dopants having opposite charges to increase the solubility of one or both." Id. Similarly, Cree argues that the Longini Article refers to donors and acceptors of "uniform concentrations." Id. Cree argues that this distinction is important because Rothschild has asserted during prosecution and in this litigation that "the introduction of 'substantially equal amounts' of co-dopants into the crystal was the 'critical' and 'important thing about her alleged invention." Id. According to Cree, the references were thus material to her invention. Rothschild disputes that either

reference teaches introducing "substantially equal amounts" of co-dopants. Reply Supp. No Inequitable Conduct '618 at 12.

The references would be material and non-cumulative only if they teach the use of "substantially equal amounts" of co-dopants. Cree supports this argument with an expert report that points to specific quotes in the articles. Based on that report, it appears that there is a material dispute as to whether the Kroger Chapter teaches "substantially equal amounts." Cree's expert, however, never stated that the Longini Article teaches "substantially equal amounts." Bretschneider Decl. Opp'n No Inequitable Conduct ¶¶ 102, 104. There is insufficient evidence to establish that the Longini Article was material, thus there was no inequitable conduct in failing to disclose that article.

b. Intent

To establish intent, Cree cites evidence to show that Rothschild was aware of these references: the 1377 Invention Disclosure that she filed at Philips which references the entire Kroger textbook and an entry in her laboratory notebook dated shortly before the filing of the '618 Patent which cites the Longini article. Cree Mem. Opp'n No Inequitable Conduct at 16. To show that Rothschild knew that the issue presented in the prior art references was highly material, Cree argues that Rothschild believed that the issue of "substantially equal amounts" of co-dopants was an important element of the invention

as evidenced by the prosecution record. Id. at 18. Thus, Cree argues that the evidence shows that Rothschild knew of these references and knew that their teachings, as ascribed by Cree, were the critical aspect of her invention, demonstrating that she intentionally withheld the references with an intent to deceive. Id.

Cree, however, cannot establish that Rothschild knew of the materiality of the references. The Court held supra that there is insufficient evidence to establish that the Longini Article was material, and thus there is insufficient evidence that Rothschild "knew" of its materiality. As to the Kroger Chapter, the only evidence that Cree submitted to show that Rothschild knew of the Kroger Chapter is the reference to the entire textbook on the 1377 Invention Disclosure. It is not clear from that reference whether Rothschild was familiar with the chapter identified by Cree as teaching "substantially equal amounts" of co-dopants or whether Rothschild understood that chapter to teach the concept of "substantially equal amounts" of co-dopants. In fact, Rothschild disputes that the Kroger Chapter teaches introducing "substantially equal amounts" of co-dopants. Reply Supp. No Inequitable Conduct '618 at 12. As there is no evidence that Rothschild knew of the materiality of the Kroger Chapter and the evidence is insufficient to establish that Rothschild should have known of the materiality of the Kroger Chapter, Cree cannot

establish inequitable conduct for Rothschild's failure to disclose the Kroger Chapter. Thus, Rothschild's motion is allowed as to both references.

4. The Zenith Trip Report

As part of the first example described in the '618 Patent, Rothschild discloses that a "suitable procedure is to heat the slice in the range between 600°C.-1000°C. in [sic] zinc vapor together with either indium gallium, or thallium as suggested in [the Kun (1982) article]." '618 Patent col.3 ll.56-62. The parties dispute whether the article, Z.K. Kun, The Variation of Residual Impurities in ZnSe Crystals Used in Light-Emitting Diode Fabrications, 53 Journal of Applied Physics 1248 (Feb. 1982) (the "Kun Article"), which was identified in the patent, teaches this method. Cree contends that Rothschild learned this concept through a report she received while at Philips, entitled "Trip Report – Discussions on Zinc Sulfo-Selenide Light Emitting Diodes with R. Robinson and Z. Kun, Zenith Corporation, Chicago, Illinois, September 8, 1975" (the "Zenith Trip Report") and that her failure to disclose that report constitutes inequitable conduct because the result was a lack of enablement. Cree Mem. Opp'n No Inequitable Conduct at 15. Rothschild argues that she was free to advocate a particular interpretation of the Kun Article referenced in the patent. Rothschild Mem. Supp. No Inequitable Conduct '618 at 16; see Innogenetics, N.V. v. Abbott

Labs., 512 F.3d 1363, 1379 (Fed. Cir. 2008) ("[A]n applicant is free to advocate its interpretation if its claims and the teachings of prior art."). Moreover, since she believed the Kun Article taught the procedure, the Zenith Trip Report would have been cumulative. Id. at 17. Finally, she argues that the concept at issue is not her claimed invention and thus, the Zenith Trip Report was not material to her patent. Id.

Even if this reference were material, Cree has not presented any evidence of intent to defraud the PTO. Rothschild did not claim that she invented the procedure as part of her patent; at most she merely cited the wrong source. The fact that she attributed the method to someone else, even if it was the wrong attribution, does not suggest an intent to deceive. The motion for summary judgment of no inequitable conduct for the '618 Patent is allowed as to this issue.

5. The Five n-type ZnSe Prior Art References

Rothschild seeks summary judgment declaring no inequitable conduct in failing to disclose five n-type ZnSe prior art references identified by Cree's expert. In support of this motion, Rothschild principally argues that these references were not material because they discuss the formation of n-type ZnSe, which is easy to dope. Rothschild Mem. Supp. No Inequitable Conduct '618 at 18. In addition, Rothschild argues that the prior art references were not material because they do not

discuss co-doping. Id. at 19. Finally, she asserts that these references are cumulative of U.S. Patent No. 4,422,888 (the ’888 patent), which was referenced as prior art to the patent examiner. Reply Supp. No Inequitable Conduct ’618 at 14; Shealy Rebuttal Supp. No Inequitable Conduct ’618 ¶¶ 13, 15-16. One of the articles was written by the inventor of the ’888 patent and shares significant text and figures. Reply Supp. No Inequitable Conduct ’618 at 14; Shealy Rebuttal Supp. No Inequitable Conduct ’618 ¶¶ 15. Cree counters that Rothschild cited these prior art references as “prior accidental uses of her patent-pending methods” in descriptions of her experiments for publications and grant proposals, and thus she must have considered the references material. Cree Mem. Opp’n No Inequitable Conduct at 18-19.

Based on the “reasonable examiner” standard, it is unlikely that these references were material to her patent application. The evidence submitted by Cree involved experiments Rothschild was conducting to make n-type ZnSe. Reply Supp. No Inequitable Conduct ’618 at 13. Were Rothschild seeking funding for research on ZnTe or diamond, she would have referenced articles discussing research on those semiconductors. In her patent application for a process covering all types of wide-band gap semiconductors, she was not required to reference every article describing how to make a wide-band gap semiconductor. Even if these particular articles were important to her patent because they accidentally

used the patent-pending process, they were not material because they were cumulative of prior art before the examiner. See Larson Mfg. Co. Of S.D., Inc. v. Aluminart Prods. Ltd., 559 F.3d 1317, 1327 (Fed. Cir. 2009) ("[A] withheld otherwise material reference is not material if it is merely cumulative to, or less relevant than, information already considered by the examiner.").

6. The Dean, Kun, and Magnea References

Rothschild requests that this Court rule that Cree cannot raise the issue of inequitable conduct based on Rothschild's alleged misrepresentations of the teachings of three articles in the '618 Patent: (1) P.J. Dean et al., Ionization Energy of the Shallow Nitrogen Acceptor in Zinc Selenide, 27 Physical Review B 2419 (Feb. 15, 1983) (the "Dean Article"); (2) the Kun Article; and (3) N. Magnea et al., SEM and Photoluminescence Study of Li Segregation in Annealed Zinc Telluride, 29 Solid State Comm. 35 (1979) (the "Magnea Article"). Rothschild Mem. Supp. No Inequitable Conduct '618 at 21. Cree argues that the paper examples in the '618 Patent rely on the Dean, Kun, and Magnea Articles, yet none of the articles disclose the methods that Rothschild claimed they disclosed. Cree Mem. Opp'n No Inequitable Conduct at 13. Thus, Rothschild committed inequitable conduct by affirmatively misrepresenting the material facts. ESpeed, Inc., 480 F.3d at 1135 ("[I]nequitable conduct

includes affirmative misrepresentation of a material fact, failure to disclose material information, or submission of false material information, coupled with an intent to deceive.”). In support of her motion, Rothschild argues that she is entitled to advocate her own interpretations of prior art to the examiner. Rothschild Mem. Supp. No Inequitable Conduct ’618 at 21; see Innogenetics, 512 F.3d at 1379.

Cree did not submit any evidence of an intent to deceive the PTO. Moreover, it is difficult to infer intent because Rothschild did not claim credit for those ideas, even if she credited the wrong sources. Thus, Rothschild’s motion is allowed on this issue.

K. Inequitable Conduct as to the ’499 Patent

Rothschild also moves for partial summary judgment declaring no inequitable conduct as to the ’499 Patent [Doc. No. 114] based on numerous grounds raised by Cree, to wit:

1. Rothschild failed to name Fitzpatrick as a co-inventor;

2. Rothschild did not inform the PTO of her failed experiments;

3. Rothschild failed to disclose the Zenith Trip Report;

4. Rothschild failed to disclose the Yasuda article; and

5. Rothschild mischaracterized the Pearton, Stucheli, and Boudoukha references.

Of the grounds listed above, there are disputes of material fact regarding Rothschild's failure to name Fitzpatrick as a co-inventor. Thus, the motion is denied on that ground. The motion is otherwise granted as discussed below.

1. The Failed Experiments

This motion is allowed as to this argument for the reasons stated in Section III.J.2. above.

2. The Zenith Trip Report

Rothschild argues that her failure to disclose the Zenith Trip Report in her prosecution of the '499 Patent was not inequitable conduct because it was not material to the '499 Patent. Rothschild Mem. Supp. No Inequitable Conduct '499 at 12. Cree does not dispute this point. Thus, this argument in Rothschild's motion for summary judgment of no inequitable conduct as to the '499 Patent is allowed.

3. The Yasuda Article

Although Cree submitted sufficient evidence to raise issues of material fact regarding inequitable conduct in withholding the Yasuda reference on the '618 Patent, it did not submit any evidence related to the '499 Patent. Thus, Rothschild's motion of no inequitable conduct for failing to submit the Yasuda reference in her application for the '499 Patent is allowed.

4. The Pearton, Stucheli, and Boudoukha References

Rothschild argues that Cree should not be allowed to raise the issue of inequitable conduct regarding her supposed misrepresentation of three references submitted as prior art during the ’499 Patent prosecution: (1) the Pearton Article; (2) the Stucheli Article; and (3) A. Boudoukha et al., Properties of Nitrogen Acceptor in CdTe: Energy Spectrum and Interaction with Hydrogen, 72 J. of Crystal Growth 226 (1985) (the “Boudoukha Article”). Rothschild Mem. Supp. No Inequitable Conduct ’499 at 16.

Cree argues that Rothschild did not disclose the full relevance of the Pearton Article or Boudoukha Article, and represented that the Stucheli Article did not discuss co-doping with an “acceptor type dopant” and atomic hydrogen when her laboratory notebook stated the opposite, Cree Mem. Opp’n No Inequitable Conduct at 15. In responding to Cree’s arguments, Rothschild points out that the Pearton Article did not disclose introducing atomic hydrogen during crystal growth as Cree would have it. Rothschild’s Reply Mem. Supp. No Inequitable Conduct ’499 at 14-15. For the reasons discussed supra in Section III.G., this Court agrees with Rothschild on the Pearton Article. As to the Stucheli Article, Cree’s assertion that Rothschild’s speculation in her laboratory notebook regarding the formation of atomic hydrogen during Stucheli’s experiments does not establish that the Stucheli Article discloses the presence of atomic

hydrogen during or after growth. Id. at 15. Finally, as to the Boudoukha Article, again while Rothschild may have speculated about what occurred during the underlying research, the article itself does not discuss the removal of atomic hydrogen as Cree argues. Id. at 16.

In addition, Cree did not submit any evidence of an intent to deceive the PTO, but suggests that intent can be inferred from a pattern of mischaracterizing and omitting material information. Id. at 16. To make such an inference, the prior art needs to be highly material and the mischaracterization blatant. See Depomed, Inc. v. Ivax Corp., 532 F. Supp. 2d 1170, 1187 (N.D. Cal. 2007) ("In a case such as this, where Depomed did disclose prior art, any misrepresentation of the prior art must be blatant . . . because the very fact of voluntary disclosure undercuts Ivax's allegation of deceptive intent."). As discussed, there is not enough evidence here to establish mischaracterizations of the articles, let alone blatant mischaracterizations to establish deceptive intent. Thus, Rothschild's motion of summary judgment of no inequitable conduct for misrepresenting disclosed prior art in the '499 Patent application is allowed.

L. Infringement

Rothschild alleges that the methods Cree uses to manufacture its gallium nitride-based LEDs infringe Claims 1 and 4 of the '618 Patent and Claims 10, 12, and 16 to 20 of the '499 Patent.

Cree moves for summary judgment that it does not infringe any asserted claim of the ’618 and ’499 Patents. Cree Mot. Non-infringement [Doc. No. 101].

1. Legal Standard

Infringement analysis involves two steps: (1) claim construction to determine the scope and meaning of the asserted claims, which is determined by the Court as matter of law, and (2) a comparison of the properly construed claims with the allegedly infringing device to determine whether it embodies every limitation of the claims - a question of fact for the jury. Markman, 517 U.S. at 384; IMS Tech, Inc. v. Haas Automation, Inc., 206 F.3d 1422, 1429 (Fed. Cir. 2000).

2. Being the Topmost Layer, the Mg-Doped GaN Layer is not a “Substrate”

The twenty-one accused processes make devices containing p-type GaN and AlGaN layers in Cree’s LEDs. Cree Infringement 56.1 Statement ¶ 8. All twenty-one accused processes involve growing a GaN layer on top of an AlGaN layer. Ladow Decl. Opp’n Non-infringement Ex. 1, Shealy Op. (“Shealy Op.”), ¶ 14 (“I identified a p-AlGaN layer and a p-GaN layer in each of the . . . recipes I reviewed”). Cree Infringement 56.1 Statement ¶ 25 (referring to “Mg-doped AlGaN layer upon which the accused Mg-doped GaN layer is grown”). For all twenty-one accused processes, Rothschild asserts that both the AlGaN layer and the GaN layer that is grown on top of the AlGaN layer are infringing.

Cree Reply Supp. Non-infringement at 4 (“As [Rothschild] correctly states, [she] accused two separate layers in each of Cree's 21 accused processes of alleged infringement – an aluminum gallium nitride (AlGaN) layer and a gallium nitride (GaN) layer.”). It is also undisputed that in twenty of the twenty-one accused processes (Recipe Nos. 1-3, 5-21) the Mg-doped GaN layer is the final layer grown epitaxially. Cree Reply Mem. Supp. Non-infringement at 13; Rothschild Counterstatement Facts ¶¶ 23-24. With respect to Recipe No. 4, there is a third epitaxial layer on top of the Mg-Doped GaN layer. Rothschild Mem. Opp’n Non-infringement at 20.

Having rejected Rothschild’s contention that “semiconductor substrate” in Claim 10 of the ’499 Patent should be defined as “the semiconductor material of interest,” this Court applies Judge Conner’s initial construction to the topmost GaN layer in Recipe Nos. 1 to 3 and 5 to 21. The GaN layer does not fall within the definition of “substrate” because no epitaxial layer is grown on top of it. See Rothschild I at *12. Rothschild also concedes that the Mg-doped GaN layer made by twenty of the twenty-one accused processes does not infringe. Rothschild Mem. Opp’n Non-infringement at 20 n.21 (“With respect to the remaining p-type GaN layers that have no epitaxial layer on top of them, those layers would not meet the Court’s present construction . . . .”). This Court rules that with respect to the twenty of the

twenty-one accused processes in which the GaN layer is the final layer grown epitaxially, that layer is not a "substrate." This does not mean, however, that the twenty accused processes can never literally infringe the '499 Patent because the jury may find that the **AlGaN layer in all twenty-one accused processes** falls within the definition of "substrate." Accordingly, this part of Cree's motion is denied.

3. Whether Cree's Accused Processes Introduce Infringing Quantities of Co-Dopants

a. The "Substantially Equal Amounts" Element of the '618 Patent

Based on the parties' agreed construction of "substantially equal amounts" in Claim 1 and Claim 5 of the '618 Patent (the only independent claims), Rothschild must prove that each of Cree's accused methods introduce "approximately equal molar quantities" of atomic hydrogen and Mg into the crystal. Rothschild I at *3. Cree argues that the quantities of atomic hydrogen and Mg introduced into the accused processes are not "approximately equal." Cree Mem. Supp. Non-infringement at 14.

Secondary Ion Mass Spectrometry ("SIMS") chemical analyses were conducted for an as-grown (unannealed) wafer made using one of the accused processes (Recipe No. 21). Rothschild Mem. Opp'n Non-infringement at 8. According to Cree's interpretation of the test results, the Mg concentration is at least three-times higher than the atomic hydrogen concentration. Id. at 12; Rothschild

Mem. Opp'n Non-infringement at 12. Shealy re-interprets the data and opines that the Mg concentration is only 1.5 times higher than the atomic hydrogen concentration. Rothschild Mem. Opp'n Non-infringement at 11-12. Despite the factual dispute about the relative quantities of atomic hydrogen and Mg, Cree argues that this motion is still ripe for summary judgment because, even under Shealy's re-interpretation, there can be no infringement because 1.5 times more Mg than atomic hydrogen is far from "approximately equal." Cree Mem. Supp. Non-infringement at 2.

The parties' agreed construction of "substantially equal amounts" meaning "approximately equal molar quantities" is inherently imprecise. "The trier of fact must determine the scope of an imprecise phrase such as 'substantially equal to,' which, by its very nature, has a fact-dependent meaning." Seattle Box Co., Inc. v. Industrial Crating & Packing, Inc., 731 F.2d 818, 829 (Fed. Cir. 1984). By deliberately agreeing to a "fact-dependent" and non-self-contained definition for "substantially equal," Rothschild and Cree have invited the jury to apply the "approximately equal molar quantities" definition to the facts, based on evidence on how a person skilled in the art would understand the scope of that term in the technological context. The evidence submitted to the Court demonstrates that the parties disagree on that question. Compare Shealy Op. at ¶ 112 (citing specific comments made by other researches

demonstrating that "substantially equal" has a wide spectrum of definitions); with 2008 Fitzpatrick Dep. 97:7-16 (explaining substantially equal to mean "amounts will be so close that they would probably be within the measurement error within about 10 percent or so"). Thus, Cree's motion for summary judgment on this issue is denied.

b. The "Effective Amount" Element of the '499 Patent

To prove infringement of Claim 10 of the '499 Patent, Rothschild must show that Cree's processes include co-doping with an "effective amount" of atomic hydrogen "to act as a compensator" of Mg. The parties agreed to define "effective amount" as "a quantity sufficient to produce the recited result." Rothschild I at *8. Although Judge Conner did not define the "recited result," based on the linguistic structure of Claim 10, the term seems to refer to the formation of a "low resistivity semiconductor from a wide band-gap semiconductor substrate that has a tendency to become compensated when it is doped." See '499 Patent col.6 l.63-col.7 l.6.

A "quantity sufficient to produce the recited result" is inherently imprecise and even more fact-dependant than "approximately equal," which at least centers around the precise concept of equality. See Seattle Box, 731 F.2d at 829. The non-self-contained definition of "effective amount" is a clear

invitation for expert opinion to be presented on the quantity sufficient to produce the desired result in any particular situation. Whether the quantity of atomic hydrogen introduced during Cree's accused processes is "sufficient to produce the recited result" is matter of fact, not matter of law.

In the particular context of one of Cree's accused processes, Shealy concluded that based on what is known about the chemical and thermodynamic processes in growing p-type GaN-based material by MOCVD, and in view of the source gases used by Cree and the relevant temperatures used, there is an effective amount of atomic hydrogen in Cree's processes to compensate Mg atoms and block other compensators. Shealy Opening Rep. ¶¶ 71, 77. Cree disagrees. Accordingly, summary judgment is denied upon this issue.

4. Whether the "Selectively Doping" Limitation is Present in the Accused Processes

As has already been mentioned, the parties largely agree on the definition of "selectively doping" but disagree on whether this limitation is present in the accused processes. Cree's infringement expert, Casey, states that since the source of atomic hydrogen, ammonia gas, is never turned "off" during crystal growth but is always "on," it is "physically impossible to be 'selective' about atomic hydrogen creation let alone incorporation into the crystal lattice." Ladow Decl. Opp'n Invalidity Ex. 3, Casey Rebuttal Rep. ¶ 168. Cree emphasizes

that its processes do not control, regulate, or monitor the generation of atomic hydrogen. In contrast, Rothschild's expert, Shealy, says that Cree's processes regulate the volume flow rate of ammonia gas, and thereby control the generation of atomic hydrogen. Shealy Dep. 73:22-74:6 ("[Cree] use[s] mass flow controllers to control, the same way everybody does, they use mass flow controllers to control precisely the volume flow rate of ammonia gas into the chamber. So that regulates the Group V component and it regulates the introduction of atomic hydrogen simultaneously."). As Shealy further explains, the source gas must be "on" throughout the whole process because "[y]ou can't grow the crystal without it." Id. at 75:7-10.

Cree also argues that selective doping is not practiced in the accused processes because atomic hydrogen is found everywhere, not just in select portions. Cree Mem. Law Opp'n Mot. Clarify Claim Construction at 15 ("atomic hydrogen is a contaminant present not just in the magnesium-doped GaN-based layers, but other epitaxial layers (e.g., doped and undoped semiconductor layers not accused of infringement) as well"). Shealy offered a convincing explanation for this phenomenon. As Shealy explained, although there is no way to prevent incorporation of atomic hydrogen into other layers during MOCVD growth, its concentration in different portions of the structure is very different. Shealy Dep. 76:10-17 ("It's quite likely that

there's atomic hydrogen, it's on the surface throughout. It has to be on the growth surface throughout or the process doesn't work. And given that [atomic hydrogen is] on the growth surface and it has a large diffusivity, it's going to be present in all layers."); see also id. at 220:18-20 ("[Atomic hydrogen is] very concentrated in those p-type layers. It's very dilute everywhere else. That, to me, fits the definition of selective doping."). The contrary views presented by the parties' experts give rise to a genuine issue of material fact as to whether the "selectively doping" limitation is present in the accused processes. Since there is a dispute over a material fact, summary judgment on this issue is denied.

IV. Conclusion

Cree's motion to dismiss for lack of standing [Doc. No. 122] is denied.

In relation to Rothschild's motion to clarify certain construction issues as to the '499 Patent [Doc. No. 139] this Court rules that: (1) the meaning of "selectively doping" does not need to be clarified; (2) Judge Conner's definition of "substrate" as "an underlying base on which an epitaxial layer is grown" is accurate and will be followed; and (3) Judge Conner's definition of "substrate" does not carry any mechanical support or thickness requirements.

This Court will not read the limitation “hard-to-dope” into the term “wide band gap semiconductor” in Claim 1 of the ’618 Patent [Doc. No. 212].

Cree’s motion for summary judgment of patent invalidity [Doc. No. 103] is denied as to both the ’618 Patent and the ’499 Patent.

Rothschild’s motion for partial summary judgment on the issue of lack of anticipation of Claims 1 and 4 of the ’618 Patent based on the Crowder reference [Doc. No. 97] is denied.

Rothschild’s motion for summary judgment of no anticipation of Claim 10 of the ’499 Patent based on the Pearton reference [Doc. No. 129] is granted.

Rothschild’s contingent motion for partial summary judgment of no anticipation of Claims 10, 12, and 16 of the ’499 Patent based on the Jacob, Ohki, and Stucheli References [Doc. No. 134] is granted.

Rothschild’s motion for partial summary judgment on Cree’s 35 United States Code Section 102(f) defense [Doc. No. 119] is denied.

In relation to Rothschild’s motion for partial summary judgment of no inequitable conduct with respect to the issuance of the ’618 Patent [Doc. No. 126], there are disputes of material fact regarding Rothschild’s failure to name Fitzpatrick as a co-inventor and her failure to disclose the Yasuda article.

Thus, the motion is denied on those grounds. The motion is granted on all other grounds.

In relation to Rothschild's motion for partial summary judgment of no inequitable conduct with respect to the issuance of the '499 Patent [Doc. No. 114], there are disputes of material fact regarding Rothschild's failure to name Fitzpatrick as a co-inventor. Thus, the motion is denied on that ground. The motion is granted on all other grounds.

In relation to Cree's motion for summary judgment of non-infringement of the '618 and '499 Patents [Doc. No. 101], this Court rules that with respect to twenty of the twenty-one accused processes in which the **GaN** layer is the final layer grown epitaxially, that layer is not a "substrate." This does not mean, however, that the twenty accused processes can never literally infringe the '499 Patent because the jury may still find that the **AlGaN** layer falls within the definition of "substrate." Cree's motion is denied on all other grounds.

SO ORDERED.

/s/ William G. Young
WILLIAM G. YOUNG
DISTRICT JUDGE