IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

PRESIDENT AND FELLOWS OF HARVARD COLLEGE,	:	
Plaintiff,	:	
v.	:	C.A. No. 17-1729-LPS-SRF
MICRON TECHNOLOGY, INC.,	:	
Defendant.	:	

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MEMORANDUM OPINION

January 26, 2018
Wilmington, Delaware

STARK, U.S. District Judge:

Plaintiff President and Fellows of Harvard College ("Harvard") brought this patent infringement suit against Defendant Micron Technology, Inc. ("Micron"), alleging that Micron's manufacture and sale of certain DRAM devices infringe Harvard's U.S. Patent Nos. 6,969,539 (the "'539 Patent") and 8,334,016 (the "'016 Patent"). (*See generally* D.I. 50) The asserted patents generally relate to "processes and materials for deposition of thin films that contain metal oxides, silicates, metal phosphates, or silicon dioxide" for microelectronics. (D.I. 50 at 3-4) Such processes are known as atomic layer deposition ("ALD"). (*Id.* at 4)

Presently before the Court is the issue of claim construction. The parties submitted technology tutorials (*see* D.I. 206, 210), claim construction briefs (*see* D.I. 111, 112, 124, 126), and expert declarations (*see* D.I. 111-1, 115, 125, 128). The Court held a claim construction hearing on January 9, 2018, at which both sides presented oral argument. (*See* D.I. 217 ("Tr.")) Per the Court's request, following the claim construction hearing, the parties submitted a joint letter with updated positions on their respective proposed claim constructions. (*See* D.I. 215)

I. LEGAL STANDARDS

The ultimate question of the proper construction of a patent is a question of law. *See Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 837 (2015) (citing *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 388-91 (1996)). "It is a bedrock principle of patent law that the claims of a patent define the invention to which the patentee is entitled the right to exclude." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (internal quotation marks omitted).

"[T]here is no magic formula or catechism for conducting claim construction." *Id.* at 1324. Instead, the Court is free to attach the appropriate weight to appropriate sources "in light

of the statutes and policies that inform patent law." *Id.*

"[T]he words of a claim are generally given their ordinary and customary meaning [which is] the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Id.* at 1312-13 (internal citations and quotation marks omitted). "[T]he ordinary meaning of a claim term is its meaning to the ordinary artisan after reading the entire patent." *Id.* at 1321 (internal quotation marks omitted). The patent specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996).

While "the claims themselves provide substantial guidance as to the meaning of particular claim terms," the context of the surrounding words of the claim also must be considered. *Phillips*, 415 F.3d at 1314. Furthermore, "[o]ther claims of the patent in question, both asserted and unasserted, can also be valuable sources of enlightenment . . . [b]ecause claim terms are normally used consistently throughout the patent." *Id.* (internal citation omitted).

It is likewise true that "[d]ifferences among claims can also be a useful guide. . . . For example, the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim." *Id.* at 1314-15 (internal citation omitted). This "presumption is especially strong when the limitation in dispute is the only meaningful difference between an independent and dependent claim, and one party is urging that the limitation in the dependent claim should be read into the independent claim." *SunRace Roots Enter. Co., Ltd. v. SRAM Corp.*, 336 F.3d 1298, 1303 (Fed. Cir. 2003).

It is also possible that "the specification may reveal a special definition given to a claim

term by the patentee that differs from the meaning it would otherwise possess. In such cases, the inventor's lexicography governs." *Phillips*, 415 F.3d at 1316. It bears emphasis that "[e]ven when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using words or expressions of manifest exclusion or restriction." *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1372 (Fed. Cir. 2014) (quoting *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004)) (internal quotation marks omitted).

In addition to the specification, a court "should also consider the patent's prosecution history, if it is in evidence." *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 980 (Fed. Cir. 1995), *aff'd*, 517 U.S. 370 (1996). The prosecution history, which is "intrinsic evidence," "consists of the complete record of the proceedings before the PTO [Patent and Trademark Office] and includes the prior art cited during the examination of the patent." *Phillips*, 415 F.3d at 1317. "[T]he prosecution history can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be." *Id.*

In some cases, "the district court will need to look beyond the patent's intrinsic evidence and to consult extrinsic evidence in order to understand, for example, the background science or the meaning of a term in the relevant art during the relevant time period." *Teva*, 135 S. Ct. at 841. Extrinsic evidence "consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises." *Markman*, 52 F.3d at 980. For instance, technical dictionaries can assist the court in determining the meaning of a

term to those of skill in the relevant art because such dictionaries "endeavor to collect the accepted meanings of terms used in various fields of science and technology." *Phillips*, 415 F.3d at 1318. In addition, expert testimony can be useful "to ensure that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field." *Id.* Nonetheless, courts must not lose sight of the fact that "expert reports and testimony [are] generated at the time of and for the purpose of litigation and thus can suffer from bias that is not present in intrinsic evidence." *Id.* Overall, while extrinsic evidence "may be useful" to the court, it is "less reliable" than intrinsic evidence, and its consideration "is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence." *Id.* at 1318-19. Where the intrinsic record unambiguously describes the scope of the patented invention, reliance on any extrinsic evidence is improper. *See Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1308 (Fed. Cir. 1999) (citing *Vitronics*, 90 F.3d at 1583).

Finally, "[t]he construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be, in the end, the correct construction." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998). It follows that "a claim interpretation that would exclude the inventor's device is rarely the correct interpretation." *Osram GmbH v. Int'l Trade Comm'n*, 505 F.3d 1351, 1358 (Fed. Cir. 2007) (quoting *Modine Mfg. Co. v. U.S. Int'l Trade Comm'n*, 75 F.3d 1545, 1550 (Fed. Cir. 1996)).

II. CONSTRUCTION OF DISPUTED TERMS[1]

A. "the metal oxide film covers an aspect ratio over 40"[2]

Harvard "the metal oxide is formed inside a hole, trench, or other structure, such that the coated hole, trench, or other structure has a ratio of length to width over 40"
Micron "the metal oxide film covers a surface structure having a ratio of height to diameter or height to width over 40, as measured before the metal oxide film forming process begins"
Court "the metal oxide film covers a surface structure having a ratio of height to diameter or height to width over 40, as measured before the metal oxide film forming process begins"

The parties' dispute centers around whether the aspect ratio of a structure (e.g., a hole or a trench) in the surface of a substrate is measured before the metal oxide film forming process begins (i.e., measured without the film), as Micron asserts, or is instead measured at the end of deposition (i.e., measured with the film), as Harvard asserts. (*See* D.I. 111 at 10; D.I. 112 at 9)

Micron argues that the claim language itself "unambiguously dictates that the 'aspect ratio' refers to the dimensions of the structure before it is coated, not after," because otherwise "the metal film nonsensically 'covers' itself." (D.I. 112 at 9) At the hearing, Micron further explained that "the metal oxide film is referring to all of the layers" and "the key here is that . . . all the layers cover something," which "has to be referring to what is underneath it," that is, the uncoated hole or trench. (Tr. at 23-24) Harvard counters that since the aspect ratio is "ever increasing" with every new layer of deposited film, the aspect ratio must be measured at the end

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[1]The parties have agreed to certain constructions, all of which the Court will adopt. (*See generally* D.I. 111 at 8-9)

[2]This term appears in claim 31 of the '539 Patent.

of the deposition process. (*See* D.I. 111 at 10; D.I. 124 at 12; Tr. at 14-17)

The Court agrees with Micron that a person of ordinary skill in the art ("POSA")[3] would understand from the patent that the aspect ratio is to be measured before the deposition process begins, in part because such a POSA would understand that the patent intends "aspect ratio" to be a single figure, not a variable that changes constantly throughout the deposition process. Harvard's construction could be correct if the claim language read "the metal oxide film ***has*** an aspect ratio over 40," but it does not.

The specification supports Micron's construction. (*See, e.g.*, '539 Patent at col. 2:30-32 ("Another advantage of the invention is its ability to make conformal coatings over substrates with narrow holes, trenches or other structures."); *id.* at col. 20:4-11 (comparing invention's success of achieving "highly uniform films . . . even in holes with very high aspect ratio[]s (over 40)" with prior art which did not succeed in uniform deposition "in holes with such high aspect ratios"); *id.* at col. 27:35-38 ("uniform films could be deposited inside holes with ratios of length to diameter over 50")) Each of the statements in the patent specification discussing aspect ratio refers to measurements of the uncoated structure.

[3]While the parties disagree as to the qualifications of a POSA, they agree that resolution of that dispute does not impact the claim construction disputes. (*See* Tr. at 26) Accordingly, the Court need not today determine the identity of a POSA.

B. "wherein deposition of the first reactant component and the second reactant component are self-limiting"[4]

Harvard "wherein each of the reactant components is reactive with the surface, but does not react with itself or its deposits, to achieve saturation"
Micron "wherein each of the reactant components is reactive with the surface, but does not react with itself or its deposits"
Court "wherein each of the reactant components is reactive with the surface, but does not react with itself or its deposits"

In their opening claim construction briefs, Harvard initially proposed construing the claim term "self-limiting" as "capable of achieving saturation of a surface reaction" (D.I. 111 at 12), and Micron proposed construing the fuller claim limitation – "wherein deposition of the first reactant component and the second reactant component are self-limiting" – as "wherein the growth of the first reactant component layer and the second reactant component layer terminates in the presence, respectively, of unreacted first reactant component and unreacted second reactant component" (D.I. 112 at 15). At the claim construction hearing, the parties appeared to agree on certain fundamental characteristics of the meaning of "self-limiting." In particular, the parties both agreed with Harvard's expert, Dr. Wayne Gladfelter, that for deposition to be self-limiting, "the reactant component must be reactive with the surface, but it cannot react with itself or its deposits." (*See, e.g.*, Tr. at 42, 64-66) Hence, the Court directed the parties to meet and confer and propose alternative constructions to the Court. (*See* Tr. at 73-74)

Following the claim construction hearing, the parties narrowed their dispute to one issue:

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[4]This term appears in claim 1 of the '016 Patent.

whether the construction of "self-limiting" should include the concept of having the ability to achieve saturation. (*See* D.I. 215 at 2-3) Harvard argues that the construction should include reference to saturation, which occurs when a present reactant has reacted with all sites on the substrate's surface and, thereafter, does not continue to react (and the metal oxide film does not continue to grow). (*See generally* D.I. 124 at 5-7) Harvard explains that as all available surface sites are reacted with, the growth curve (measuring the thickness of the film) theoretically approaches zero growth, but since the reactants are volatile materials, there will be incidental reactions, so the growth curve will never actually reach absolute zero. (*See* Tr. at 10-11 ,31-33, 37-38) Harvard argues that this is different from continuous growth, as occurs in chemical vapor deposition ("CVD"), which is outside the scope of the claims. (*See* Tr. at 63-64) Harvard urges the Court to include the concept of having the ability to achieve saturation in the construction of "self-limiting" to account for the fact that in real-world situations, the growth curve would never actually reach zero, yet still a POSA would understand the surface to be saturated and the materials to be self-limiting. (*See, e.g.*, Tr. at 31-34)

Micron argues that inclusion of the concept of saturation would be confusing to the jury, because a film that is growing through decomposition, which the parties agree is not self-limiting growth, also achieves saturation of the substrate's surface. (*See* D.I. 215 at 3) Moreover, Micron argues that "self-limiting" means nothing more than that the precursor cannot react with itself or its deposits, and that saturation is a different concept that relates more to decomposition, which is not self-limiting. (*See* Tr. at 52-53) Further, in Micron's view, "non-self-limiting deposition can occur even when saturation has been achieved." (D.I. 112 at 18)

The Court agrees with Defendant that it is not necessary to include the saturation concept

in the construction, and that doing so may be confusing to the jury. Harvard admits that "[w]hether or not the process is run to completion or not, it would still be a self-limiting process because the reactants aren't reacting with themselves [or each other]." (Tr. at 31; *see also* D.I. 111 at 13 ("A surface reaction does not need to reach saturation for the deposition to be considered self-limiting.")) The inclusion of the language "to achieve saturation," when a deposition process can be infringing even if it has not achieved saturation, would likely be confusing to the jury. Accordingly, the Court will adopt Micron's newly-proposed construction.

Nevertheless, the Court agrees with Harvard that a POSA would understand that the claimed process accounts for real-world chemical reactions and is not limited to the idealized model. (*See* Tr. at 31-32) For example, the Court understands that an ALD process is infringing if the precursor generally reacts with the surface but not itself or its deposits, even if there are incidental reactions, as long as the growth of the film as a whole stops when substantially all of the surface sites are reacted with (i.e., the film does not enter decomposition mode). (*See* Tr. at 63-64) In other words, if the growth rate is greater than zero due to some minor drift in the thickness of the film as a result of incidental reactions, but decomposition mode has not begun, then the process still infringes the claims (assuming the rest of the claim limitations are met). (*See id.*)

Additionally, the Court understands that process conditions will affect whether the process is self-limiting, and therefore, whether the process is infringing. (*See* Tr. at 56-59) For example, all else being equal, if at temperature X the process is self-limiting, but at temperature Y the process is not self-limiting, the process will be infringing at temperature X (assuming the rest of the claim limitations are met) and not infringing at temperature Y. (*See id.*)

III. CONCLUSION

The Court construes the disputed terms as explained above. An appropriate Order follows.