UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GLOBAL FOUNDRIES U.S., INC., GLOBALFOUNDRIES DRESDEN MODULE ONE LLC & CO. KG, GLOBALFOUNDRIES DRESDEN MODULE TWO LLC & CO. KG, and THE GILLETTE COMPANY

Petitioners

v.

ZOND, LLC
Patent Owner

Case No. IPR2014-01098[1]

Patent 76,853,142 B2

PATENT OWNER'S NOTICE OF APPEAL
35 U.S.C. § 142 & 37 C.F.R. § 90.2

[1] Case IPR 2014-01016 has been joined with the instant proceeding.

Pursuant to 37 C.F.R. § 90.2(a), Patent Owner, Zond, LLC, hereby provides notice of its appeal to the United States Court of Appeals for the Federal Circuit for review of the Final Written Decision of the United States Patent and Trademark Office ("USPTO") Patent Trial and Appeals Board ("PTAB") in *Inter Partes* Review 2014-01098, concerning U.S. Patent 6,853,142 ("the '142 patent"), entered on September 25, 2015, attached hereto as Appendix A.

ISSUES TO BE ADDRESSED ON APPEAL

A. Whether the PTAB erred in finding claim 40 unpatentable as being obvious under 35 U.S.C. § 103 in view by U.S. Pat. 6,413,382 to Wang ("Wang") and A. A. Kudryavtsev and V.N. Skrebov, *Ionization Relaxation in a Plasma Produced by a Pulsed Inert-Gas Discharge*, 28(1) SOV. PHYS. TECH. PHYS. 30–35 (Jan. 1983) ("Kudryavetsev")?

B. Whether the PTAB erred in finding claim 41 unpatentable as being obvious under 35 U.S.C. § 103 in view of Wang and U.S. Pat. 6,413,382 to Lantsman ("Lantsman")?

Simultaneous with submission of this Notice of Appeal to the Director of the United States Patent and Trademark Office, this Notice of Appeal is being filed with the Patent Trial and Appeal Board. In addition, this Notice of Appeal, along

with the required docketing fees, is being filed with the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

Dated: November 23, 2015

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APPENDIX A

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Paper 35
Entered: September 25, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GLOBALFOUNDRIES U.S., INC.,
GLOBALFOUNDRIES DRESDEN MODULE ONE LLC & CO. KG,
GLOBALFOUNDRIES DRESDEN MODULE TWO LLC & CO. KG,
and THE GILLETTE COMPANY
Petitioners,

v.

ZOND, LLC,
Patent Owner.

Case IPR2014-01098[1]
Patent 6,853,142 B2

Before KEVIN F. TURNER, DEBRA K. STEPHENS, JONI Y. CHANG, SUSAN L.C. MITCHELL, and JENNIFER MEYER CHAGNON, *Administrative Patent Judges*.

TURNER, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

[1] Case IPR2014-01016 has been joined with the instant *inter partes* review.

I. INTRODUCTION

GLOBALFOUNDRIES U.S., Inc., GLOBALFOUNDRIES Dresden Module One LLC & Co. KG, and GLOBALFOUNDRIES Dresden Module Two LLC & Co. KG, (collectively, "GlobalFoundries") filed a Petition requesting *inter partes* review of claims 40 and 41 of U.S. Patent No. 6,853,142 B2 ("the '142 Patent"). Paper 2 ("Pet."). Patent Owner Zond, LLC ("Zond") filed a Preliminary Response. Paper 7 ("Prelim. Resp."). We instituted the instant trial on October 31, 2014, pursuant to 35 U.S.C. § 314. Paper 9 ("Dec.").

Subsequent to institution, we granted the revised Motion for Joinder filed by The Gillette Company, joining Case IPR2014-01016 with the instant trial (Paper 13).[2] Zond filed a Response (Paper 22 ("PO Resp.")), and GlobalFoundries filed a Reply (Paper 27 ("Reply")). Oral hearing[3] was held on June 12, 2015, and a transcript of the hearing was entered into the record. Paper 34 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, we determine that GlobalFoundries has shown, by a preponderance of the evidence, that claims 40 and 41 of the '142 Patent are unpatentable under 35 U.S.C. § 103(a).

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[2] Herein, we refer to all Petitioners collectively as "GlobalFoundries."
[3] The hearings for this review and the following *inter partes* reviews were consolidated: IPR2014-00807, IPR2014-00808, IPR2014-00818, IPR2014-00819, IPR2014-00821, IPR2014-000827, IPR2014-01099, and IPR2014-01100.

A. Related District Court Proceedings

The parties indicate that the '142 Patent was asserted in numerous proceedings in Massachusetts: 1:13-cv-11570-RGS (*Zond v. Intel*); 1:13-cv-11577-DPW (*Zond v. AMD, Inc.*); 1:13-cv-11581-DJC (*Zond v. Toshiba Am. Elec. Comp. Inc.*); 1:13-cv-11591-RGS *(Zond v. SK Hynix, Inc.)*; 1:13-cv-11625-NMG (*Zond v. Renesas Elec. Corp*.); 1:13-cv-11634-WGY (*Zond v. Fujitsu*); and 1:13-cv-11567-DJC (*Zond v. The Gillette Co*.). Pet. 1; Paper 5.

B. The '142 Patent

The '142 Patent relates to methods and apparatus for generating high-density plasma. Ex. 1401, Abs. At the time of the invention, sputtering was a well-known technique for depositing films on semiconductor substrates. *Id*. at 1:16–24. The '142 Patent indicates that prior art magnetron sputtering systems deposit films having low uniformity and poor target utilization (the target material erodes in a non-uniform manner). *Id*. at 3:32–36. To address these problems, the '142 Patent discloses that increasing the power applied between the target and anode can increase the uniformity and density in the plasma. *Id*. at 3:37–44. However, increasing the power also "can increase the probability of generating an electrical breakdown condition leading to an undesirable electrical discharge (an electrical arc) in the chamber 104." *Id*.

According to the '142 Patent, forming a weakly-ionized plasma substantially eliminates the probability of establishing a breakdown condition in the chamber when high-power pulses are applied between the cathode and anode. *Id*. at 6:21–30. Once the weakly-ionized plasma is formed, high-power pulses are applied between the cathode and anode to

generate a strongly-ionized plasma from the weakly-ionized plasma. *Id*. at 7:23–36. The '142 Patent also discloses that the provision of the feed gas to the plasma allows for homogeneous diffusion of the feed gas in the weakly-ionized plasma and allows for the creation of a highly uniform strongly-ionized plasma. *Id*. at 6:31–35.

C. Challenged Claims

Both challenged claims are independent claims. Claims 40 and 41 are reproduced below:

> 40. An apparatus for generating a strongly-ionized plasma in a chamber, the apparatus comprising:
>
> means for ionizing a feed gas to form a weakly-ionized plasma that reduces the probability of developing an electrical breakdown condition in the chamber;
>
> means for supplying power to the weakly-ionized plasma by applying an electrical pulse across the weakly-ionized plasma, the electrical pulse having a magnitude and a rise-time that is sufficient to increase the density of the weakly-ionized plasma to generate a strongly-ionized plasma; and
>
> means for diffusing the strongly-ionized plasma with additional feed gas to allow additional power to be absorbed by the strongly-ionized plasma.
>
> 41. An apparatus for generating a strongly-ionized plasma, the apparatus comprising:
>
> means for ionizing a feed gas to generate a weakly-ionized plasma proximate to a cathode, the weakly-ionized plasma reducing the probability of developing an electrical breakdown condition proximate to the cathode; and

> means for applying an electric field across the weakly-ionized plasma in order to excite atoms in the weakly-ionized plasma and to generate secondary electrons from the cathode, the secondary electrons ionizing the excited atoms, thereby creating the strongly-ionized plasma.

Ex. 1401, 23:10–24:15.

D. Prior Art Relied Upon

Based on the instituted ground, GlobalFoundries relies upon the following prior art references:

Lantsman	US 6,190,512 B1	Feb. 20, 2001	(Ex. 1406)
Wang	US 6,413,382 B1	July 2, 2002	(Ex. 1405)

A. A. Kudryavtsev and V.N. Skrebov, *Ionization Relaxation in a Plasma Produced by a Pulsed Inert-Gas Discharge*, 28(1) SOV. PHYS. TECH. PHYS. 30–35 (Jan. 1983) (Ex. 1404) (hereinafter, "Kudryavtsev").

E. Grounds of Unpatentability

We instituted the instant trial based on the following grounds of unpatentability (Dec. 29):

Claim	**Basis**	**References**
41	§ 103(a)	Wang and Kudryavtsev
40	§ 103(a)	Wang and Lantsman

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the

patent in which they appear. 37 C.F.R. § 42.100(b); *see also In re Cuozzo Speed Techs., LLC*, 793 F.3d 1268, 1275–79 (Fed. Cir. 2015) ("Congress implicitly approved the broadest reasonable interpretation standard in enacting the AIA,"[4] and "the standard was properly adopted by PTO regulation."). Significantly, claims are not interpreted in a vacuum but are part of, and read in light of, the specification. *United States v. Adams*, 383 U.S. 39, 49 (1966) ("[I]t is fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention."). Claim terms are given their ordinary and customary meaning as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). An inventor may rebut that presumption by providing a definition of the term in the specification with "reasonable clarity, deliberateness, and precision." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read from the specification into the claims. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

During the pre-trial stage of this proceeding, the parties submitted their constructions for the claim terms "a weakly-ionized plasma" and "a strongly-ionized plasma." Pet. 13–14; Prelim. Resp. 19–21. In our Decision on Institution, we adopted Zond's proposed constructions, in light of the Specification, as the broadest reasonable interpretation. Dec. 6–8.

Upon review of the parties' explanations and supporting evidence before us, we discern no reason to modify our claim constructions set forth

[4] The Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011) ("AIA").

in the Decision on Institution with respect to these claim terms. *Id*. Therefore, for purposes of this Final Written Decision, we construe, in light of the Specification, the claim term "a weakly-ionized plasma" as "a plasma with a relatively low peak density of ions," the claim term "a strongly-ionized plasma" as "a plasma with a relatively high peak density of ions."

The parties also identify three claim elements recited in the claims as means-plus-function elements, invoking 35 U.S.C. § 112, ¶ 6.[5] Pet. 14–16; Prelim. Resp. 21–27. We address the claim terms identified by the parties below.

We agree that those claim elements are written in means-plus-function form and fall under 35 U.S.C. § 112, ¶ 6, because: (1) each claim element uses the term "means for"; (2) the term "means for" in each claim element is modified by functional language; and (3) the term "means for" is not modified by any structure recited in the claim to perform the claimed function. *Personalized Media Commc'ns, LLC v. Int'l Trade Comm'n*, 161 F.3d 696, 703–04 (Fed. Cir. 1998) (using the term "means for" creates a rebuttable presumption that the drafter intended to invoke § 112, ¶ 6) (citations omitted); *Sage Prods., Inc. v. Devon Indus., Inc.*, 126 F.3d 1420, 1427–28 (Fed. Cir. 1997) (the presumption is not rebutted if the term "means for" is modified by functional language and is not modified by any structure recited in the claim to perform the claimed function); *see also Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015)

[5] Section 4(c) of the AIA re-designated 35 U.S.C. § 112, ¶ 6, as 35 U.S.C. § 112(f). Pub. L. No. 112-29, 125 Stat. 284, 296 (2011). Because the '142 Patent has a filing date before September 16, 2012 (effective date), we refer to the pre-AIA version of § 112 in this Decision.

(confirming that "use of the word 'means' creates a presumption that § 112, ¶ 6 applies" (citing *Personalized Media*, 161 F.3d at 703)).

The first step in construing a means-plus-function claim element is to identify the recited function in the claim element. *Med. Instrumentation & Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1210 (Fed. Cir. 2003). The second step is to look to the specification and identify the corresponding structure for that recited function. *Id*. A structure disclosed in the specification qualifies as "corresponding" structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim. *B. Braun Med., Inc. v. Abbott Labs.*, 124 F.3d 1419, 1424 (Fed. Cir.1997). "While corresponding structure need not include all things necessary to enable the claimed invention to work, it must include all structure that actually performs the recited function." *Default Proof Credit Card Sys. Inc. v. Home Depot U.S.A., Inc.*, 412 F.3d 1291, 1298 (Fed. Cir. 2005) (citation omitted).

Upon review of the parties' contentions and the Specification, we set forth our claim constructions in the Decision on Institution for the means-plus-function elements identified by the parties. Dec. 9–12. The parties do not challenge any aspect of our claim constructions as to these claim elements, although GlobalFoundries alleges that Zond and Zond's expert, Dr. Hartsough, have disregarded these constructions in their analyses. PO Resp. 17–20; Reply 2–9. Based on this entire record, we also discern no reason to modify our claim constructions at this juncture.

For convenience, our claim constructions are reproduced in the table below:

Means-Plus-Function Claim Element	**Identified Corresponding Structure**
"means for ionizing a feed gas"	a pulsed power supply electrically connected to a cathode, an anode, and/or an electrode
"means for supplying power / applying an electrical field"	a pulsed power supply electrically connected to a cathode, an anode, and/or an electrode
"means for diffusing"	a feed gas source and structures for supplying the gas to the strongly-ionized plasma

B. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). In that regard, an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418; *Translogic*,

504 F.3d at 1259. The level of ordinary skill in the art is reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978). We analyze the asserted grounds of unpatentability in accordance with the above-stated principles.

C. Claims 40 and 41—Obviousness over Wang and Lantsman, or Wang and Kudryavtsev

GlobalFoundries asserts that claim 41 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Wang and Kudryavtsev. Pet. 33–43. GlobalFoundries also asserts that claim 40 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Wang and Lantsman. Pet. 53–60. As support, GlobalFoundries provides detailed explanations as to how each claim limitation is met by the references and rationales for combining the references, as well as a Declaration of Dr. Kortshagen (Ex. 1402). GlobalFoundries also submitted a Declaration of Dr. Overzet (Ex. 1422) to support its Reply to Zond's Patent Owner Response.

Zond responds that the combinations of prior art do not disclose every claim element. PO Resp. 42–49. Zond also argues that there is insufficient reason to combine the technical disclosures of Wang and Kudryavtsev or Lantsman. *Id*. at 30–42. To support its contentions, Zond proffers a Declaration of Dr. Larry D. Hartsough (Ex. 2005).

We have reviewed the entire record before us, including the parties' explanations and supporting evidence presented during this trial. We begin our discussion with a brief summary of Wang, Lantsman, and Kudryavtsev,

address their combinations with respect to the instant grounds, and then we address the parties' contentions about specific claim elements in turn.

Wang

Wang discloses a power pulsed magnetron sputtering apparatus for generating a very high plasma density. Ex. 1405, Abs. Wang also discloses a sputtering method for depositing metal layers onto advanced semiconductor integrated circuit structures. *Id*. at 1:4–15.

Figure 1 of Wang, reproduced below, illustrates a cross-sectional view of a power pulsed magnetron sputtering reactor:

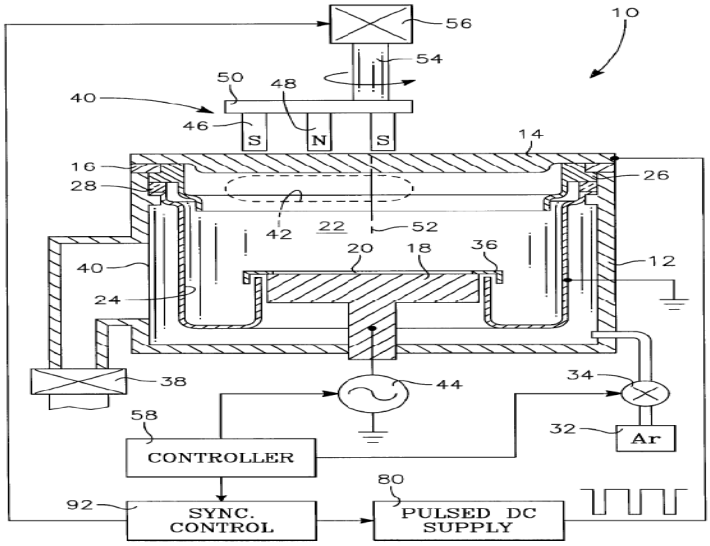


FIG. 1

Fig. 1 of Wang illustrates its magnetron sputtering apparatus.

As shown in Figure 1 of Wang, magnetron sputtering apparatus 10 has pedestal 18 for supporting semiconductor substrate 20, anode 24, cathode 14, magnet assembly 40, and pulsed DC power supply 80. *Id*. at 3:57–4:55. According to Wang, the apparatus is capable of creating high density plasma in region 42, from argon gas feed 32 through mass flow controller 34, which ionizes a substantial fraction of the sputtered particles

into positively charged metal ions and also increases the sputtering rate. *Id*. at 4:5–34. Wang further recognizes that, if a large portion of the sputtered particles are ionized, the films are deposited more uniformly and effectively—the sputtered ions can be accelerated towards a negatively charged substrate, coating the bottom and sides of holes that are narrow and deep. *Id*. at 1:24–29.

Figure 6 of Wang, reproduced below, illustrates how the apparatus applies a pulsed power to the plasma:

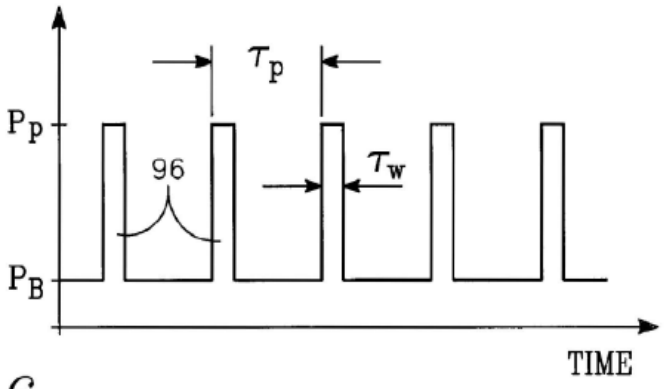


FIG. 6

Fig. 6 of Wang illustrates a representation of applied pulses.

As shown in Figure 6 of Wang, the target is maintained at background power level P_B between high power pulses 96 with peak power level P_P. *Id*. at 7:13–39. Background power level P_B exceeds the minimum power necessary to support a plasma in the chamber at the operational pressure (e.g., 1kW). *Id*. Peak power P_P is at least 10 times (preferably 100 or 1000 times) background power level P_B. *Id*. The application of high peak power P_P causes the existing plasma to spread quickly, and increases the density of the plasma. *Id*. According to Dr. Kortshagen, Wang's apparatus generates a low-density (weakly-ionized) plasma during the application of background

power P_B, and a high-density plasma during the application of peak power P_P. Ex. 1402 ¶¶ 117–119; *see* Pet. 41–42.

Lantsman

Lantsman discloses a plasma ignition system for plasma processing chambers having primary and secondary power supplies, used to generate a plasma current and a process initiation voltage, respectively. Ex. 1406, Abs. The primary power supply provides the primary power to electrically drive the cathode during the plasma process, and the secondary power supply supplies an initial plasma ignition voltage to "pre-ignite" the plasma so that when the primary power supply is applied, the system smoothly transitions to final plasma development and deposition. *Id*. at 2:48–51.

The system is applicable to magnetron and non-magnetron sputtering and radio frequency (RF) sputtering systems. *Id*. at 1:6–8. Lantsman also provides that "arcing which can be produced by overvoltages can cause local overheating of the target, leading to evaporation or flaking of target material into the processing chamber and causing substrate particle contamination and device damage," and "[t]hus, it is advantageous to avoid voltage spikes during processing wherever possible." *Id*. at 1:51–59.

Lantsman also discloses that "at the beginning of processing . . . gas is introduced into the chamber" and "[w]hen the plasma process is completed, the gas flow is stopped." *Id*. at 3:10–13. This is illustrated in Figure 6 of Lantsman reproduced below:

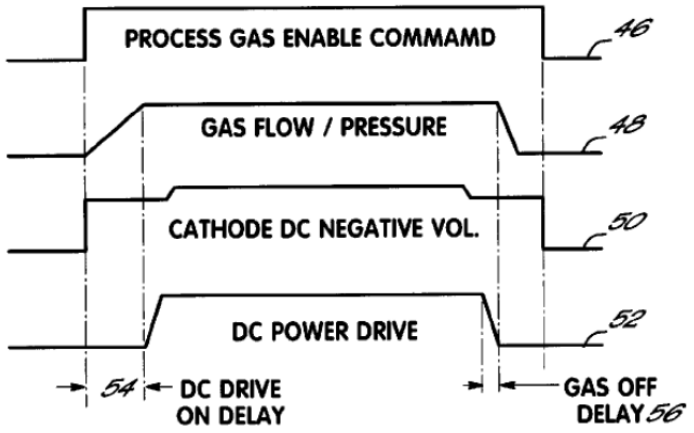


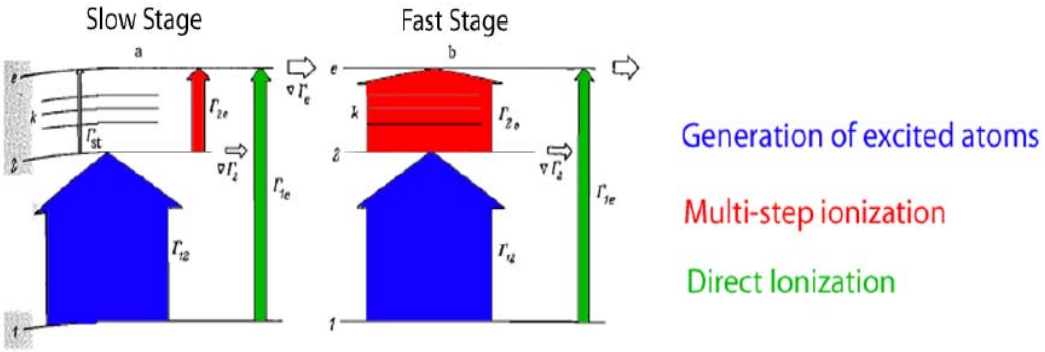
FIG. 6

Fig. 6 of Lantsman illustrates the timing of its processes. Figure 6 illustrates that the gas flow is initiated, and the gas flow and pressure begin to ramp upwards toward normal processing levels for the processing stage. *Id*. at 5:39–42.

Kudryavtsev

Kudryavtsev discloses a multi-step ionization plasma process, comprising the steps of exciting the ground state atoms to generate excited atoms, and then ionizing the excited atoms. Ex. 1404, Abs., Figs. 1, 6.

Figure 1 of Kudryavtsev (annotations added) illustrates the atomic energy levels during the slow and fast stages of ionization. Annotated Figure 1 is reproduced below:



As shown in annotated Figure 1 of Kudryavtsev, ionization occurs with a "slow stage" (Fig. 1a) followed by a "fast stage" (Fig. 1b). During the initial slow stage, direct ionization provides a significant contribution to the generation of plasma ions (arrow Γ_{1e} showing ionization (top line labeled "e") from the ground state (bottom line labeled "1")). Dr. Kortshagen explains that Kudryavtsev shows the rapid increase in ionization once multi-step ionization becomes the dominant process. Ex. 1402 ¶¶ 137–138; Pet. 47–48.

Specifically, Kudryavtsev discloses:

> For nearly stationary n_2 [excited atom density] values . . . *there is an explosive increase in* n_e [plasma density]. The subsequent increase in n_e then reaches its maximum value, equal to the rate of excitation . . . which is several orders of magnitude greater than the ionization rate during the initial stage.

Ex. 1404, 31 (emphasis added). Kudryavtsev also recognizes that "in a pulsed inert-gas discharge plasma at moderate pressures . . . [i]t is shown that the electron density increases explosively in time due to accumulation of atoms in the lowest excited states." *Id*. at Abs., Fig. 6.

Rationale to Combine References

GlobalFoundries asserts that it would have been obvious to have combined Wang and Lantsman to render the claim 40 obvious. Pet. 53–60. GlobalFoundries discusses the suggestion of continuing to supply the feed gas in the process of Wang, and argues that supply of the feed gas is likely to occur during that disclosed process, although not expressly recited. *Id*. at 56–57; Ex. 1402 ¶ 166. GlobalFoundries also argues that even if Wang does not disclose maintaining the flow of the feed gases, "[i]t would have been

obvious to one of ordinary skill to continue to exchange the feed gas during Wang's application of background power and high peak power, as taught by Lantsman." Pet. 58. GlobalFoundries submits an ordinarily skilled artisan would have been motivated to combine Wang and Lantsman because both are directed to sputtering and both employ two power supplies, one for pre-ionization and the other for deposition. *Id*. at 58–59. In addition, both Wang and Lantsman are concerned with generating plasma while avoiding arcing. *Id*. GlobalFoundries also cites to the testimony of Dr. Kortshagen that the continuous flow of gas would allow for diffusion of the strongly-ionized plasma and additional power to be absorbed by the plasma. *Id*. at 57; Ex. 1402 ¶ 167.

In addition, GlobalFoundries asserts that it would have been obvious to have combined Wang and Kudryavtsev to render the claim 41 obvious. Pet. 39–42 (citing Ex. 1402 ¶¶ 116–126). GlobalFoundries contends that Kudryavtsev teaches that ionization proceeds in a slow stage followed by a fast stage and that excited atoms are produced in both stages, such that excited atoms would be produced in Wang's weakly-ionized plasma in response to the applied electrical pulse. *Id*. at 39–40 (citing Ex. 1402 ¶¶ 119, 120). GlobalFoundries also submits that it would have been obvious to one with ordinary skill in the art to adjust Wang's operating parameters (e.g., to increase the pulse length of the power and/or the pressure of the gas inside the chamber) to trigger a fast stage of ionization. *Id*. According to GlobalFoundries, triggering such a fast stage of ionization in Wang's apparatus would increase plasma density and, thereby, would increase the sputtering rate, and reduce the time required to reach a given plasma density. *Id*.

In addition, GlobalFoundries notes that the '142 Patent admits that secondary electrons are produced in a sputtering process by collisions between ions and the cathode and those secondary electrons form ions. *Id*. at 41 (citing Ex. 1402 ¶ 122). As such, GlobalFoundries argues, the combination of Wang and Kudryavtsev teaches the generation of excited atoms in the weakly-ionized plasma, and the production of secondary electrons.

The parties' dispute mainly centers on whether GlobalFoundries has articulated a reason with rational underpinning why one with ordinary skill in the art would have combined the prior art teachings. Zond argues that GlobalFoundries fails to demonstrate that one with ordinary skill in the art would have combined the system of Wang with those of Lantsman or Kudryavtsev, to achieve the claimed invention with reasonable expectation of success or predictable results. PO Resp. 30–42.

In particular, Zond contends that GlobalFoundries does not take into consideration the substantial, fundamental structural differences between the systems of Wang and Lantsman—e.g., pressure, chamber geometry, gap dimensions, and magnetic fields. *Id*. at 30–32 (citing ***e.g.***, Ex. 1404; Ex. 1405, 3:60–61, 5:18–22; Ex. 2004, 6:60–62; Ex. 2005 ¶¶ 80–84). Additionally, even if a combination was somehow made, Zond contends it would differ significantly from the system disclosed in the '142 Patent. *Id*.

As well, Zond contends that it would not have been obvious how to combine Wang and Kudryavtsev, arguing that Wang's sputtering apparatus differs significantly from Kudryavtsev's experimental apparatus. *Id*. at 34–41. Zond argues that "Kudryavtsev's theoretical work is targeted for 'emission mechanisms in pulsed gas lasers, gas breakdown, laser sparks,

etc,'" with no magnet, but Wang discloses a pulsed magnetron sputter reactor (*id*. at 35–36 (citing Ex. 1404, 34)), that GlobalFoundries' characterization of Kudryavtsev is incorrect and cannot serve as a rationale to combine (*id*. at 36–37); and that GlobalFoundries does not take into consideration the substantial, fundamental structural differences between the systems of Wang and Kudryavtsev—e.g., pressure, chamber geometry, gap dimensions, and magnetic fields. *Id*. at 37–41 (citing Ex. 2005 ¶¶ 64, 67, 85–92; Ex. 1401, 1:19–20, 4:15–17, 5:38–39; Ex. 1404, 31–34, Fig. 3; Ex. 1405, 3:16–22, 60–61, 4:35–37, 7:32–34, 57–61, Fig. 1; Ex. 2004, 14:37–50).

In its Reply, GlobalFoundries responds that Zond's arguments combine statements directed to different embodiments of Wang together and attempt to physically incorporate Lantsman into Wang. Reply 9–14. GlobalFoundries also responds that one of ordinary skill in the art would have viewed Lantsman's teachings as applicable to Wang's system, based on the ordinary level of skill in the art and the similarities between Wang and Lantsman. *Id*. Additionally, GlobalFoundries continues that Zond's arguments with respect to the combination of Wang and Kudryavtsev "focus on bodily incorporat[ion]," and that "[d]ifferences in such systems are routine and a person of ordinary skill in the art would work with such differences on a regular basis, and would consider it routine to make any necessary changes to accommodate for any and all such variables." *Id*. at 14–17. Upon consideration of the evidence before us, we are persuaded by GlobalFoundries' contentions.

We are not persuaded by Zond's argument that Lantsman's, Wang's, and Kudryavtsev's apparatuses would have been viewed as significantly

different, or that one with ordinary skill in the art would not have had a reasonable expectation of success in combining the teachings. Obviousness does not require absolute predictability, only a reasonable expectation that the beneficial result will be achieved. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

"It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012); *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc) (noting that the criterion for obviousness is not whether the references can be combined physically, but whether the claimed invention is rendered obvious by the teachings of the prior art as a whole). In that regard, one with ordinary skill in the art is not compelled to follow blindly the teaching of one prior art reference over the other without the exercise of independent judgment. *Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 889 (Fed. Cir. 1984); *see also KSR*, 550 U.S. at 420–21 (stating that a person with ordinary skill in the art is "a person of ordinary creativity, not an automaton," and "in many cases . . . will be able to fit the teachings of multiple patents together like pieces of a puzzle").

Dr. Overzet testifies that Kudryavtsev's model on plasma behavior is not intended to be limited to a particular type of plasma apparatus. Ex. 1422 ¶ 61. Indeed, Kudryavtsev discloses a study of the ionization relaxation in plasma when the external electric field suddenly increases. Ex. 1404, 30. Specifically, Kudryavtsev discloses that "the *electron density increases explosively* in time due to accumulation of atoms in the lowest excited states." *Id*. at Abs. (emphasis added). Kudryavtsev also describes the

experimental results that confirm the model. *Id*. at 32–34. Moreover, Kudryavtsev expressly explains that "the effects studied in this work are characteristic of ionization *whenever a field is suddenly applied to a weakly ionized gas*." *Id*. at 34 (emphasis added).

Dr. Overzet also testifies that a person having ordinary skill in the art "would have looked to Kudryavtsev to understand how plasma would react to a quickly applied voltage pulse, and how to achieve an explosive increase in electron density" when generating a strongly-ionized plasma for improving sputtering and manufacturing processing. Ex. 1422 ¶ 62. Dr. Overzet further explains that such an artisan would have known how to apply Kudryavtsev's model to Wang's system by making any necessary changes to accommodate the differences through routine experimentation. *Id*. ¶¶ 63–65. On this record, we credit Dr. Overzet's testimony (*id*. ¶¶ 61–65) because his explanations are consistent with the prior art of record.

As well, Dr. Overzet testifies, Lantsman states that its techniques can be applied to any plasma process, including DC magnetron sputtering, where Wang is directed to DC magnetron sputtering. Ex. 1422 ¶¶ 66–67 (citing Ex. 1406, 6:14–17). Additionally, Dr. Overzet testifies that the different processing conditions in Wang and Lantsman are routine variables that ordinarily skilled artisans would understand need to be changed to accommodate different systems and processing conditions. *Id*. ¶ 68. In addition, Dr. Overzet points out that both Lantsman and Wang "teach two stage plasma systems." *Id*. ¶ 69. Indeed, Lantsman discloses both "limited" and "substantial" plasma stages (Ex. 1406, 2:48–51, 4:58–61, 5:6), and Wang discloses plasma states that vary with the application of pulses (Ex. 1405, 7:13–39). As noted above, Wang discloses background power P_B

of 1 kW (falling within the range of 0.01–100 kW, as disclosed in the '142 Patent, for generating a weakly-ionized plasma), and pulse peak power P_P of 1 MW (falling within the range of 1 kW–10 MW, as disclosed in the '142 Patent, for generating a strongly-ionized plasma). Ex. 1405, 7:19–25; Ex. 1401, 11:34–38, 12:1–8, Fig. 5. On this record, we credit Dr. Overzet's testimony (Ex. 1422 ¶¶ 66–69) because his explanations are consistent with the prior art of record.

For the foregoing reasons, we are persuaded that GlobalFoundries has articulated a reason with rational underpinning why one with ordinary skill in the art would have combined Wang and Lantsman, and Wang and Kudryavtsev as indicated in the Petition, and we are persuaded that GlobalFoundries' reason to combine Wang with each of Lantsman, and Kudryavtsev is supported by a preponderance of evidence.

Feed Gas Diffusing the Strongly-ionized plasma

Claim 40 recites, in part, "diffusing the strongly-ionized plasma with additional feed gas to allow additional power to be absorbed by the strongly-ionized plasma." This limitation is part of a means-plus-function limitation, discussed above, that we have determined to have "a feed gas source and structures for supplying the gas to the strongly-ionized plasma" as its corresponding structure.

Zond argues that Lantsman fails to disclose generating a strongly-ionized plasma, or disclose any activity of the feed gas and plasma diffusion. PO Resp. 43–44 (citing Ex. 2005 ¶ 94). Additionally, Zond argues that Wang does not teach "the feed gas diffusing the strongly-ionized plasma"

because Wang's chamber is significantly different in design from that of the '142 Patent and the feed gas in Wang "'could not possibly diffuse the strongly ionized plasma because it enters the chamber far from the strongly ionized plasma and is directed away from the strongly ionized plasma.'" *Id*. at 44–46 (citing Ex. 2005 ¶¶ 94–100). Also, Zond argues that the only motivation to diffuse the strongly-ionized plasma and allow additional power to be absorbed comes from the '142 Patent. *Id*. at 48–49. We do not find Zond's arguments to be persuasive.

First, we note that it not essential for Lantsman to disclose a strongly-ionized plasma because Wang discloses a strongly-ionized plasma, and the specified ground of unpatentability relies on the combination of Lantsman and Wang. Second, Dr. Overzet testifies that the gas applied in Wang enters the chamber and moves throughout, including plasma region 42. Ex. 1422 ¶ 76 (citing Ex. 1405, 4:5–12, Fig. 1). Additionally, Dr. Overzet testifies that due to random thermal motion and the pressure gradient in the reaction chamber, Wang's argon gas will diffuse into the plasma near the target. Ex. 1422 ¶ 77. Lastly, Dr. Hartsough acknowledges that a feed gas was commonly used to diffuse a strongly-ionized plasma (Ex. 1424, 32:18–33:5), such that ordinarily skilled artisans would have used such a process without resort to the disclosure of the '142 Patent.

In addition, we agree with GlobalFoundries that Zond's arguments with respect to claim 40 attempt to "read out the means-plus-function nature" of that claim by arguing that Wang and Lantsman do not disclose the *function* in the limitations of claim 40. Reply 18. We are persuaded that the combination of Wang and Lantsman discloses or suggests a feed gas source and structures for supplying the gas to the strongly-ionized plasma.

Given the evidence in this record, we determine that GlobalFoundries has demonstrated, by a preponderance of evidence, that the combination of Wang and Lantsman would have suggested to one with ordinary skill in the art at the time of the invention a feed gas source and structures for supplying a feed gas to a strongly-ionized plasma, to diffuse the plasma and allow for greater absorption of power, as required by claim 40.

Conclusion

GlobalFoundries does not provide additional arguments with respect to specific elements of claim 41. We have reviewed GlobalFoundries' arguments and evidence regarding this claim (Pet. 33–43), and, given the evidence in the record before us, we determine that GlobalFoundries has demonstrated, by a preponderance of evidence the unpatentability of claim 41. For the foregoing reasons, we conclude that GlobalFoundries has demonstrated, by a preponderance of evidence, that claims 40 and 41 are unpatentable over the asserted combinations of Wang and Lantsman, and Wang and Kudryavtsev, respectively.

III. CONCLUSION

For the foregoing reasons, we conclude that GlobalFoundries has demonstrated, by a preponderance of the evidence, that claims 40 and 41 of the '142 Patent are unpatentable based on the following grounds of unpatentability:

Claims	Basis	References
41	§ 103(a)	Wang and Kudryavtsev
40	§ 103(a)	Wang and Lantsman

IV. ORDER

In consideration of the foregoing, it is

ORDERED that claims 40 and 41 of the '142 Patent are held *unpatentable*; and

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing

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As required under 37 C.F.R. § 90.2(a).

Respectfully submitted,

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