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 No. IPR2014-01088[1]
Patent 6,806,652 B1

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

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[1] Case IPR2014-01000 has been joined with the instant *inter partes* review.

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 Patent Trial and Appeals Board ("PTAB") in *Inter Partes* Review No. 2014-01088, concerning U.S. Patent 6,806,652, entered on January 5, 2016, and attached hereto as Appendix A.

ISSUES TO BE ADDRESSED ON APPEAL

A. Whether the PTAB erred in finding claims 1-14, 16, and 17 unpatentable as being obvious under 35 U.S.C. § 103(a) in view of Mozgrin, et al., *High-Current Low-Pressure Quasi-Stationary Discharge in a Magnetic Field: Experimental Research*, 21 PLASMA PHYSICS REPORTS 400–409 (1995) ("Mozgrin"), Kudryavtsev and Skrebov, *Ionization Relaxation in a Plasma Produced by a Pulsed Inert-Gas Discharge*, 28(1) SOV. PHYS. TECH. PHYS. 30–35 (Jan. 1983) ("Kudryavtsev"), Fahey et al., *High Flux Beam Source of Thermal Rare-Gas Metastable Atoms*, 13 J. PHYS. E: SCI. INSTRUM. 381–383 (1980) ("Fahey"), and Iwamura et al., US Pat. No. 5,753,886 ("Iwamura")?

B. Whether the PTAB erred in finding claim 5 unpatentable as being obvious under 35 U.S.C. § 103(a) in view of Mozgrin, Kudryavtsev, Fahey, Vratney, US Pat. No. 3,461,054 ("Vratney"), and Iwamura?

C. Whether the PTAB erred in finding claims 8-10 unpatentable as being obvious under 35 U.S.C. § 103(a) in view of Mozgrin, Kudryavtsev, Fahey, Lantsman, US Pat. No. 6,190,512 B1 ("Lantsman"), and Iwamura?

D. Whether the PTAB erred in finding claim 15 unpatentable as being obvious under 35 U.S.C. § 103(a) in view of Mozgrin, Kudryavtsev, Fahey, Wang et al., US Pat. No. 6,413,382 B1 ("Wang"), and Iwamura?

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: March 7, 2015

/Tarek N. Fahmi/
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APPENDIX A

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Paper 41
Entered: January 5, 2016

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 IPR2014-01088[1]
Patent 6,806,652 B1

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

MITCHELL, *Administrative Patent Judge.*

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

[1] Case IPR2014-01000 has been joined with the instant *inter partes* review.

I. INTRODUCTION

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 Petitioners have shown, by a preponderance of the evidence, that claims 1–17 of U.S. Patent No. 6,806,652 B1 (Ex. 1001, "the '652 patent") are unpatentable under 35 U.S.C. § 103(a).

A. Procedural History

GlobalFoundries U.S., Inc., GlobalFoundries Dresden Module One LLC & Co. KG, and GlobalFoundries Dresden Module Two LLC & Co., KG (collectively, "GlobalFoundries") filed a Petition (Paper 2, "Pet.") seeking *inter partes* review of claims 1–17 ("the challenged claims") of the '652 patent. GlobalFoundries included a Declaration of Dr. Uwe Kortshagen (Ex. 1002) to support its positions. Patent Owner Zond, LLC ("Zond") filed a Preliminary Response (Paper 10, "Prelim. Resp."). Pursuant to 35 U.S.C. § 314(a), on January 6, 2015, we instituted an *inter partes* review of the challenged claims to determine if the claims are unpatentable under 35 U.S.C. § 103 as obvious over various combinations of Mozgrin, Kudryavtsev, Fahey, Iwamura, Vratney, Lantsman, and Wang. Paper 16, 32 ("Dec.").

Subsequent to institution, we granted a revised Motion for Joinder filed by the Gillette Company listed in the Caption above, joining Case IPR2014-01000 with the instant trial (Paper 17). Zond filed a Patent Owner Response (Paper 28, "PO Resp."), along with a Declaration of Larry D.

Hartsough, Ph.D. (Ex. 2002) to support its positions. GlobalFoundries filed a Reply (Paper 29, "Reply") to the Patent Owner Response, along with a supplemental Declaration of Dr. Kortshagen (Ex. 1020). An oral hearing[2] was held on August 13, 2015. A transcript of the hearing is included in the record. Paper 40 ("Tr.").

B. Related Matters

GlobalFoundries indicates that the '652 patent was asserted in seven patent infringement actions in the District of Massachusetts, naming many of the Petitioners as defendants. Pet. 1; Ex. 1018. GlobalFoundries also identifies Petitions for *inter partes* review that are related to this proceeding. Pet. 1.

C. The '652 Patent

The '652 patent notes several problems with known magnetron sputtering systems, such as poor target utilization resulting from a relatively high concentration of positively charged ions in the region that results in a non-uniform plasma. Ex. 1001, 4:23–28. The '652 patent states that while increasing the power applied to the plasma may increase the uniformity and density of the plasma, doing so may significantly increase the probability of establishing an electrical breakdown condition of arcing. *Id.* at 4:31–37. The invention set forth in the '652 patent involves a plasma generation method that provides independent control of two or more co-existing plasmas in a system. *Id.* at 4:62–64.

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[2] The oral arguments for the instant review and IPR2014-00861 and IPR2014-01089 were consolidated.

One embodiment of the ’652 patent is shown in Figure 2A set forth below.

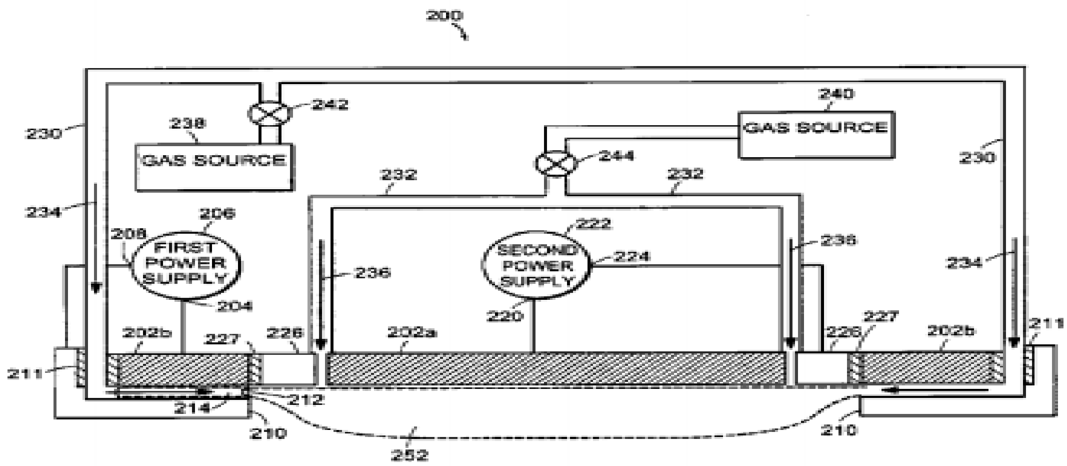


Figure 2A, reproduced above, shows a cross-sectional view of plasma generating apparatus 200 with segmented cathode 202. *Id.* at 5:43–45. Such segmented cathode has inner cathode section 202*a* and outer cathode section 202*b*. *Id.* at 5:45–47. Outer cathode 202*b* is coupled to first output 204 of first power supply 206, which can operate in a constant power mode or a constant voltage mode. *Id.* at 5:56–67. Second output 208 of first power supply 206 is coupled to first anode 210 that has insulator 211 to isolate it from outer cathode section 202*b*. *Id.* at 6:5–7.

Gap 212 is formed between first anode 210 and outer cathode section 202*b* that is sufficient to allow current to flow through region 214 within gap 212. *Id.* at 6:34–38. Gap 212 can be a plasma generator where plasma is ignited in gap 212 from feed gas 234, such as argon, fed from gas line 230. *Id.* at 6:59–61, 8:1–3, 10–11. Such an ignition condition and plasma development in the gap can be optimized by crossed electric and magnetic fields in gap 212 that trap electrons and ions improving the efficiency of the ionization process. *Id.* at 6:61–67. Gap 212 can be configured to generate excited atoms, which can increase the density of plasma, from ground state atoms. *Id.* at 6:44–46. "Since excited atoms generally require less energy to ionize than ground state gas atoms, a volume of excited atoms can generate higher density plasma than a similar volume of ground state feed gas atoms for the same input energy." *Id.* at 6:46–50.

Gap 212 facilitates high input power by having additional feed gas supplied to gap 212 that displaces some of the already developing plasma and absorbs any excess power applied to the plasma. *Id.* at 7:1–6. Such absorption prevents the plasma from contracting and terminating. *Id.* at 7:6–9. Feed gases 234, 236 are introduced into the chamber from more than one feed source, such as feed source 238, 240, through gas lines 230, 232 that may include in-line gas valves 242, 244 to control gas flow to the chamber. *Id.* at 8:1–5. Pulsing the feed gas can help generate excited atoms, including metastable atoms, by increasing the instantaneous pressure in gap 212, while the average pressure in the chamber is unchanged. *Id.* at 8:23–28.

Second power supply 222 applies high power pulses between inner cathode section 202*a* and second anode 226 after an appropriate volume of initial plasma is present in region 252. *Id.* at 12:1–5. "The high-power pulses create an electric field 254 between the inner cathode section 202*b* and the second anode 226 that strongly-ionizes the initial plasma thereby creating a high-density plasma in the region 252." *Id.* at 12:5–9. These high power pulses from second power supply 222, which add additional power to an already strongly-ionized plasma, super-ionizes the high-density plasma in region 252. *Id.* at 11:54–57. The '652 patent defines "super-ionized" to mean that "at least 75% of the neutral atoms in the plasma are converted to ions." *Id.* at 5:8–10.

Figure 2B, reproduced below, shows a more detailed cross-sectional view of the segmented cathode of Figure 2A.

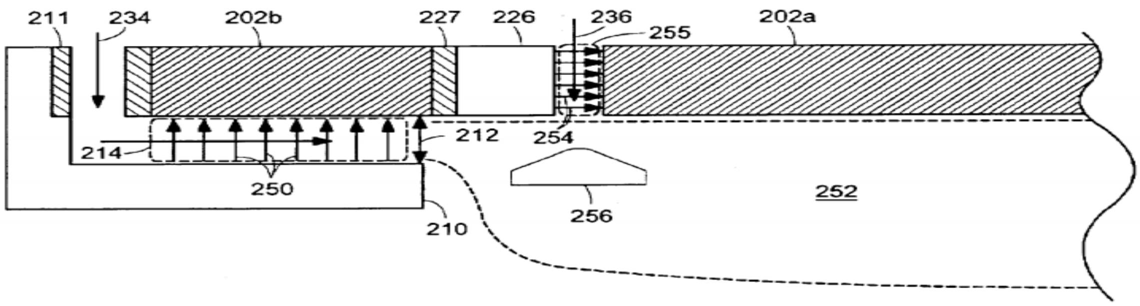


FIG. 2B

Figure 2B shows that electric fields 250, 254, which enhance the formation of ions in the plasma, can facilitate a multi-step ionization process of feed gases 234, 236, respectively, that substantially increases the rate at which the high-density plasma is formed. *Id.* at 12:50–56.

Figure 12, set forth below with GlobalFoundries's annotations, Pet. 10, shows another embodiment of the '652 patent.

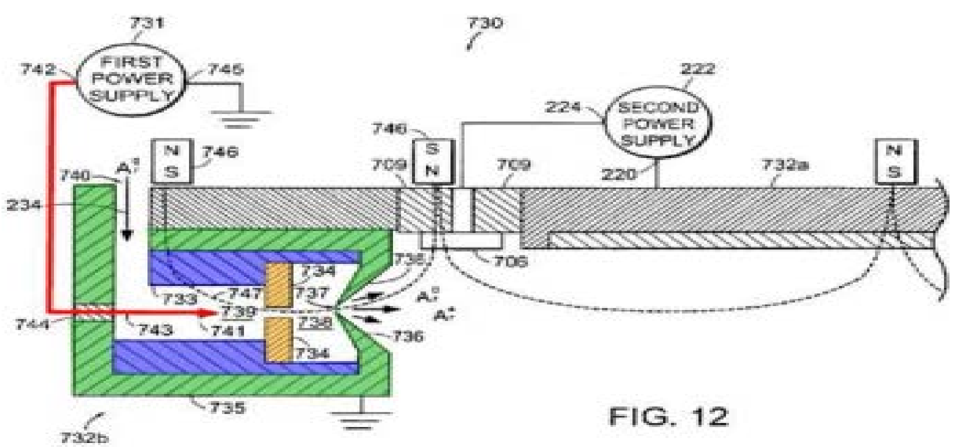


FIG. 12

Excited atom source 732*b* generates an initial plasma and excited atoms, which include metastable atoms, from ground state atoms from feed gas 234. Ex. 1001, 25:35–38. Nozzle chamber 738 traps a large fraction of ions and electrons, while excited atoms and ground state atoms flow through aperture 737 of skimmer 736. *Id.* at 27:18–21. The ’652 patent further provides:

> After a sufficient volume of excited atoms including metastable atoms is present proximate to the inner cathode section 732*a* of the cathode assembly 732, the second power supply 222 generates an electric field (not shown) proximate to the volume of excited atoms between the inner cathode section 732*a* and the second anode 706. The electric field super-ionizes the initial plasma by raising the energy of the initial plasma including the volume of excited atoms which causes collisions between neutral atoms, electrons, and excited atoms including metastable atoms in the initial plasma. The high-density collisions generate the high-density plasma proximate to the inner cathode section 732*a*. The high-density plasma includes ions, excited atoms and additional metastable atoms. The efficiency of this multi-step ionization process increases as the density of excited atoms and metastable atoms increases.

Id. at 27:22–37.

D. Illustrative Claim

Of the challenged claims, claim 1 is the only independent claim. Challenged claims 2 through 17 depend, either directly or indirectly, from claim 1. Claim 1, reproduced below, is illustrative:

> 1. A high-density plasma source comprising:
>
> a) a cathode assembly;
>
> b) an anode that is positioned adjacent to the cathode assembly;

> c) an excited atom source that generates an initial plasma and excited atoms from a volume of feed gas, the initial plasma and excited atoms being proximate to the cathode assembly; and
>
> d) a power supply that generates an electric field between the cathode assembly and the anode, the electric field super-ionizing the initial plasma so as to generate a high-density plasma.

Ex. 1001, 33:53–64.

E. Prior Art Relied Upon

GlobalFoundries relies upon the following prior art references:

Wang et al.	US 6,413,382 B1	July 2, 2002	(Ex. 1004)
Iwamura et al.	US 5,753,886	May 19, 1998	(Ex. 1007)
Lantsman	US 6,190,512 B1	Feb. 20, 2001	(Ex. 1013)
Vratny	US 3,461,054	Aug. 12, 1969	(Ex. 1008)

D.V. Mozgrin, et al., *High-Current Low-Pressure Quasi-Stationary Discharge in a Magnetic Field: Experimental Research*, 21 PLASMA PHYSICS REPORTS 400–409 (1995) (Ex. 1003) ("Mozgrin").

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. 1006) ("Kudryavtsev").

D. W. Fahey, W. F. Parks, and L. D. Schearer, *High Flux Beam Source of Thermal Rare-Gas Metastable Atoms*, 13 J. PHYS. E: SCI. INSTRUM. 381–383 (1980) (Ex. 1005) ("Fahey").

F. Asserted Grounds of Unpatentability

We instituted the instant trial based on the following grounds of unpatentability (Dec. 32).

Claims	Basis	References
1–14, 16, and 17	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, and Iwamura
5	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, Vratny, and Iwamura
8–10	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, Lantsman, and Iwamura
15	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, Wang, and Iwamura

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). 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).

In the instant proceeding, GlobalFoundries proposed a construction of the term "super-ionizing the initial plasma." Pet. 13–14. Although Zond offered its own construction of this term, in addition to a construction of an "excited atom source that generates an initial plasma and excited ions from a volume of feed gas" and "a gas valve that injects feed gas proximate to the cathode assembly at a predetermined time" in its Preliminary Response, Prelim. Resp. 12–20, Zond did not address explicitly constructions of these terms in its Patent Owner Response. In its Patent Owner Response, however, Zond does apply our initial construction of the term "super-ionizing the initial plasma," PO Resp. 2–4, and relies on its proposed construction for "generating an initial plasma and excited ions from a volume of feed gas" in its overview of the teachings of Kudryavtsev. PO Resp. 16–20. We address these two claim terms in turn.

1. "excited atom source that generates an initial plasma and excited atoms from a volume of feed gas"

All claims at issue require an "excited atom source that generates an initial plasma and excited atoms from a volume of feed gas." Ex. 1001, 33:53–34:44. As we previously stated, Zond does not propose an explicit construction for this claim limitation in its Patent Owner Response. In its Preliminary Response, however, Zond proposes that this claim limitation should be construed as "a source for generating both an initial plasma and significantly more than an incidental amount of excited atoms from the same volume of feed gas, wherein a feed gas is a gas that is a flowing gas." Prelim. Resp. 15. Zond implicitly applies this proposed construction in its assertions concerning the teachings of Kudryavtsev.

Zond asserts in its Preliminary Response that the recitation of a "*volume* of feed gas" requires that both ionization and excitation occur in the *same* volume of feed gas, and that "feed gas" implies a flow of gas. Prelim. Resp. 12–13. In its Patent Owner Response, Zond reiterates this understanding of the meaning of "excited atom source that generates an initial plasma and excited atoms from a volume of feed gas," by asserting as follows regarding Kudryavtsev.

> Furthermore, and perhaps most importantly, *Kudryavtsev* says that the "studied effects" are characteristic of a system in which a ***field applied to a pre-existing weak plasma***, i.e. an initial plasma has already been created when the electric field is applied. In the claims at issue, excited atoms are formed from a volume of feed gas at the same time as an initial plasma is being formed from the same volume of feed gas. *Kudryavtsev* does not consider this situation. The analysis deals only with the reaction of an existing plasma when an electric field is suddenly applied.

PO Resp. 20 (citations omitted); *see also* PO Resp. 18 ("*Kudryavtsev* deals with the ***reaction of an existing plasma*** when an electric field is suddenly applied, and the formation of ions and excited atoms as a result of that pulse.").

As we previously stated in our Decision on Institution, *see* Dec. 12, the recitation of "feed gas" in claim 1 does not imply necessarily the flow of gas. Certainly, the gas is provided, but claim 1 does not recite generating an initial plasma and excited atoms "from a gas being fed," for example. Construing the claim limitation as Zond suggests would be equivalent to changing the scope of claim 1.

Also, we previously noted that the Specification of the '652 patent describes the use of in-line gas valves 242, 244 that can control the flow of gas to the chamber (Ex. 1001, 8:3–5), and also describes pulsing feed gases 234, 236 to help generate excited atoms, including metastable atoms, in gap 212 (Ex. 1001, 8:3–5, 8:23–25). *See* Dec. 12–13. Therefore, we concluded that such control of the feed gas supports the notion that "feed gas" does not necessitate a "gas that is a flowing gas." *Id.* at 13.

We also previously stated that the Specification of the '652 patent further states that feed gases may be introduced from multiple locations into the chamber. *Id.* (citing Ex. 1001, 8:1–3). We also stated that having multiple sources for feed gases does not support a construction that "a volume of feed gas" requires that the initial plasma and excited ions are generated from the *same* volume of feed gas, assuming that a particular volume of feed gas may be identified in such a process. *Id.* In its Patent Owner Response, Zond does not address these issues that we expressed with regard to its proposed claim construction. Although we did not construe explicitly the claim limitation "excited atom source that generates an initial plasma and excited atoms from a volume of feed gas," we discern no reason to modify our conclusions that the claim limitation does not imply necessarily the flow of gas, nor does it require that the initial plasma and excited ions are generated from the same volume of feed gas.

2. "super-ionizing the initial plasma"

All claims at issue require "super-ionizing the initial plasma." Ex. 1001, 33:53–34:44. GlobalFoundries notes that the Specification of the '652 patent explicitly defines "super-ionized" as "at least 75% of the neutral atoms in the plasma are converted to ions." Pet. 13 (citing Ex. 1001, 5:8–10). From this definition, GlobalFoundries concludes that the limitation at issue should be construed as "converting at least 75% of the neutral atoms *in the initial* plasma generated from a volume of feed gas to ions." *Id.* at 13–14 (emphasis added).

Zond made arguments in its Preliminary Response that it did not reiterate in its Patent Owner Response. Zond, noting the same definition in the '652 patent, asserts that the reference to "the plasma" in the definition means that "75% of the neutrals in the original feed gas have been converted to ions in the super-ionized plasma." Prelim. Resp. 15–16. Therefore, Zond asserts that this claim limitation should be construed to mean ionizing the plasma "so that at least 75% of the neutrals in the original feed gas have been converted to ions." Prelim. Resp. 16.

We noted in our Decision on Institution that the claim limitation at issue requires "super-ionizing the *initial* plasma," Ex. 1001, 33:63 (emphasis added), which Zond's proposed construction did not reflect. Dec. 11. We also noted that Zond's construction introduced a term "original feed gas" that does not appear to be used or defined in the Specification of the '652 patent; therefore, Zond's construction would introduce an unnecessary ambiguity into the claims. *Id.* We found that GlobalFoundries's proposed construction reflects the explicit definition of "super-ionized" provided in the '652 patent Specification. *Id.* Therefore, we initially construed the claim limitation as "converting at least 75% of the neutral atoms in the initial plasma into ions." *Id.* Neither party challenges our construction, *see* PO Resp. 27, Reply 3–11, and we discern no reason to modify our construction based on the complete record now before us. Therefore, we construe "super-ionizing the initial plasma" as "converting at least 75% of the neutral atoms in the initial plasma into ions."

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; *see Translogic*, 504 F.3d at 1259. A prima facie case of obviousness is established when the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art. *In re Rinehart*, 531 F.2d 1048, 1051 (CCPA 1976). Notwithstanding that Dr. Hartsough provides a definition of "a person of ordinary skill in the art" in the context of the ’652 patent,[3] we are mindful that the level of ordinary skill in the art also 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. Obviousness over, in Whole or in Part, the Combination of Mozgrin, Kudryavtsev, Fahey, Iwamura, Lantsman, and Wang

GlobalFoundries asserts the following: (1) Claims 1–14, 16, and 17 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Mozgrin, Kudryavtsev, Fahey, and Iwamura, Pet. 54–58; (2) Claim 5 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Mozgrin, Kudryavtsev, Fahey, Vratny, and Iwamura; (3) Claims 8–10 are unpatentable as obvious over the combination of Mozgrin, Kudryavtsev, Fahey, Lantsman, and Iwamura, Pet. 58–59; and (4) Claim 15 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Mozgrin, Kudryavtsev, Fahey, Wang, and Iwamura, Pet. 59–60.

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 an initial declaration and a supplemental declaration of Dr. Kortshagen to support GlobalFoundries’s Petition and

[3] “[A] person of ordinary skill in the art at the time of filing of the ’652 patent [is] someone who holds at least a bachelor of science degree in physics, material science, or electrical/computer engineering with at least two years of work experience or equivalent in the field of development of plasma-based processing equipment.” Ex. 2002 ¶ 17.

Reply, respectively. Pet. 54–60; Ex. 1002; Reply 16-20; Ex. 1020. Zond responds that these combinations do not disclose every claim element. PO Resp. 25–35.

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 Mozgrin, Kudryavtsev, Fahey, and Iwamura.

Mozgrin

Mozgrin discloses experimental research conducted on high-current, low-pressure, quasi-stationary discharge in a magnetic field. Ex. 1003, 400, Title. In Mozgrin, pulse or quasi-stationary regimes are discussed in light of the need for greater discharge power and plasma density. *Id.* Mozgrin discloses a planar magnetron plasma system having cathode 1, anode 2 adjacent and parallel to cathode 1, and magnetic system 3, as shown in Figure 1(a). *Id.* at 400–01. Mozgrin also discloses a power supply unit that includes a pulsed discharge supply unit and a system for pre-ionization. *Id.* at 401–02, Fig. 2. For pre-ionization, an initial plasma density is generated when the square voltage pulse is applied to the gas. *Id.*

Figure 3(b) of Mozgrin is reproduced below.

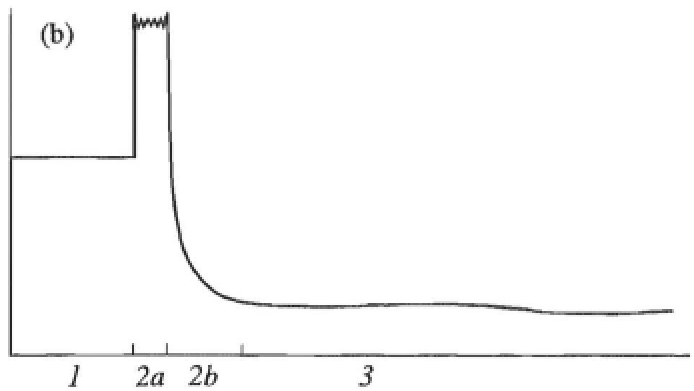


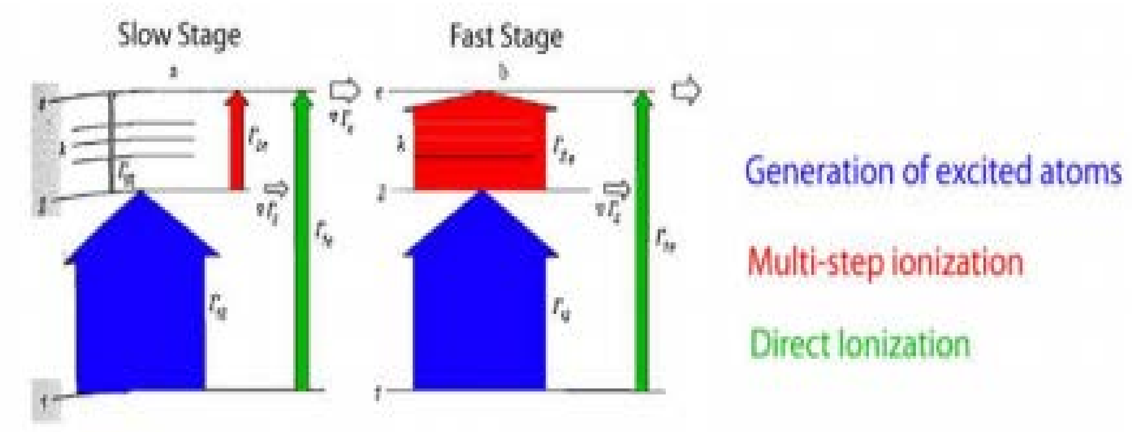
Figure 3(b) of Mozgrin illustrates an oscillogram of voltage of the quasi-stationary discharge. *Id.* at 402. In Figure 3(b), Part 1 represents the voltage of the stationary discharge (pre-ionization stage); Part 2 displays the square voltage pulse application to the gap (Part 2a), where the plasma density grows and reaches its quasi-stationary value (Part 2b); and Part 3 displays the voltage as the discharge current grows and both the voltage and discharge current attain their quasi-stationary value. *Id*. More specifically, the power supply generates a square voltage with rise times of 5–60 µs and durations of as much as 1.5 ms. *Id.* at 401.

Mozgrin further discloses the current-voltage characteristic of the quasi-stationary plasma discharge that has four different stable forms or regimes: (1) pre-ionization stage, *id*. at 401–02; (2) high-current magnetron discharge regime, in which the plasma density exceeds 2 x 10^{13} cm^{-3}, appropriate for sputtering, *id*. at 402–04, 409; (3) high-current diffuse discharge regime, in which the plasma density produces large-volume uniform dense plasmas $\eta_1 \approx 1.5 \times 10^{15}$ cm^{-3}, appropriate for etching, *id*.; and (4) arc discharge regime, *id*. at 402–04. *Id*. at 402–09, Figs. 3–7.

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. 1006, Abs., Figs. 1, 6.

Figure 1 of Kudryavtsev illustrates the atomic energy levels during the slow and fast stages of ionization. Figure 1 of Kudryavtsev is reproduced below (with annotations added by GlobalFoundries, Pet. 17).



As shown in 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. 1002 ¶ 46; Pet. 18–19.

Indeed, 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. 1006, 31, right col., ¶ 6 (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 30, Abs., Fig. 6.

Fahey

Fahey discloses a high-flux beam source that produces a beam of helium, neon, and argon metastable atoms. Ex. 1005, Abs. Figure 1, reproduced below, shows a beam source schematic showing Pyrex tube (A), boron nitride nozzle (B), skimmer (C), and needle or needle array (D). *Id.* at 381, right col.

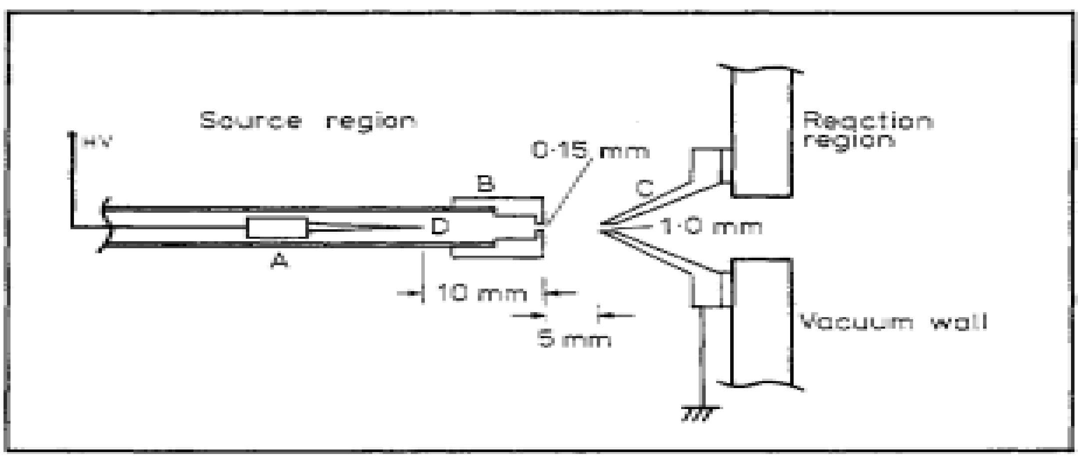
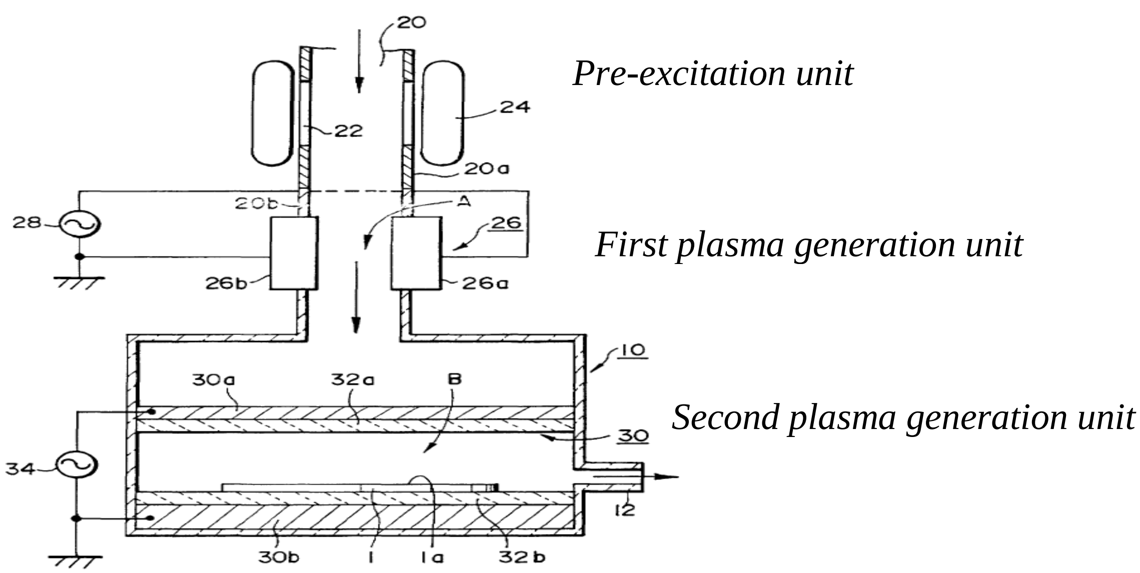


Figure 1 above shows a source that produces a low-voltage discharge between sharp needle D, which is a cathode maintained at a negative potential, and cone-shaped skimmer electrode C, which is kept at ground potential. *Id.* at 381, right col., ¶ 4; 382, left col., ¶ 2. Skimmer piece C is attached with an aluminum gasket to a vacuum wall to allow differential pumping of the source. *Id.* at 382, left col., ¶ 1. For all diagnostic measurements, a set of parallel sweep plates, maintained at an adequate voltage, is mounted after the skimmer to keep the beam free of charged species. *Id.* at 382, left col., ¶ 5. The source can provide very stable thermal energy beams of helium, neon, and argon metastable atoms. *Id.* at 381, right col., ¶ 3.

<u>Iwamura</u>

Iwamura discloses a plasma treatment apparatus for generating a stable plasma with a multi-step ionization process, to treat a semiconductor wafer. Ex. 1007, Abs., 6:67–7:8. Figure 1 of Iwamura, reproduced below (with our annotations added), illustrates a plasma treatment apparatus.

FIG. 1



As shown in Figure 1 of Iwamura, plasma chamber 10 is coupled to the gas supply pipe (shown as items 20a and 20b). Gas supply 20 supplies a gas capable of plasma discharge (e.g., helium or argon, a noble gas) through a pre-excitation unit that includes ultraviolet lamp 24, and a first plasma generation unit that includes electrodes 26. *Id*. at 6:67–7:17, 49. Ultraviolet lamp 24 causes photoionization, raising the excitation level of the gas and generating excited and metastable atoms from ground state atoms. *Id*. at 7:55–60. Thereafter, a plasma is generated from the gas in plasma region A, between electrodes 26 (the first plasma generation unit), and a plasma also is generated in plasma region B, between electrodes 30 (the second plasma generation unit). *Id*. at 7:61–65, 8:4–9, 8:32–46. According to Iwamura, because the excitation level of the gas is raised first, a stable plasma can be generated inside the plasma chamber. *Id*. at 8:32–37. Consequently, the uniformity of the plasma density, as well as the yield of the treatment of the semiconductor wafer, can be improved. *Id*. at 8:41–46.

Analysis

Zond does not take issue with GlobalFoundries's assertions that the cited references teach "a high density plasma source comprising a cathode assembly, and an anode that is positioned adjacent to the cathode assembly." *See* PO Resp. 25–30. After reviewing the record, we are persuaded that GlobalFoundries has shown that the references teach these limitations that are found in all challenged claims. *See* Pet. 20–34, 54–58; Ex. 1002 ¶¶ 52–81, 141–146.

Zond does assert that GlobalFoundries has failed to show any cited reference teaches "super-ionizing the initial plasma so as to generate a high-density plasma," *see* PO Resp. 25–30, and, at least implicitly, asserts that no reference teaches "an excited atom source that generates an initial plasma and excited atoms from a volume of feed gas," PO Resp. 20–23.

“an excited atom source that generates an initial plasma and excited atoms from a volume of feed gas”

Zond notes deficiencies in the references for what each teaches alone (*see* PO Resp. 16–23), and argues that the combination does not teach or suggest “an excited atom source that generates an initial plasma and excited atoms from a volume of feed gas,” *see* PO Resp. 22–23 (regarding Fahey), 20 (regarding Kudryavtsev). References must be read, however, not in isolation, but for what each fairly teaches in combination with the prior art as a whole. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Zond does not address what the combination of references asserted by GlobalFoundries teaches, but only addresses the references individually.

GlobalFoundries asserts that both Fahey and Iwamura teach “generating an initial plasma and excited atoms from a volume of feed gas.” *See* Pet. 22–24, 54–58. GlobalFoundries asserts the following concerning Fahey.

> While many of the charged species are skimmed by Fahey’s skimmer, some of the charged species will pass through the skimmer, as is said to occur in the ’652 Patent. *See, e.g.*, ’652 Patent, 27:18–21 (“A large fraction of the ions and electrons are trapped in the nozzle chamber 738 while the excited atoms and ground state atoms flow through the aperture 737 of the skimmer 736.”) (Ex. 1001). Kortshagen Decl. ¶ 58 (Ex. 1002). Therefore, like the ’652 Patent, Fahey generates both an initial plasma and excited atoms from a volume of feed gas. *Id*.

Pet. 23–24.

Zond’s argument with respect to the teachings of Fahey focuses on a lack of teaching of generation of an initial plasma and excited atoms from a volume of feed gas by pointing out that Fahey "describes a device for generating a beam of 'metastable atoms,'" where the beam is kept free from charged species because ions are removed by a set of parallel plates mounted after the skimmer. PO Resp. 22 (citing Ex. 1005, 382, left col., penultimate paragraph). This does not detract, however, from the teaching that Fahey's source generates plasma containing charged species, such as electrons and ions. Pet. 22–24; Ex. 1020 ¶¶ 54–62; Ex. 1002 ¶ 47; Ex. 1005, Introduction (describing metastable beam source, simplified by Fahey's modifications, which design employed a "weak, high-voltage *corona* discharge between a sharp needle and a cone-shaped anode") (emphasis added).

As Dr. Kortshagen points out, Fahey discloses a high-flux beam source design *and* a diagnostic measurement setup to characterize the performance of the beam using two different detection methods. Ex. 1020 ¶ 57. It is only for the diagnostic measurements, however, that Fahey states that the beam was kept free of charged species by using parallel sweep plates mounted after the skimmer. *Id.* ¶ 59 (citing Ex. 1005, 382, left col., ¶ 5). Therefore, Dr. Kortshagen concludes that the use of the parallel sweep plates in Fahey is irrelevant to the combination that he proposes where "one of ordinary skill in the art would look to apply Fahey's high-flux beam source disclosed in Section 2, and as shown in Fig. 2.3, to generate an initial plasma and excited atoms that are then transported to Mozgrin's discharge assembly where the high-density plasma is generated from the initial plasma." *Id*. ¶ 60 (citing Ex. 1002 ¶ 59).

We agree with GlobalFoundries that Fahey's beam source, which has substantially the same structure as an embodiment in the '652 patent, teaches generating an initial plasma and excited atoms from a volume of feed gas. *See* Pet. 22–24 (citing Ex. 1002 ¶¶ 56–58; Ex. 1005).[4] Figure 12 of the ’652 patent and Figure 1 of Fahey (with GlobalFoundries’s annotations, Pet. 22) are reproduced below.

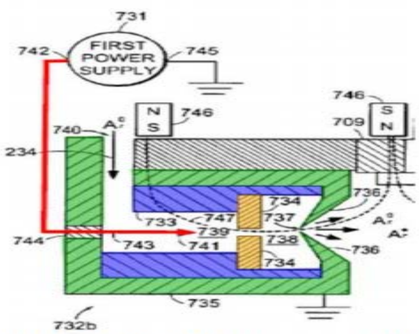


Fig. 12 of ’652 Patent (partially reproduced) (Ex. 1101)

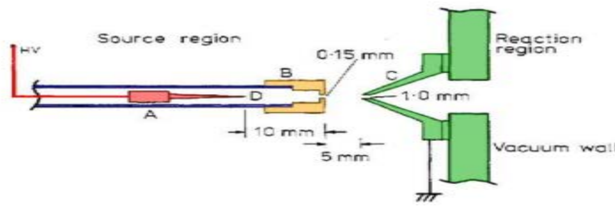


Fig. 1 of Fahey (Ex. 1105)

Figure 12 of the ’652 patent shows a cross-sectional view of the plasma generating apparatus, and Figure 1 of Fahey shows a very similar beam source.

We also agree with GlobalFoundries that Iwamura teaches “the desirability of generating excited species, and having a preexcitation unit for

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[4] Zond also appears to assert that the combination does not teach “generating an initial plasma and excited ions from a volume of feed gas” because Kudryavtsev does not address circumstances where excited atoms are formed from a volume of feed gas at the same time as an initial plasma is being formed from the same volume of feed gas. PO Resp. 20; *see also* PO Resp. 19 (stating Kudryavtsev does not disclose details of pre-ionization process “such as whether the gas was flowing during the ionization”). As we indicated in our claim construction section above, a construction of “an excited atom source that generates an initial plasma and excited atoms from a volume of feed gas” that requires creation of the initial plasma and excited ions from the *same* volume of feed gas that is flowing is not supported by the record. *See supra* Section II.A.1.

generating a first plasma." *Id.* at 55 (citing Ex. 1002 ¶¶ 141–142; Ex. 1007, 1:14–19, 2:34–39). We also agree that Iwamura does not state that the disclosed methods of generating initial plasma (e.g., UV, microwave, or radio frequency) are critical, and that the '652 patent suggests that various methods may be used to generate the initial plasma. Pet. 56–57; Ex. 1001, 9:49–64; Ex. 1002 ¶¶ 142–147. The method of Fahey would have been another method that could have been used as "an excited atom source that generates an initial plasma and excited atoms from a volume of feed gas." Pet. 55–57; Ex. 1002 ¶ 143, 146.

<u>"Super-Ionizing the Initial Plasma so as to Generate a High-Density Plasma"</u>

Zond asserts that the combination of Mozgrin, Kudryavtsev, Fahey, and Iwamura does not teach or suggest "super-ionizing an initial plasma so as to generate a high-density plasma" as required by all challenged claims. PO Resp. 1. Specifically, Zond states that Dr. Kortshagen's testimony, at best, only shows "the percentage of ions in the *final*, high-density plasma, and is silent on what percentage of those ions were generated from the neutral atoms in the *initial* plasma." *Id.* at 3; *see id.* at 25–26. Zond's argument relies on Dr. Hartsough's explanation that

> The initial neutral gas (the volume of feed gas) is acted upon by "an excited atom source that generates an initial plasma and excited atoms from [that] volume of feed gas." As a result, there are fewer neutral atoms remaining in the initial plasma than in the original volume of feed gas. It is 75% of these, fewer in number, neutral atoms that are then converted into ions, through super-ionization, so as to generate the high-density plasma as claimed. Dr. Kortshagen's computations fail to address this requirement and, instead, address only the ionization degree of the high-density plasma, without regard to

> the percentage of neutrals in the initial plasma that are converted.

Ex. 2002 ¶ 85; PO Resp. 29. Zond concludes that GlobalFoundries has failed to demonstrate that the proposed combination of Mozgrin, Kudryavtsev, Fahey and Iwamura teaches or suggests super-ionizing an initial plasma and excited atoms so as to generate a high-density plasma, as required by claim 1. PO Resp. 26. Notably, Zond does not disagree that Mozgrin discloses super-ionization of a plasma. *See* Reply 9; Ex. 1020 ¶ 35; PO Resp. 16 (stating "the pre-ionized gas created by *Mozgrin*'s DC voltage apparently remains in the same location when *Mozgrin's* High-Voltage component superimposes the voltage pulse across the electrodes to thereby grow the density of the pre-ionized gas").

GlobalFoundries responds that the number of ions present in the initial plasma is so much less than the number of ions present in the high-density plasma, some six to eight orders of magnitude less, as to make the initial plasma's ion contribution negligible when calculating the degree of ionization of the high-density plasma. Reply 16–17; Ex. 1002 ¶¶ 72–78; Ex. 1020 ¶¶ 35–40. For instance, Mozgrin explicitly states that a degree of ionization approaching 1 was observed, wherein ~100 percent of the neutral gas atoms are ionized (*see* Reply 2–3 (citing Ex. 1020 ¶¶ 32–34; Ex. 1021, 124:12–23 (testimony showing agreement from Dr. Hartsough))), indicating a super-ionized plasma. Reply 17. GlobalFoundries further asserts that Mozgrin discloses the same two-step process for generating a high-density plasma as disclosed in the '652 patent, specifically, power pulse characteristics that fall within the ranges in the ’652 patent. *Id.* at 17 (citing Ex. 1020 ¶¶ 19–30, 88).

We agree with GlobalFoundries that Mozgrin does indeed disclose “super-ionizing the initial plasma so as to generate a high-density plasma.” In addition to the detailed explanation of how Mozgrin teaches creating a high density plasma by super-ionizing the initial plasma, *see* Pet. 29–34; Ex. 1002 ¶¶ 71–81, Dr. Kortshagen further explains in his Supplemental Declaration, in response to Zond’s arguments, that Mozgrin discloses power levels and pulse characteristics that fall within the ranges disclosed in the ’652 patent for first generating an initial plasma and then applying a high-power pulse to increase the plasma density. Reply 6–8 (citing Ex. 1020 ¶¶ 24–28). Dr. Kortshagen summarized his comparison of the ’652 patent and Mozgrin in the table below. *See* Ex. 1020 ¶ 29.

	’652 Patent	**Mozgrin**
Generating the **initial plasma**	Applied Power: 10W to 100kW. ’652 Patent at 17:67-18:1. Resulting Plasma Density: 10^7 to 10^{12} cm^{-3}. ’652 Patent at 8:60-62.	Applied Power: 52W to 56W. Mozgrin at p. 402, right col. ¶ 3. Resulting Plasma Density: 10^9 – 10^{11} cm^{-3}. Mozgrin at p. 402, right col. ¶ 2.
Generating the **high-density plasma**	High-Power Pulse: 1kW to 1MW. ’652 Patent at 18:10-12. Pulse Rise Time: 0.1μs to 10s. ’652 Patent at 18:16-18. Pulse Duration: 0.1μs to 10s. ’652 Patent at 18:22-24. Resulting Plasma Density: Greater than 10^{12} cm^{-3}. ’652 Patent at 10:57-63.	High-Power Pulse: 100kW. Mozgrin at p. 404, right col. ¶ 2. Pulse Rise Time: 5μs to 60μs. Mozgrin at p. 401, right col. ¶ 1. Pulse Duration: 50μs. Mozgrin at Fig. 3; p. 401, right col. ¶ 1. Resulting Plasma Density: 1.5 x 10^{15} cm^{-3}. Mozgrin at p. 404, right col. ¶ 2.

From this comparison of the applied power and resulting plasma density for the generation of an initial plasma and the comparison of the high-power pulse, including the pulse rise time and duration, and the resulting plasma density for the generation of the high-density plasma as shown in the table above, Dr. Kortshagen concludes that "Mozgrin expressly teaches generating a high-density plasma from an initial plasma under the conditions and parameters that the '652 patent discloses will super-ionize the initial plasma to generate a high-density plasma." Ex. 1020 ¶ 30; *see also* Ex. 1002 ¶ 71 (explaining that Mozgrin discloses embodiments and parameters that result in at least 75% of the neutral atoms in the plasma being converted to ions as required by the challenged claims).

We also agree with GlobalFoundries, as Dr. Kortshagen explains, that Mozgrin *expressly* confirms super-ionizing the initial plasma to create a high density plasma. *See* Ex. 1020 ¶¶ 31–34. Dr. Kortshagen explains that Mozgrin discloses an ionization degree that approaches 100 percent for the transition between regime 2 and 3, an assessment with which Dr. Hartsough agrees. *Id.*; Ex. 1021, 124:12–23. At a level of ionization approaching 100 percent, Mozgrin discloses super-ionization of an initial plasma.[5] *See*

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[5] Dr. Hartsough questions Dr. Kortshagen's computations concerning Mozgrin, asserting that "*Mozgrin* does not control pressure of his fill gas, so as temperature rises, pressure will rise." Ex. 2002 ¶ 13. We credit Dr. Kortshagen's testimony (*see* Ex. 1002 ¶¶ 71–81; Ex. 1020 ¶¶ 35–53) and agree with GlobalFoundries, however, that Mozgrin does control its sputtering chamber pressure, but even if Mozgrin does not, Dr. Kortshagen's analysis demonstrates that Mozgrin teaches super-ionizing its initial plasma. *See* Reply 11–15.

Ex. 1002 ¶ 72 (concluding "if Mozgrin's neutral gas density were about 2.0 x 10^{15} atoms cm^{-3}, then at least 75% of the neutral argon gas would have been ionized").

Rationale to Combine

In providing a rationale to combine the references for the combinations of Mozgrin, Kudryavtsev, Fahey, and Iwamura, GlobalFoundries states that

> In short, Mozgrin and Kurdyavtsev teach super-ionizing and the desirability of high density with multi-step ionization, including very high plasma densities in a gas such as argon, that would be considered "super-ionized". Fahey provides a structure that is substantially the same as the disclosed embodiment in the '652 patent at Figure 12, and thus discloses the generating and transporting an initial plasma that includes an enhanced level of excited atoms. Iwamura teaches the desirability of providing an initial plasma with excited atoms using one of several methods. The method of Fahey would have been just another method that could have been used rather than the ones shown specifically in Iwamura.
>
> . . . Iwamura provides additional motivation for providing an initial plasma with excited atoms in a first step, followed by an energy-providing second step.

Pet. 57–58 (citing Ex. 1002 ¶¶ 146).

Although Zond does not challenge expressly GlobalFoundries rationale to combine the references, Zond's overview of the individual references indicates that it narrowly focuses on the physical differences between the prior art systems to show that one system cannot be bodily incorporated into the other. For example, Zond asserts that Kudryavtsev is directed to "pulsed gas lasers, gas breakdown, laser sparks, etc.," and Kudryavtsev's disclosed pressures and gas densities are much higher than those used for sputtering. PO Resp. 18. Zond also states that Kudryavtsev uses a "specially designed electric circuit" for generating pulses without describing the design or how it promotes the generation of excited atoms. *Id.* at 19. Zond also asserts that Fahey teaches a source that forms a flow of metastable atoms that are directed into a time-of-flight spectrometer, and does not suggest transporting a mixture of plasma and excited atoms to a region proximate to a cathode assembly for super-ionization. *Id.* at 23.

"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"). Also, as previously stated, references must be read, however, not in isolation, but for what each fairly teaches in combination with the prior art as a whole. *In re Merck & Co.*, 800 F.2d at 1097.

Zond improperly focuses on the teachings of individual references and whether all of the disclosed apparatuses of the references are able to be combined to teach what is claimed in the challenged claims. GlobalFoundries, however, focused on specific teachings from the references and what the combination of these teachings showed.

For instance, Dr. Kortshagen testifies that he did not propose to combine the diagnostic equipment of Fahey with Mozgrin, but relied on the teaching of Fahey's high-flux beam source that he concludes generates both an initial plasma and excited atoms from a volume of feed gas in the same manner as disclosed by the '652 patent. *See* Ex. 1020 ¶¶ 56–62. By the same token, Dr. Kortshagen states that Zond focuses on the physical differences between the invention of the '652 patent and Kudryavtsev's experimental setup. *Id.* ¶ 65. Dr. Kortshagen testifies, however, that Zond's arguments

> miss the point and are immaterial, as again, [Dr. Kortshagen] did not propose to somehow substitute or combine Kudryavtsev's physical tube used in his experiment to verify his model with Fahey or Mozgrin. Nor did [he] propose applying Kudryavtsev's teachings to generate an initial plasma. Rather, one of ordinary skill in the art would recognize the desirability of multi-step ionization with excited atoms from the teachings of Kudravtsev's model and apply that teaching to combine Fahey, ***which discloses a mechanism for providing an initial plasma and excited atoms***, with Mozgrin to further increase the plasma density of the plasma.
>
> . . . .
>
> As such, it would have been obvious to one of ordinary skill in the art in view of the teachings of Kudryavtsev's model to locate Fahey's excited atom source such that it provides an initial plasma and excited atoms proximate to Mozgrin's anode

> and cathode assembly to achieve the predictable and desirable result of explosively increasing the plasma density as taught by Kudryavtsev's model.

Ex. 1020 ¶¶ 66, 68.

We credit Dr. Kortshagen's testimony. Upon consideration of the parties' contentions and the evidence in this entire record, we determine that GlobalFoundries has demonstrated that combining the technical disclosures of Mozgrin, Kudryavtsev, Fahey, and Iwamura is merely a predictable use of prior art elements according to their established functions—an obvious improvement. *See KSR*, 550 U.S. at 417 ("[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.").

For the foregoing reasons, we determine that GlobalFoundries has demonstrated by a preponderance of the evidence that claim 1 is unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, and Iwamura.

<u>Claim 5</u>

Claim 5 of the '652 patent adds the following limitation to claim 1: "wherein the power supply comprises a RF power supply that generates an alternating electric field between the cathode assembly and the anode." Ex. 1001, 34:7–9. Zond asserts that the power supply of claim 5 refers to an RF power supply that super-ionizes the initial plasma to generate a high-density plasma. PO Resp. 31 (citing Ex. 2002 ¶ 87). Zond argues that, because GlobalFoundries relies on Mozgrin's statement that teaches use of an RF discharge for pre-ionization, GlobalFoundries misses the mark and has failed to show unpatentability of claim 5. *Id.* at 31–32. Zond argues that the addition of the teaching of Vratny does not remedy this deficiency. *Id.* at 32–33.

GlobalFoundries counters that Zond offers no explanation as to why Mozgrin's teaching of using RF for pre-ionization teaches away from using RF to generate a high-density plasma, and improperly ignores Vratney's teaching that its RF source increases the density of an existing plasma. Reply 19. Dr. Kortshagen testifies that "Vratny expressly discloses the simultaneous application of a direct-current potential and RF excitation to increase the density of a sputtering plasma for improved deposition rates." Ex. 1020 ¶ 94 (citing Ex. 1008, 2:63–38). Dr. Kortshagen concludes that "one of ordinary skill in the art would have been motivated to combine Vratny's teachings of providing RF excitation in addition to DC excitation with Mozgrin in order to generate the high-density plasma from the initial plasma, for the express benefit of further increasing the plasma density to enhance the rate of sputter deposition." *Id.* ¶ 95.

We agree that Mozgrin's teaching of using RF for pre-ionization does not discourage its use with super-ionization, especially when read in light of the teachings of Vratny. We also agree with Dr. Kortshagen's assessment of the teachings of Vratny and credit his testimony concerning the rationale to combine Vratney with the teaching of Mozgrin. The combination of references teaches the additional limitation of claim 5.

Remaining Dependent Claims

Zond does not address specifically any additional arguments of GlobalFondries regarding the obviousness of dependent claims 2–4, 6–14, 16, or 17 in relation to the combination of Mozgrin, Kudryavtsev, Fahey, and Iwamura, *see* PO Resp. 25–30, nor the obviousness of dependent claims 8–10 in relation to the combination of Mozgrin, Kudryavtsev, Fahey, Lantsman, and Iwamura, *see id*. at 34, nor the obviousness of dependent claim 15 in relation to the combination of Mozgrin, Kudryavtsev, Fahey, Wang, and Iwmaura, *see id*. at 34–35.

We have reviewed GlobalFoundries's assertions and Dr. Kortshagen's testimony regarding these claims, *see* Pet. 34–47, 49–60; Reply 1 (stating Zond and Dr. Hartsough "failed to address individual elements of claims 2–4, 6, 7, 11–14, 16, 17, effectively conceding that these claim elements are unpatentable with a combination of the cited references"), 20 (stating "[b]ecause Patent Owner does not put forth any distinct arguments for claims 8–10 and 15 outside of its arguments for independent claim 1, Petitioner treats these claims as having not been explicitly contested by Patent Owner similar to claims 2–4, 6, 7, 11–14, 16 and 17 of the '652 Patent about which Patent Owner makes no explicit mention in its Response"); Ex. 1002 ¶¶ 82–124, 131–130, 132–147, 149–150, and determine that GlobalFoundries has demonstrated by a preponderance of the evidence that claims 2–4, 6, 7, 11–14, 16, 17 are unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, and Iwamura; that claims 8–10 are unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, Lanstman, and Iwamura; and that claim 15 is unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, Wang, and Iwamura.

Conclusion

For the foregoing reasons, we determine that GlobalFoundries has demonstrated by a preponderance of the evidence that claims 1–14, 16, and 17 are unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, and Iwamura, that claim 5 is unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, Vratny, and Iwamura, that claims 8–10 are unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, Lantsman, and Iwamura, and that claim 15 is unpatentable over the combination of Mozgrin, Kudryavtsev, Fahey, Wang, and Iwamura.

III. CONCLUSION

For the foregoing reasons, we determine that GlobalFoundries has demonstrated, by a preponderance of the evidence, that claims 1–17 are unpatentable based on the following grounds:

Claims	**Basis**	**References**
1–14, 16, and 17	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, and Iwamura
5	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, Vratny, and Iwamura
8–10	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, Lantsman, and Iwamura
15	§ 103(a)	Mozgrin, Kudryavtsev, Fahey, Wang, and Iwamura

IV. ORDER

For the foregoing reasons, it is

ORDERED that claims 1–17 of the ’652 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,

Dated: March 7, 2016

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