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Paper 48
Entered: October 1, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE GILLETTE COMPANY, FUJITSU SEMICONDUCTOR LIMITED,
and FUJITSU SEMICONDUCTOR AMERICA, INC.
Petitioners,

v.

ZOND, LLC,
Patent Owner.

Case IPR2014-00580[1]
Patent 6,896,773 B2

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

Opinion for the Board filed by *Administrative Patent Judge Chang*.

Opinion Dissenting-in-Part filed by *Administrative Patent Judge Stephens*.

CHANG, *Administrative Patent Judge*.

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

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[1] Case IPR2014-01479 has been joined with the instant *inter partes* review.

I. INTRODUCTION

The Gillette Company ("Gillette") filed a revised Petition requesting an *inter partes* review of claims 1–20 and 34–39 of U.S. Patent No. 6,896,773 B2 (Ex. 1001, "the '773 patent"). Paper 7 ("Pet."). Patent Owner Zond, LLC ("Zond") filed a Preliminary Response. Paper 10 ("Prelim. Resp."). Upon consideration of the Petition and Preliminary Response, we instituted the instant trial on October 10, 2014, pursuant to 35 U.S.C. § 314. Paper 11 ("Dec.").

Subsequent to institution, we granted the Motion for Joinder filed by Taiwan Semiconductor Manufacturing Company, Ltd., TSMC North America Corp. (collectively, "TSMC"), Fujitsu Semiconductor Limited, and Fujitsu Semiconductor America, Inc. (collectively, "Fujitsu"), joining Case IPR2014-01479 with the instant trial (Paper 20), and also granted a Joint Motion to Terminate with respect to TSMC (Paper 37).[2] Zond filed a Response (Paper 32 ("PO Resp.")), and Gillette filed a Reply (Paper 39 ("Reply")). Oral hearing[3] was held on June 16, 2015, and a transcript of the hearing was entered into the record. Paper 47 ("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 Gillette has shown, by a preponderance of the evidence, that claims 1–20 and 34–39 of the '773 patent are unpatentable under 35 U.S.C. § 103(a).

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[2] In this Decision, we refer to The Gillette Company (the original Petitioner) and Fujitsu as "Gillette," for efficiency.

[3] The oral arguments for the instant review and Case IPR2014-00726 were consolidated.

A. Related District Court Proceedings

Gillette indicates the ’773 patent was asserted in *Zond, LLC v. The Gillette Co.*, No.1:13-CV-11567-DJC (D. Mass.), and identifies other proceedings in which Zond asserted the claims of the ’773 patent. Pet. 1.

B. The ’773 Patent

The ’773 patent relates to a method and an apparatus for high-deposition sputtering. Ex. 1001, Abs. At the time of the invention, sputtering was a well-known technique for depositing films on semiconductor substrates. *Id*. at 1:5–6. According to the ’773 patent, conventional magnetron sputtering systems deposit films with relatively low uniformity. *Id.* at 1:53–54. Although film uniformity can be increased by mechanically moving the substrate and/or magnetron, the ’773 patent indicates such systems are relatively complex and expensive to implement. *Id.* at 1:54–57. The ’773 patent further states that conventional magnetron sputtering systems also have relatively poor target utilization (how uniformly the target material erodes during sputtering) and a relatively low deposition rate (the amount of material deposited on the substrate per unit of time). *Id.* at 1:57–66. To address these issues, the ’773 patent discloses a plasma sputtering apparatus that creates a strongly-ionized plasma from a weakly-ionized plasma using a pulsed power supply. *Id*. at Abs. According to the ’773 patent, “[t]he strongly-ionized plasma includes a first plurality of ions that impact the sputtering target to generate sufficient thermal energy in the sputtering target to cause a sputtering yield of the sputtering target to be non-linearly related to a temperature of the sputtering target.” *Id*.

C. Illustrative Claim

Of the challenged claims, claims 1 and 34 are independent. Claims 2–20 and 35–39 depend, directly or indirectly, from claims 1 and 34. All of the claims at issue here are directed to a sputtering source. Claim 1, reproduced below, is illustrative:

> 1. A sputtering source comprising:
>
> a cathode assembly that is positioned adjacent to an anode, the cathode assembly including a sputtering target;
>
> an ionization source that generates a weakly-ionized plasma from a feed gas proximate to the anode and the cathode assembly; and
>
> a power supply that generates a voltage pulse between the anode and the cathode assembly that creates a strongly-ionized plasma from the weakly-ionized plasma, an amplitude and a rise time of the voltage pulse being chosen to increase a density of ions in the strongly-ionized plasma enough to generate sufficient thermal energy in the sputtering target to cause a sputtering yield to be non-linearly related to a temperature of the sputtering target.

Ex. 1001, 21:8–24.

D. Prior Art Relied Upon

Gillette relies upon the following prior art references:

Wang	US 6,413,382 B1	July 2, 2002	(Ex. 1003)
Fu	US 6,306,265 B1	Oct. 23, 2001	(Ex. 1007)
Lantsman	US 6,190,512 B1	Feb. 20, 2001	(Ex. 1008)
Kawamata	US 5,958,155	Sept. 28, 1999	(Ex. 1009)
Chiang	US 6,398,929 B1	June 4, 2002	(Ex. 1011)

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. 1005) ("Mozgrin").

D.V. Mozgrin, *High-Current Low-Pressure Quasi-Stationary Discharge in a Magnetic Field: Experimental Research*, Thesis at Moscow Engineering Physics Institute (1994) (Ex. 1015) ("Mozgrin Thesis").[4]

Interaction of Low-Temperature Plasma With Condensed Matter, Gas, and Electromagnetic Field in (III) ENCYCLOPEDIA OF LOW-TEMPERATURE PLASMA (V.E. Fortov ed., 2000) (Ex. 1004) ("Fortov").[5]

A.A. Kudryavtsev and V.N. Skrebov, *Ionization Relaxation in a Plasma Produced by a Pulsed Inert-Gas Discharge,* 28 SOV. PHYS. TECH. PHYS. 30–35 (Jan. 1983) (Ex. 1006) ("Kudryavtsev").

Yuri P. Raizer, GAS DISCHARGE PHYSICS, 1–35, Springer 1997 (Ex. 1012) ("Raizer").

W. Ehrenberg and D.J. Gibbons, ELECTRON BOMBARDMENT INDUCED CONDUCTIVITY AND ITS APPLICATIONS, 80–122, (1981) (Ex. 1026) ("Ehrenberg").

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[4] Mozgrin Thesis is a Russian-language reference (Ex. 1016). The citations to Mozgrin Thesis are to the certified English-language translation submitted by Gillette (Ex. 1015).

[5] Fortov is a Russian-language reference (Ex. 1010). The citations to Fortov are to the certified English-language translation submitted by Gillette (Ex. 1004).

E. Grounds of Unpatentability

We instituted the instant trial based on the following grounds of unpatentability (Dec. 46, Paper 19, 2):

Claim(s)	**Basis**	**References**
1, 6, and 8–20	§ 103	Mozgrin and Fortov
5	§ 103	Mozgrin, Fortov, and Kawamata
3, 4, and 34–39	§ 103	Mozgrin, Fortov, and Lantsman
7	§ 103	Mozgrin, Fortov, and Kudryavtsev
2	§ 103	Mozgrin, Fortov, Mozgrin Thesis, and Raizer

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,"[6] and "the standard was properly adopted by PTO regulation."). 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

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

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).

"weakly-ionized plasma" and "strongly-ionized plasma"

Claim 1 recites "a power supply that generates a voltage pulse between the anode and the cathode assembly that creates a *strongly-ionized plasma* from the *weakly-ionized plasma*." Ex. 1001, 21:15–17 (emphases added). During the pre-trial stage of this proceeding, the parties also submitted their constructions for the claim terms "a weakly-ionized plasma" and "a strongly-ionized plasma." Pet. 4–5; Prelim. Resp. 19. In our Decision on Institution, we adopted Zond's proposed constructions, in light of the Specification, as the broadest reasonable interpretations. Dec. 11–12; *see, e.g.,* Ex. 1001, 13:31–33 ("strongly-ionized plasma 268 having a large ion density being formed").

Upon review of the parties' explanations and supporting evidence before us, we discern no reason to modify our claim constructions set forth in the Decision on Institution with respect to these claim terms. Dec. 11–12. Therefore, for purposes of this Final Written Decision, we construe, in light of the Specification of the '773 patent, the claim term "a weakly-ionized plasma" as "a plasma with a relatively low peak density of ions," and the claim term "a strongly-ionized plasma" as "a plasma with a relatively high peak density of 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; *Translogic*, 504 F.3d at 1262. 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. Obviousness over Mozgrin and Fortov

Gillette asserts that claims 1, 6, and 8–20 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Mozgrin and Fortov.

Pet. 13–25. In its Petition, Gillette explains how the combination of the prior art technical disclosures collectively meets each claim limitation and articulates a rationale to combining the teachings. *Id*. Gillette also submitted a Declaration of Mr. Richard DeVito (Ex. 1005) to support its Petition, and a Declaration of Dr. John C. Bravman (Ex. 1028) to support its Reply to Zond's Patent Owner Response.

Zond responds that the combination of Mozgrin and Fortov does not disclose every claim element. PO Resp. 34–53. Zond also argues that there is insufficient reason to combine the technical disclosures of Mozgrin and Fortov. *Id*. at 14–34. 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 Mozgrin and Fortov, and then we address the parties' contentions in turn.

<u>Mozgrin</u>

Mozgrin discloses experimental research conducted on high-current low-pressure quasi-stationary discharge in a magnetic field. Ex. 1002, 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) (reproduced below). *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:

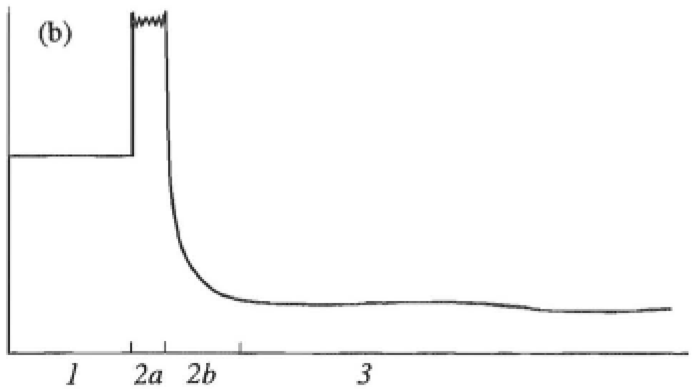


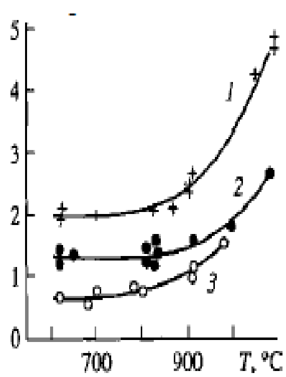
Figure 3(b) of Mozgrin illustrates an oscillogram of voltage of the quasi-stationary discharge. *Id.* at 402. In Figure 3(b), Part 1 represents the voltage of the stationary discharge (pre-ionization stage); Part 2 displays the square voltage pulse application to the gap (Part 2a), where the plasma density grows and reaches its quasi-stationary value (Part 2b); and Part 3 displays the discharge current growing and attaining its 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 402–409, Figs. 3–7.

Fortov

Fortov is a Russian-language encyclopedia of plasma physics. Ex. 1004, 1. The cited portion of Fortov is directed to interaction of plasma with condensed matter and, more particularly, to sputtering. *Id*. at 3–4. Fortov discloses the non-linear relationship between the target temperature and the sputtering yield *Y* above temperature T_0. *Id.* at 16. According to Fortov, *Y* is the coefficient of sputtering, "defined as the relation of the number of sputtered atoms of a target to the number of bombarding ions (atoms)," which "depends on the type of ions (its atomic number Z_i and mass M_i)." *Id.* at 6.

Figure VI.1.315 of Fortov is reproduced below.



Pic. VI.1.315. Sputtering coefficient of cuprum being bombarded by the ions of Ar^+ with the energy of 400 eV, from the temperature: 1 — electrolytic copper, 2 — rolled copper, 3 — cuprum monocrystal, facet (101)

Figure VI.1.315 of Fortov describes the sputtering coefficient of copper (cuprum) being bombarded by ions of Ar^+ with the energy of 400 eV, from the temperature: 1 — electrolytic copper, 2 — rolled copper, 3 — single crystal copper (cuprum monocrystal), facet (101). *Id*. at 9. According to Fortov, at a temperature less than T_1, coefficient *Y* is not actually dependent on the temperature, and, at $T \approx T_1$, *Y* starts to grow rapidly, concurrently with growth of temperature. *Id*. Fortov further explains temperature T_1 is sometimes defined according to the empirical relation $T_1 = .7\ T_m$ where T_m is the melting temperature, though in some cases, e.g., for tin (stannum) $T_1 > T_m$ and $T_1 = U/40k$ (k is Boltzmann constant; U is the energy of sublimation correlated to one atom). *Id.* at 7, 9. Temperature T_1 depends on the type, energy, and density of ion flow. *Id.* at 9.

Ionization source

Gillette takes the position that Mozgrin in combination with Fortov discloses a sputtering source comprising a cathode assembly that is positioned adjacent to an anode, and "an ionization source that generates a weakly-ionized plasma from a feed gas proximate to the anode and the cathode assembly," as recited in independent claims 1 and 34.[7] Pet. 13–19, 41. According to Gillette, Mozgrin discloses using a power supply to generate a weakly-ionized plasma with density less than 10^{12} ions/cm^3 from the feed gas. *Id*. at 14–15 (citing Ex. 1002, 400–02, Figs. 1, 2, 6).

Figure 1 of Mozgrin is reproduced below.

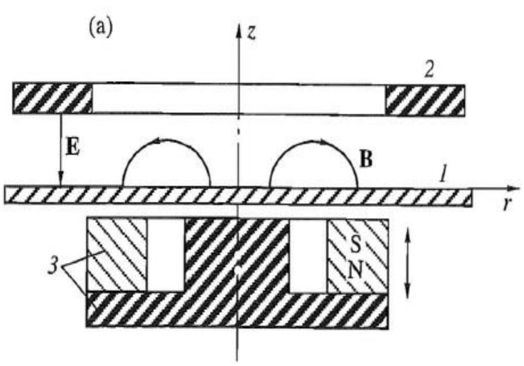


Figure 1(a) of Mozgrin

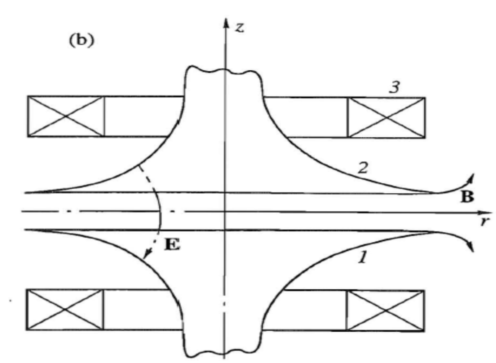


Figure 1(b) of Mozgrin

[7] We include independent claim 34 in our analysis as to claim 1 here because claim 34 includes all of the limitations of claim 1. Gillette relies upon the same teachings of Mozgrin and Fortov, and Zond asserts the same arguments, for these limitations of claim 34. *See* PO Resp. 35–43.

Figure 1 of Mozgrin illustrates two types of systems: (1) a planar magnetron system, as shown in Figure 1(a); and (2) a shaped-electrode magnetron system, as shown in Figure 1(b). Ex. 1002, 401. Each system comprises cathode 1, anode 2, and magnetic system 3. *Id*. Gillette points out that Mozgrin's magnetron systems generate a plasma from a feed gas, such as argon and nitrogen, between and proximate to the anode and cathode, as shown in Mozgrin's Figure 1. Pet. 15; Ex. 1002, 400–02 ("The [plasma] discharge had an annular shape and was adjacent to the cathode.").

In its Response, Zond opposes and advances two arguments. PO Resp. 35–39. First, Zond counters that Mozgrin does not disclose "a weakly-ionized plasma *proximate to both* the anode and the cathode assembly." *Id*. at 35–38 (emphasis added). As support, Dr. Hartsough testifies that a point on the z-axis of the shaped-electrode system, where Mozgrin measured the density of the plasma, "can either be close to the cathode [] or the anode [], *but not both*." Ex. 2005 ¶ 84 (emphasis added).

Upon review of the record before us, we are not persuaded by Zond's argument and expert testimony. Rather, we determine that Gillette's contentions are supported by a preponderance of the evidence.

As an initial matter, we note that, notwithstanding the claim term "proximate" is a relative term, Zond does not allege that the Specification of the '773 patent sets forth a special definition for the term. PO Resp. 35–39. Nor does Zond explain how one of ordinary skill in the art, reading the Specification, would have ascertained, with reasonable certainty, the required distance between the plasma and the anode/cathode in order for the plasma to be "proximate to the anode and the cathode assembly." *Id*.

Nonetheless, Zond's expert, Dr. Hartsough, testified during his cross-examination that the plasma formed in region 245—within *the gap* between anode 238 and cathode assembly 216, as shown in Figure 5B of the '773 patent—is *proximate* to both anode 238 and cathode assembly 216. Ex. 1025, 120:4–8.

Figure 5B of the '773 patent is reproduced below with green annotations added.

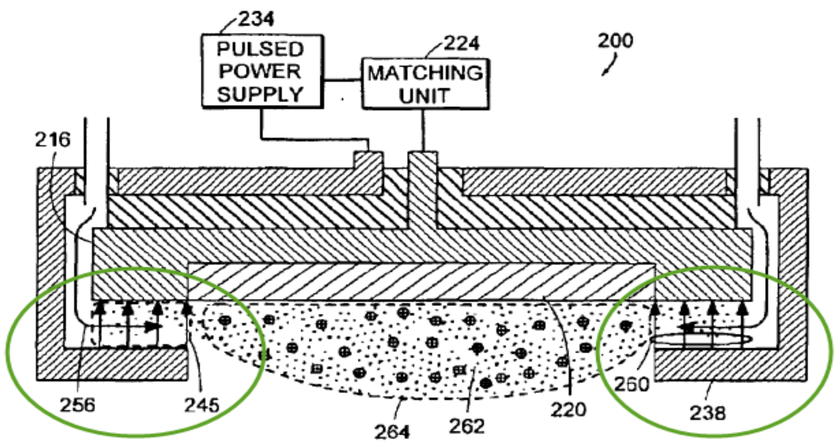


FIG. 5B

As shown in the annotated Figure 5B of the '773 patent, a plasma is generated in region 245 within the gap between anode 238 and cathode assembly 216. According the Specification of the '773 patent, the width of that gap is between approximately 3 to 100 mm. Ex. 1001, 10:23–24.

We observe that Mozgrin similarly discloses that the plasma discharge volume is generated between the electrodes (the anode and the cathode assembly), and that the gap between the electrodes is about *10 mm*—falling squarely within the range of *3–100 mm*, disclosed in the '773 patent (Ex. 1001, 10:23–24). Ex. 1002, 401. Therefore, one of ordinary skill in the art would have recognized that Mozgrin's plasma is generated proximate to both the anode and the cathode assembly.

We are not persuaded by Zond's argument and supporting expert testimony that Mozgrin's plasma is not close to both the anode and the cathode assembly because the plasma is at the center of the hollow, shaped electrodes "where the diameters of the anode and cathode are their largest" (PO Resp. 35–39; Ex. 2005 ¶ 84). This argument is predicated improperly on the notion that Mozgrin's plasma is generated only *at a single point*, contrary to the understanding of a person with ordinary skill in the art regarding plasma and the explicit disclosure of Mozgrin (Ex. 1002, 401). Notably, as Zond's expert, Dr. Hartsough, testified during his cross-examination, a "plasma exists over *a volume of space*, and so plasma *isn't at a point*." Ex. 1025, 121:10–13 (emphases added). More importantly, Mozgrin explicitly discloses that its plasma is a discharge *volume*, generating between the anode and cathode. Ex. 1002, 401.

Nothing in Mozgrin's disclosure indicates that the plasma is generated only at a single point or only at the z-axis, as alleged by Zond. Even if Mozgrin's plasma is generated only at the middle portion of the z-axis, Zond does not explain with sufficient specificity as to why such plasma would not be proximate to both electrodes. In fact, each of Mozgrin's electrodes has a diameter of 120 mm (i.e., a radius of 60 mm), and the distance between the middle portion of the z-axis and both electrodes is approximately *60 mm* (Ex. 1002, 401)—again falling squarely within the range of *3–100 mm*, disclosed in the '773 patent (Ex. 1001, 10:23–24). Based on the evidence before us, we determine that Mozgrin discloses an ionization source that generates a weakly-ionized plasma proximate to both the anode and the cathode assembly, as recited in claims 1 and 34.

Second, Zond argues that Mozgrin does not disclose a "feed gas," as required by claims 1 and 34, because Mozgrin does not disclose "generating a weakly-ionized plasma from a *flowing* feed gas." PO Resp. 39; Ex. 2005 ¶ 87 (emphasis added). Zond's argument, however, is not commensurate with the scope of the claims. *See In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) (stating that limitations not appearing in the claims cannot be relied upon for patentability). Each of claims 1 and 34 recites "a feed gas," and not "a *flowing* feed gas," as alleged by Zond. *See* Ex. 1001, 21:12–13, 23:14–15. The claim term "a feed gas" does not require a constant flow of gas, because the term does not imply necessarily the flow of gas. Construing the claim term "a feed gas" as "a *flowing* feed gas," as argued by Zond, would import a limitation improperly from the Specification into the claims. *See Van Geuns*, 988 F.2d at 1184.

In any event, even if the claims at issue here were to require such a limitation, we observe that the combination of Mozgrin and Fortov would render the claimed subject matter recited in the limitation obvious. As Gillette points out, Mozgrin discloses generating "high-current [plasma] discharge in wide ranges of discharge current (from 5 A to 1.8 kA) and operating pressure (from 10^{-3} to 10 torr) using various gases (Ar, N_2, SF_6, He, and H_2)." Pet. 15; Ex. 1002, 402. Mr. DeVito testifies during his cross-examination that Mozgrin suggests using a constant flow of gas in order to maintain a constant pressure during the plasma process and to yield high deposition rates. Ex. 2010, 84:13–85:2.

Zond's allegation and expert testimony that using four needle valves is an indication that Mozgrin's feed gas is "a static gas" also is of no moment. PO Resp. 39; Ex. 2005 ¶ 87. Dr. Bravman testifies that it was well-known in the art at the time of the invention that needle valves provide a *continuous flow* of gas. Ex. 1028 ¶ 48. As an example to support his testimony, Dr. Bravman cites to Ehrenberg, a book published in 1981, which states that "while still pumping, argon gas is allowed to enter the bell-jar [chamber] through a needle valve. . . . This continuous flow method tends to sweep away any impurities" (Ex. 1026, 81). Ex. 1028 ¶ 48.

We credit the testimony of Mr. DeVito (Ex. 2010, 84:13–85:2) and Dr. Bravman (Ex. 1028 ¶ 48), as their explanations are consistent with the prior art of record. Given the evidence before us, we are persuaded that one of ordinary skill in the art at the time of the invention would have recognized that Mozgrin's system supplies a constant flow of feed gas into the chamber during the plasma processing, and, therefore, Mozgrin's feed gas need not be a "static gas," as alleged by Zond.

For the foregoing reasons, we are persuaded that Gillette has demonstrated, by a preponderance of the evidence, that the combination of Mozgrin and Fortov discloses "an ionization source that generates a weakly-ionized plasma from a feed gas proximate to the anode and the cathode assembly," as recited in independent claims 1 and 34.

Power supply

Claim 1 recites *an ionization source* for generating a weakly-ionized plasma, as discussed above, and *a power supply* for generating a voltage pulse to create a strongly-ionized plasma from the weakly-ionized plasma.

Ex. 1001, 21:12–23. Claim 18 depends directly from claim 1, and further recites "wherein the ionization source and the power supply comprise *a single power supply*." *Id.* at 22:12–14 (emphasis added).

Zond argues that Mozgrin discloses "*two distinct power supplies*: a pulsed discharge supply unit and a system for pre-ionization," rather than *a single power supply* that generates both the weakly-ionized plasma and strongly-ionized plasma, as required by claim 18. PO Resp. 52–53 (emphasis added). Zond's argument, however, contradicts the explicit disclosure of Mozgrin (Ex. 1002, 401, Fig. 2). Notably, Figure 2 of Mozgrin (reproduced below) discloses a single discharge supply unit.

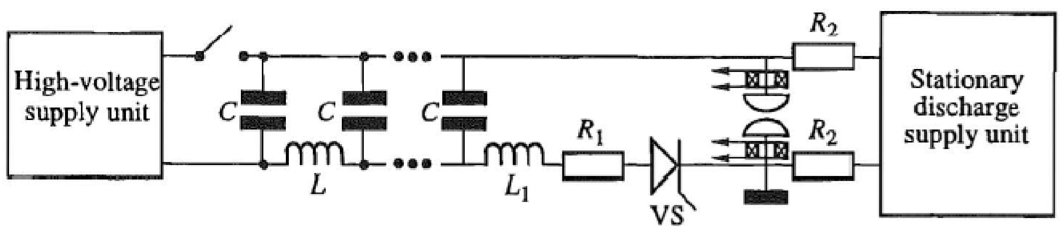


Fig. 2. Discharge supply unit.

Figure 2 of Mozgrin illustrates that the discharge supply unit includes: (1) a stationary discharge supply unit for generating a weakly-ionized plasma at the pre-ionization stage; and (2) a high-voltage supply unit for applying a voltage pulse, generating a strongly-ionized plasma from the weakly-ionized plasma. *Id*. Moreover, Mozgrin explicitly states that "Figure 2 presents a simplified scheme of the discharge supply system," and "[t]he supply unit involved a pulsed discharge supply unit and a system for pre-ionization." *Id*. As such, one of ordinary skill in the art would have appreciated that the discharge supply unit is a single power supply, comprising an ionization source and a pulsed-power supply, as required by claim 18.

<u>Ionization source comprises an electrode</u>

Claim 10 depends directly from claim 1, and further recites "wherein the ionization source is . . . comprising *an electrode* coupled to a DC power supply." Ex. 1001, 21:52–57 (emphasis added). Gillette takes the position that Mozgrin discloses this limitation because Mozgrin indicates that its pre-ionization system includes a DC power supply, and that the anode and cathode constitute a pair of *electrodes*. Pet. 22; Ex. 1002, 401, Figs. 1–3.

Zond disagrees, arguing Mozgrin does not teach a *separate and distinct* electrode, as required by claim 10, in that the "electrode" must be "a component other than the cathode assembly or the anode that are recited in claim 1." PO Resp. 43–45. According to Zond, the Specification of '773 patent confirms this proposed construction of the claim term "electrode," as it indicates that the cathode assembly, the anode, and the electrode are three distinct components. *Id.* (citing Ex. 1001, 20:14–22).

We are not persuaded by Zond's arguments, as the Specification also discloses several other embodiments that do not include three separate and distinct components for these elements. *See, e.g.*, Ex. 1001, 8:19–23, Fig. 4. Zond does not explain sufficiently why the claims at issue here are limited to one particular embodiment, excluding all other embodiments. Nor does Zond point out with particularity where the claim language imposes such a requirement.

We are mindful that, "[w]here a claim lists elements separately, clear implication of the claim language is that those elements are distinct components of the patented invention." *Becton, Dickinson & Co. v. Typco Healthcare Group, LP*, 616 F.3d 1249, 1254 (Fed. Cir. 2010) (holding that the spring means is a separate element from the hinged arm because "[t]here is no suggestion that the hinged arm or its hinges can function as springs"); *see also CAE Screenplates, Inc. v. Heinrich Fiedler GmbH & Co.*, 224 F.3d 1308, 1317 (Fed. Cir. 2000) ("In the absence of any evidence to the contrary, we must presume that the use of . . . different terms in the claims connotes different meanings.").

That being said, the Federal Circuit also states that a claim element should not be construed narrowly to require a separate and distinct component, when the claim or specification indicates that the claim element need not be a separate component, or the specification suggests that a single component can function as both elements. *Linear Tech. Corp. v. ITC*, 566 F.3d 1049, 1054–56 (Fed. Cir. 2009); *see also Powell v. The Home Depot U.S.A., Inc.*, 663 F.3d 1221, 1231–32 (Fed. Cir. 2011) (stating that because "the specification teaches that the cutting box may also function as a 'dust collection structure' to collect sawdust and wood chips generated during the wood cutting process, . . . it does not suggest that the claim terms 'cutting box' and 'dust collection structure' require separate structures"); *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1303 (Fed. Cir. 2011) ("The claims and the specifications indicate that the 'needle holder' and 'retainer member' need not be separately molded pieces."); *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1310 (Fed. Cir. 2005) (noting that the asserted claim language did not support a limitation requiring that the claimed "RF receiver" and "destination processor" be separate and distinct).

Here, the evidence before us does not support Zond's proposed construction for the claim term "electrode" to require a separate component from the cathode assembly or the anode. Nothing in the claim language or Specification of the '773 patent supports such a narrow construction. For instance, unlike the claims in *Becton*, 616 F.3d at 1255, that require the spring means to be "connected to" the hinged arm or to be "extend[ed] between" the hinged arm and a mounting means, the claims at issue here require no connection or relationship between the electrode and the cathode assembly or between the electrode and the anode. In fact, the Specification of the '773 patent discloses several embodiments in which the ionization source does not include a separate and distinct electrode, but rather the electrode is part of the anode or cathode assembly. *See, e.g.*, Ex. 1001, 8:19–23 ("In one embodiment, the DC power supply generates an initial voltage of several kilovolts between the cathode assembly 216 and the anode 238 in order to generate and maintain the [weakly-ionized or] pre-ionized plasma."), Fig. 4.

We are cognizant that a patent owner may draft claims that are directed to a particular embodiment. Here, nothing in the claim language indicates Zond has elected to limit the claims at issue to a specific embodiment. Rather, Zond's claim drafting style indicates otherwise. Notably, claim 1 lists an ionization source and a power supply as two elements, and yet claim 18, which depends directly from claim 1, requires these two elements to be a single component. *See* Ex. 1001, 22:12–14.

More significantly, adopting Zond's proposed construction would import a limitation improperly from a particular embodiment into the claims, and exclude other disclosed embodiments. *Deere & Co. v. Bush Hog, LLC,* 703 F.3d 1349, 1354 (Fed. Cir. 2012) ("One must not import limitations from the specification that are not part of the claim."); *Thorner v. Sony Computer Entm't Am. L.L.C.*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) (holding that it is not enough that the only embodiment, or all of the embodiments, contain a particular limitation to limit a claim to that particular limitation.). For the reasons stated above and in light of the Specification, we decline to adopt Zond's proposed construction that requires the "electrode" to be a separate and distinct component from the cathode assembly or the anode.

Having considered the prior art of record, we are persuaded that Mozgrin discloses an ionization source that includes a DC power supply coupled to an electrode, generating a weakly-ionized plasma from a feed gas proximate to the anode and cathode, as required by claim 10. *See* Ex. 1002, 400–02, Figs. 1, 2. For the reasons stated above, we determine that Gillette has demonstrated, by a preponderance of the evidence, that Mozgrin in combination with Fortov teaches or suggests an ionization source that comprises of "an electrode coupled to a DC power supply," as recited in claim 10.

<u>Voltage pulse</u>

Each of independent claims 1 and 34 recites:

> a power supply that generates *a voltage pulse* between the anode and the cathode assembly that creates a strongly ionized plasma from the weakly-ionized plasma, *an amplitude and a rise time of the voltage pulse being chosen to increase a density of ions* in the strongly-ionized plasma enough to generate sufficient *thermal energy* in the sputtering target *to cause a sputtering yield to be non-linearly related to a temperature of the sputtering target*.

Ex. 1001, 21:14–23, 23:17–25 (emphases added).

In its Response, Zond argues that the combination of Mozgrin and Fortov does not teach or suggest the aforementioned "voltage pulse" limitation, as recited in claims 1 and 34. PO Resp. 39–42. In particular, Zond alleges that Mozgrin does not disclose "any attempt to achieve a sputtering yield to be non-linearly related to a temperature of the sputtering target." *Id*. at 41. Zond also contends that Fortov does not disclose "how to generate sufficient target thermal energy to cause the sputtering yield to be non-linear with target temperature." *Id*. at 42; Ex. 2005 ¶¶ 91–92.

We are not persuaded by Zond's arguments. Nonobviousness cannot be established by attacking references individually where, as here, the ground of unpatentability is based upon the teachings of a combination of references. *In re Keller*, 642 F.2d 413, 426 (CCPA 1981). Rather, the test for obviousness is whether the combination of references, taken as a whole, would have suggested the patentees' invention to a person having ordinary skill in the art. *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

As Gillette points out (Pet. 15–16), Mozgrin discloses applying a voltage pulse that has a rise time 5–60 μs and durations of 1.5 ms, in between the anode and cathode, to generate a strongly-ionized plasma from a weakly-ionized plasma. Ex. 1002, 402 ("Part 1 in the voltage oscillogram [as shown in Figure 3(b)] represents the voltage of the stationary discharge (pre-ionization stage)."), 401 ("This initial density [of 10^9–10^{11} cm^{-3} range] was sufficient for plasma density to grow when the square voltage pulse was applied to the gap."), 409 ("The implementation of the high-current magnetron discharge (regime 2) in sputtering . . . plasma density (exceeding 2×10^{13} cm^{-3})."), Figs, 1, 3). Gillette directs our attention to the Declaration of Mr. DeVito, who testifies that one of ordinary skill in the art reading

Mozgrin "would have understood that controlling discharge parameters, such as the current or the characteristics of the pulse (e.g., duration, amplitude and rise time), could have been performed to cause the plasma to remain in the region 2 that is useful for sputtering." Pet. 17–18; Ex. 1005 ¶ 117 (citing Ex. 1002, 403–04, Figs. 5a, 7). Furthermore, Zond's expert witness, Dr. Hartsough, confirms that Mozgrin delivers a voltage pulse, which has parameters, such as amplitude, rise time, and pulse width, to the weakly-ionized plasma, for increasing the plasma density. Ex. 1025, 77:20–79:6. Indeed, Mozgrin selects the pulse characteristics with the goal of increasing the plasma density. Ex. 1002, 400–01.

Gillette also relies upon Fortov to disclose a non-linear relationship between the sputtering yield and the temperature of the target (Cu (copper) in argon plasma). Pet. 16–19 (citing Ex. 1004, 9, 16, Pic. VI.1.315).

Fortov's Formula 10.7 is reproduced below:

$$Y_\tau = \mathrm{const}\frac{\tau}{\sqrt{T_0 + \Delta T_\mathrm{m}}}\exp\left(-\frac{U}{T_0 + \Delta T_\mathrm{m}}\right), \qquad (10.7)$$
$$\tau = \frac{R^2}{k}\left(\frac{T_0 + \Delta T_\mathrm{m}}{U}\right)^2,$$

Ex. 1004, 16. Fortov discloses that, based on Formula 10.7, the sputtering yield Y "increases with the increase of target temperature T_0, meanwhile, the relation $Y(T_0)$ has an exponential character which explains the thermal dependence of the sputtering yield (*see* pic. VI.1.315)." Ex. 1004, 16, Pic. VI.1.315 (reproduced previously). The Specification of the '773 patent also uses the same formula to establish that, when the sputtering target temperature reaches a sufficiently high temperature (T_0), the sputtering yield increases at a non-linear rate. Ex. 1001, 18:64–19:18.

Both Fortov and Mozgrin describe the use of a copper cathode in argon plasma as a suitable system for sputtering. Ex. 1004, 9, 16, Pic. VI.1.315; Ex. 1002, 406, Table 1. Mr. DeVito testifies that one of ordinary skill in the art would have been motivated to combine the teachings of Mozgrin and Fortov, because "[a]pplying the teaching of Fortov to Mozgrin would be to use known processes to achieve Fortov's predictable result of greater sputtering yield." Ex. 1005 ¶ 122.

Given the evidence before us, we are persuaded that the combination of Mozgrin and Fortov teaches the aforementioned "voltage pulse" limitation of claims 1 and 34.

<u>Rationale to combine</u>

In its Response, Zond further argues that it would not have been obvious to combine Mozgrin with Fortov to achieve the claimed invention with a reasonable expectation of success. PO Resp. 24–26, 42. Specifically, Zond alleges that Gillette failed to provide any evidence that the contradictory teachings of Mozgrin and Fortov regarding when sputtering occurs would have led an artisan to achieve the particular sputtering yield required by the claims. *Id*. at 24–26. According to Zond, Fortov discloses sputtering over a large range of plasma densities, whereas "Mozgrin's voltage pulse creates a direct transition from a weakly-ionized plasma to Mozgrin's regime 3," which produces no sputtering of the cathode. *Id*.

We are not persuaded by Zond's arguments, as they narrowly focus on Mozgrin's regime 3, and fail to consider Mozgrin's regime 2 that is dedicated to sputtering. It is well-settled that, when evaluating claims for obviousness, "the prior art as a whole must be considered." *In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986).

As Gillette points out (Pet. 13–14), Mozgrin explicitly states that, in regime 2, the voltage pulse that generates a strongly-ionized plasma from the weakly-ionized plasma is appropriate for sputtering. Ex. 1002, 402, 406, 409 ("The implementation of the high-current magnetron discharge (regime 2) in sputtering . . . provides an enhancement in . . . plasma density (exceeding 2 x 10^{13} cm^{-3})."), Figs. 1, 3). Mozgrin also discloses specific process parameter ranges that are more efficient for sputtering in regime 2. *Id*. Therefore, contrary to Zond's assertion that Mozgrin's voltage pulse creates a direct transition to regime 3, one of ordinary skill in the art reading Mozgrin would have been able to select the pulse characteristics and parameter ranges to generate a strongly-ionized plasma in regime 2 that is dedicated to sputtering. Upon consideration of Mozgrin and Fortov, as a whole, we do not share Zond's view that there are contradictory teachings between Mozgrin and Fortov that would dissuade one of ordinary skill in the art from combining the prior art teachings to achieve Fortov's non-linear increase in sputtering yield.

As noted above, Mr. DeVito testifies that one of ordinary skill in the art would have been motivated to combine the teachings of Mozgrin and Fortov, because "[a]pplying the teaching of Fortov to Mozgrin would be to use known processes to achieve Fortov's predictable result of greater sputtering yield." Ex. 1005 ¶ 122. More specifically, Mr. DeVito explains that it would have been obvious to apply a voltage pulse to generate a strongly-ionized plasma from the weakly-ionized plasma in Mozgrin, increasing "the density of ions in the strongly-ionized plasma to generate sufficient thermal energy in the sputtering target [so as] to increase the sputtering yield to a point where 'it starts to grow rapidly in a non-linear way with the growth of temperature,' as taught by Fortov." Ex. 1005 ¶¶ 120–22. Zond's expert, Dr. Hartsough, confirms that a person having ordinary skill in the art would have been motivated to increase sputtering yield in a sputtering process. Ex. 1025, 53:13–17. The Admitted Prior Art (Ex. 1001, 1:5–2:4, 2:47–5:60) indicates that "increasing the sputtering yield typically will increase the deposition rate," and, at the time of the invention, "[s]puttering systems are generally calibrated to determine the deposition rate under certain operating conditions." *Id*. at 2:57–58, 4:48–49. Upon consideration of the evidence in this record, we credit Mr. DeVito's testimony (Ex. 1005 ¶¶ 120–22) as it is consistent with the prior art of record.

For the reasons stated above, we determine that Gillette has demonstrated, by a preponderance of the evidence, that combining the technical disclosures of Mozgrin and Fortov 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."). Therefore, we are persuaded that Gillette has articulated a reason with rational underpinning as to why a person having ordinary skill in the art at the time of the invention would have found it obvious to combine the teachings of Mozgrin and Fortov.

For the foregoing reasons, we are persuaded that Gillette has demonstrated, by a preponderance of the evidence, that the combination of Mozgrin and Fortov would render obvious the aforementioned "voltage pulse" limitation, as recited in claims 1 and 34.

Increasing an ionization rate and generating a substantially uniform plasma

In its Response, Zond further argues that the combination of Mozgrin and Fortov does not teach that "a rise time of the voltage pulse is chosen to *increase an ionization rate* of the strongly-ionized plasma," as recited in claim 11, and that "a distance between the anode and the cathode assembly is chosen to *increase an ionization rate* of strongly-ionized plasma," as recited in claim 14. PO Resp. 45–47, 50–51 (emphases added). Zond also contends that the combination of prior art references does not teach that a "strongly-ionized plasma is *substantially uniform* proximate to the cathode assembly," as recited in claim 13. *Id*. at 47–49 (emphasis added).

We are not persuaded by Zond's arguments and supporting expert testimony. An obviousness analysis is not an *ipsissimis verbis* test. *See In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009). Rather, a *prima facie* case of obviousness is established when the prior art itself would appear to have suggested the claimed subject matter to one of ordinary skill in the art. *In re Rinehart*, 531 F.2d 1048, 1051 (CCPA 1976).

As Gillette points out, Mozgrin discloses using a magnetron plasma system that has a gap (about 10 mm) between the cathode and anode, applying a voltage pulse with a rise time of 5–60 μs, to generate a strongly-ionized plasma from a weakly-ionized plasma. Pet. 22, 24; Ex. 1002, 401, Fig. 1. As shown in Figure 3 of Mozgrin, when the voltage pulse applies to the gap, the plasma density, at this stage, grows and reaches its quasi-stationary value (Parts 2a and 2b). Ex. 1002, 402, Fig. 3. According to Gillette, Mozgrin teaches that, in regime 2, the strongly-ionized plasma is substantially uniform proximate to the cathode assembly because Mozgrin indicates that "the discharge expands over a considerably large area of the cathode surface than it occupied in the stationary pre-ionization regime." Pet. 23; Ex. 1002, 403–04.

Zond's expert, Dr. Hartsough, confirms that a quick increase in the plasma density indicates an increase in the ionization rate. Ex. 1031, 88:21–89:6. Mr. DeVito testifies that "[o]ne skilled in the art would have known how to adjust the distance between the anode and the cathode to achieve a desired ionization rate." Ex. 1005 ¶ 132. Dr. Bravman also testifies that a person of ordinary skill in the art would have appreciated from the teachings of Mozgrin that various experimental variables, such as rise time of a voltage pulse and the distance between the anode and cathode, were chosen for the purpose of achieving high ionization rate. Ex. 1028 ¶¶ 80–83, 113–17. Based on the evidence before us, we credit the testimony of Mr. DeVito and Dr. Bravman, as their testimony is consistent with the prior art of record. For instance, Mozgrin states that, "[b]ecause of the need for greater discharge power and plasma density, pulse or quasi-stationary regimes appear to be of interest" and that "[t]he main purpose of this work was to study experimentally a high-power non-contracted quasi-stationary discharge in crossed fields of various geometry and to determine their parameter ranges." Ex. 1002, 400. Mozgrin also discloses that in "[d]esigning the unit, [Mozgrin] took into account the dependencies which had been obtained in [Kudryavtsev] of ionization relaxation on pre-ionization parameters, pressure, and pulse voltage amplitude" and, "[t]hus, the supply unit was made providing square voltage and current pulse with [rise] times (leading edge) of 5 – 60 μs." Ex. 1002, 401. Kudryavtsev explains that, in the initial stage, the number of atoms in the first excited state increases rapidly for a relatively slow change in the electron density, and "[t]he *rate of ionization then increases* with time," achieving "several orders of magnitude greater than the ionization rate during the initial stage." Ex. 1006, 31 (emphasis added). Kudryavtsev also explains that *the ionization occurs uniformly*. *Id*. at 34.

We are not persuaded by Zond's arguments that Mozgrin shows a non-uniform discharge proximate to the cathode (PO Resp. 48–49). Mozgrin discloses using magnetic field to distribute the plasma uniformly (Ex. 1002, 401, Fig. 1), similar to the '773 patent (Ex. 1001, 18:3–7). More importantly, Mozgrin indicates that "the implementation of the high-current magnetron discharge (regime 2) in sputtering or layer-deposition technologies provides an enhancement in the flux of deposited materials and plasma density (exceeding 2×10^{13} cm^{-3})," enhancing the homogeneity of deposited layers, which is an indication that the plasma is substantially uniform. Ex. 1002, 409.

For the reasons stated above, we determine that Gillette has demonstrated, by a preponderance of the evidence, that the combination of Mozgrin and Fortov teaches or suggests that "a rise time of the voltage pulse is chosen to increase an ionization rate of the strongly-ionized plasma," as recited in claim 11, that "a distance between the anode and the cathode assembly is chosen to increase an ionization rate of the strongly-ionized plasma," as recited in claim 14, and that "the strongly-ionized plasma is substantially uniform proximate to the cathode assembly," as recited in claim 13.

Conclusion

With respect to dependent claims 6, 8, 9, 15–17, 19, and 20, Zond essentially relies upon the same arguments presented in connection with independent claim 1. PO Resp. 14–26, 34–45. We addressed those arguments above, and found them unavailing. Upon review of Gillette's contentions and supporting evidence and, for the foregoing reasons, we conclude that Gillette has demonstrated, by a preponderance of the evidence, that claims 1, 6, and 8–20 are unpatentable over the combination of Mozgrin and Fortov.

D. Obviousness over Mozgrin, Fortov, and Kawamata

Gillette asserts that claim 5 is unpatentable under § 103(a) as obvious over the combination of Mozgrin, Fortov, and Kawamata. Pet. 25–27. Claim 5 depends directly from claim 1. For the reasons discussed above, we are persuaded that the combination of Mozgrin and Fortov renders the subject matter of claim 1 obvious. We address the parties' contentions in connection with the additional limitation recited in claim 5, in turn below, after a brief summary of Kawamata.

Kawamata

Kawamata discloses a process for producing a thin film at a high speed by sputtering. Ex. 1009, Abs., 1:5–8. In one embodiment, Kawamata discloses a plasma sputtering apparatus that includes a quartz boat, containing MgF_2 granules as a source material (sputtering target) that is mounted on a cathode. *Id.* at 7:14–19. Cooling water flows on a lower face of the cathode so the temperature of the cathode is held constant. *Id.* at 7:20–22. The cathode is supplied power by a power source, generating a plasma. *Id.* at 7:34–36. The MgF_2 granules are heated by the plasma, and their temperature is maintained by a balance between plasma heating and cooling via cooling water flowing on the lower face of cathode. *Id.* at 7:36–40.

<u>Average temperature of the sputtering target</u>

Claim 5 recites "[t]he sputtering source of claim 1 wherein the thermal energy generated in the sputtering target does not substantially increase *an average temperature of the sputtering target*." Ex. 1001, 21:34–37 (emphasis added). Gillette asserts that the combination of Mozgrin, Fortov, and Kawamata would render claim 5 obvious. Pet. 25–27.

Zond counters neither Mozgrin nor Kawamata mentions that cooling is performed to the extent that the average temperature of the sputtering target does not increase. PO Resp. 53–54. Zond argues that the combination of Kawamata with Mozgrin and Fortov would increase the average temperature of the sputtering target. *Id*. at 54–55. To support Zond's contention, Dr. Hartsough testifies that Kawamata teaches raising the temperature of the target material to weaken interatomic bonds. Ex. 2005 ¶ 121 (citing Ex. 1009, 4:4–9, 7:36–37).

Zond's arguments and expert testimony, however, improperly conflate the *surface* temperature of the target with the *average* temperature of the target. The portion of Kawamata relied upon by Zond and Dr. Hartsough discloses raising the *surface* temperature of the target. Ex. 1009, 3:3–11, 3:62–63. In fact, Kawamata teaches maintaining the *average* temperature of the target substantially constant by cooling the opposite side of the target with water. Ex. 1009, Abs. ("Cooling water (8) for *holding the temperature* of the magnetron cathode (5) *constant* flows against a lower face of the magnetron cathode (5)." Emphases added).

Mr. DeVito testifies that "[o]ne way to increase only the *surface temperature* of the target, while avoiding a substantial increase in the *average temperature* of the target, is by cooling the target." Ex. 1005 ¶ 138 (emphases added). We credit Mr. DeVito's testimony as it is consistent with Kawamata and other prior art of record. For instance, the Admitted Prior Art discloses that, when ions in a plasma impact a surface of the target, the impact generates heat at the target surface. Ex. 1001, 4:61–5:8, Fig. 2. The Admitted Prior Art also discloses a known cathode cooling system for transferring the heat away from the cathode assembly and target. *Id*.

As Gillette points out, Kawamata also discloses cooling the sputtering target to balance the heat added by the plasma. Pet. 26; Ex. 1009, 7:20–22, 7:36–40, Fig. 1. Indeed, Kawamata discloses that the sputtering target was "heated by the plasma with their temperature maintained by a balance between plasma heating and cooling by cooling water 8 flowing on the lower face of the magnetron cathode 5," which holds the sputtering target. Ex. 1009, 7:36–40. Kawamata explains that the cooling water "maintained at 20 $\pm$ 0.5^{o}C was caused to flow on a lower face of the magnetron cathode 5 so that the temperature of the magnetron cathode 5 was held constant." *Id*. at 7:20–22, Fig. 1. Gillette also notes that Mozgrin cools the target on the side that is opposite to where the plasma ions are bombarding the target surface. Pet. 26; Ex. 1002, 401. Mr. DeVito testifies that one of ordinary skill in the art would have combined the teachings of Kawamata and Mozgrin, as both recognize the need to cool the sputtering target to enhance the sputtering rate. Ex. 1005 ¶¶ 141–42. Upon review of the evidence in this record, we are persuaded by Mr. DeVito's testimony that using Kawamata's temperature control in Mozgrin's system would have been a combination of old elements in which each element behaves as expected. *Id.*

Given the evidence before us, we determine that Gillette has demonstrated sufficiently that combining the technical disclosures of Mozgrin, Fortov, and Kawamata is merely a predicable use of prior art elements according to their established functions—an obvious improvement. *See KSR*, 550 U.S. at 417. Consequently, we are persuaded that the combination of Mozgrin, Fortov, and Kawamata teaches "the thermal energy generated in the sputtering target does not substantially increase an average temperature of the sputtering target," as recited in claim 5.

For the reasons stated above, we determine that Gillette has demonstrated, by a preponderance of the evidence, that claim 5 is unpatentable over Mozgrin, Fortov, and Kawamata.

E. Obviousness over Mozgrin, Fortov, and Lantsman

Gillette asserts that claims 3, 4, and 34–39 are unpatentable under § 103(a) as obvious over the combination of Mozgrin, Fortov, and Lantsman. Pet. 41–45. Independent claim 34 recites all of the limitations set forth in claim 1, and further adds a limitation. For the reasons discussed above, we are persuaded that the combination of Mozgrin and Fortov renders the subject matter of claim 1 obvious. We address the parties' contentions in connection with the additional limitations recited in claim 34 and dependent claims 3, 4, and 35–39, in turn below, after a brief summary of Lantsman.

Lantsman

Lantsman discloses a plasma processing system. Ex. 1008, Abs. The system is applicable to magnetron and non-magnetron sputtering and RF sputtering systems. *Id*. at 1:6–8. 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:

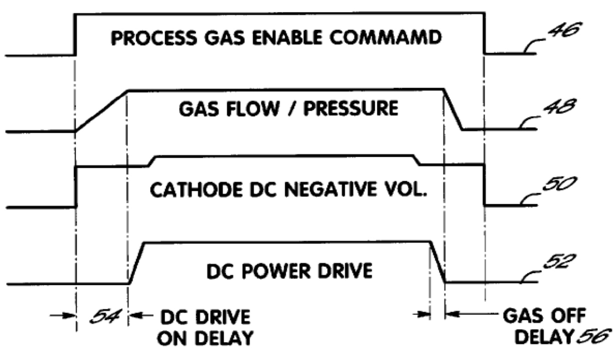


FIG. 6

Figure 6 of Lantsman shows 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. As also illustrated, gas continues flowing during the entire processing stage. *Id.* at 5:30–58.

Gas flow controller

Claim 34 recites "*a gas controller* that controls a flow of the feed gas to the strongly-ionized plasma to facilitate the creation of additional ions that generate additional thermal energy in the sputtering target." Ex. 1001, 23:26–24:2 (emphasis added). Claim 3 depends directly from claim 1 and further recites "*a gas flow controller* that controls a flow of the feed gas so that the feed gas *diffuses the strongly-ionized plasma*." *Id*. at 21:27–29 (emphases added). Claim 35 depends directly from claim 34 and also recites a similar limitation. *Id*. at 24:3–5. Claim 4 depends from claim 3 and further recites "wherein the feed gas *allows additional power to be absorbed* by the strongly ionized plasma, thereby generating additional thermal energy in the sputtering target." *Id*. at 21:30–33 (emphasis added).

Gillette asserts that the combination of Mozgrin, Fortov, and Lantsman would have rendered these "gas controller" limitations obvious. Pet. 41–44. In its Response, Zond opposes and advances several arguments. PO Resp. 26–30, 55–58.

First, Zond and its expert witness argue that Mozgrin does not disclose a "feed gas," but rather a "static gas." *Id*.; Ex. 2005 ¶¶ 122–125. This argument is essentially the same one Zond and its expert advanced with respect to claim 1. We addressed this argument previously in our discussion as to claim 1, and found it unavailing. In particular, the evidence before us suggests that Mozgrin uses a constant flow of gas in order to maintain a constant pressure during the plasma process and to yield high deposition rates. *See, e.g.*, Ex. 1002, 402; Ex. 2010, 84:13–85:2. Contrary to Zond's assertion and expert testimony that using four needle valves is an indication that Mozgrin's feed gas is "a static gas," Dr. Bravman testifies that it was well-known in the art at the time of the invention that needle valves provide a *continuous flow of gas*. Ex. 1028 ¶ 48. Notably, Ehrenberg states that "while still pumping, argon gas is allowed to enter the bell-jar [chamber] through a needle valve. . . . This continuous flow method tends to sweep away any impurities." Ex. 1026, 81. We credit the testimony of Dr. Bravman over Zond's expert testimony, as we find the explanations proffered by Dr. Bravman to be more consistent with the prior art teachings (*see, e.g.*, Ex. 1026, 81). *Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010) (finding Board has discretion to give more weight to one item of evidence over another "unless no reasonable trier of fact could have done so").

Second, Zond argues that "Lantsman is also silent with regard to controlling the flow of feed gas with a controller to diffuse strongly ionized-plasma." PO Resp. 56; Ex. 2005 ¶ 124. As Dr. Bravman explains, however, adding feed gas into the plasma chamber, where the strongly-ionized plasma is generated, "will naturally diffuse and intermingle with other gas particles within the plasma." Ex. 1028 ¶ 106. Zond's expert witness, Dr. Hartsough, confirms that "if the feed gas diffuses, it intermingles with the particles of the plasma, then that means . . . the plasma density would be diffused." Ex. 1025, 35:25–36:20.

Third, Zond and its expert argue that "Lantsman does not teach how the flow of feed gas is controlled to allow additional power to be absorbed by the strongly ionized plasma or to generate additional thermal energy in the sputtering target." PO Resp. 57; Ex. 2005 ¶ 128. An obviousness analysis, however, is not an *ipsissimis verbis* test. *See Gleave*, 560 F.3d at 1334. As Gillette points out, it would have been obvious to continue adding the feed gas in Mozgrin during the production of the strongly-ionized plasma in light of Lantsman, which explains that the feed gas flows into the chamber throughout the entire plasma process including the pre-ionization and sputtering deposition phases. Pet. 42–43; Ex. 1005 ¶¶ 183–86;

Ex. 1008, 2:48–51, 3:9–13, 4:32–38, 5:39–45, Fig. 6. Mr. DeVito testifies that introducing the feed gas continuously during the production of the strongly-ionized plasma increases the number of atoms that can be ionized, and, thus, increasing the density of the strongly-ionized plasma. Ex. 1005 ¶¶ 185–87. According to Mr. DeVito, "[t]his allows additional power to be absorbed by the strongly-ionized plasma and, therefore, generates additional thermal energy in the sputtering target, as required by claims 4 and 34." *Id*. We credit Mr. DeVito's testimony, as it is consistent with the prior art of record.

Finally, Zond argues that Lantsman does not provide any details as to the configuration of a gas supply, and that Gillette fails "to provide experimental data or other objective evidence indicating that a skill artisan would have been motivated to combine Lantsman's dual DC power supply system with the pulsed power supply system of Mozgrin." PO Resp. 26–30, 56–57; Ex. 2005 ¶¶ 71–72. Zond and its expert also contend that Gillette does not take into consideration the substantial, fundamental differences between Lantsman's DC power system and Mozgrin's system, and the contradictory sputtering teachings of Mozgrin and Fortov. *Id*.

We previously addressed Zond's arguments and expert testimony regarding the combination of Mozgrin and Fortov in the discussion concerning claim 1, and found them unpersuasive. Rather, we conclude that Gillette has articulated a sufficient rationale to combine the teachings of Mozgrin and Fortov.

As to combining Lantsman with Mozgrin and Fortov, we also are not persuaded by Zond's arguments and expert testimony, because they are improperly predicated on bodily incorporating Lantsman's entire system into

Mozgrin's system. "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) (citing *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 (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.").

Here, Gillette does not propose to combine Lantsman's DC power supply system with Mozgrin's system. *See* Pet. 41–44. More importantly, Gillette is not relying on Lantsman for disclosing a pulsed power supply, but rather for teaching a continuous gas flow controller. *Id*.

As noted by Gillette, the use of a gas flow controller in a sputtering plasma chamber was well-known in the art at the time of the invention, as evidenced by Lantsman. Pet. 41–42; Ex. 1008, 3:9–13, 4:32–38, 5:39–45, Fig. 6. Lantsman discloses a gas flow controller and explains that the feed gas flows into the chamber throughout the entire plasma process including the pre-ionization and sputtering deposition phases. Ex. 1008, 2:48–51, 3:9–13, 4:32–38, 5:39–45, Fig. 6. In fact, the Admitted Prior Art discloses a known magnetron plasma system that uses a gas valve for controlling the flow of the feed gas. Ex. 1001, 3:34–37, Fig. 1. Zond recognizes that Mozgrin's system uses needle valves to control the gas flow, and, as explained by Ehrenberg, needle valves are known to provide continuous gas flow during a plasma process. PO Resp. 55–56; Ex. 1026, 81.

We are persuaded that one of ordinary skill in the art, in light of Lantsman, would have used a gas flow controller with Mozgrin's system to maintain a desired pressure in the chamber throughout the entire process, and to maintain a continuous flow of gas in Mozgrin, which would diffuse the strongly-ionized plasma and allow additional power to be absorbed by the strongly-ionized plasma, as required by claims 3, 4, 34, and 35. As discussed above, Mozgrin discloses generating a weakly-ionized plasma from a feed gas proximate to the anode and cathode. Ex. 1002, 402. We agree with Gillette that it would have been obvious to continue adding the feed gas in Mozgrin during the production of the strongly-ionized plasma in light of Lantsman. Pet. 42–43; Ex. 1005 ¶¶ 183–89; Ex. 1008, 2:48–51, 3:9–13, 4:32–38, 5:39–45, Fig. 6. Mr. DeVito testifies that it also was well-known to supply feed gas during a sputtering process. Ex. 1005 ¶ 182. Mr. DeVito further testifies that one of ordinary skill in the art would have used Lantsman's continuous gas flow controller within Mozgrin's system so as to maintain a desired pressure in the chamber, and that such continuous flow of gas would diffuse the strongly-ionized plasma and allow additional power to be absorbed by the strongly-ionized plasma. *Id*. ¶¶ 183–89. We credit Mr. DeVito's testimony (*id*. ¶¶ 182–89), as it is consistent with Lantsman and other prior art of record.

Based on the evidence before us, we are persuaded that the use of Lantsman's continuous gas flow controller within Mozgrin's system is an obvious combination of old elements with each performing the same function it had been known to perform. *See KSR*, 550 U.S. at 417. Consequently, we determine that Gillette has demonstrated, by a preponderance of the evidence, that the combination of Mozgrin, Fortov, and Lantsman teaches or suggests the "gas controller" limitations, as recited in claims 3, 4, 34, and 35. Gillette also has articulated a reason with rational underpinning why one of ordinary skill in the art would have combined the teachings of Mozgrin, Fortov, and Lantsman.

<u>Conclusion</u>

Zond does not provide separate arguments with respect to dependent claims 36–39. *See* PO Resp. 14–30, 34–45, 57–58. Upon review of Gillette's contentions and supporting evidence and, for the foregoing reasons, we conclude that Gillette has demonstrated, by a preponderance of the evidence, that claims 3, 4, 34, and 35, as well as claims 36–39 are unpatentable over Mozgrin, Fortov, and Lantsman.

F. Obviousness over Mozgrin, Fortov, and Kudryavtsev

Gillette asserts that claim 7 is unpatentable under § 103(a) as obvious over the combination Mozgrin, Fortov, and Kudryavtsev. Pet. 51– 55. Claim 7 depends directly from claim 1, and further recites "the voltage pulse generated between the anode and the cathode assembly excites atoms in the weakly-ionized plasma and generates secondary electrons from the cathode assembly, the secondary electrons ionizing the excited atoms, thereby creating the strongly-ionized plasma." Ex. 1001, 21:43–47.

In its Response, Zond argues that Gillette fails to "provide any objective evidence that a skilled artisan would have been motivated to combine the cylindrical tube system without a magnet of Kudryavtsev with the Mozgrin magnetron system." PO Resp. 30–34 (citing Ex. 2005 ¶¶ 75–77). In particular, Zond and its expert witness contend that Gillette does not take into consideration the substantial, fundamental structural differences between the systems of Mozgrin and Kudryavtsev—e.g., pressure, chamber geometry, gap dimensions, and magnetic fields. *Id*. at 31–33; Ex. 2005 ¶¶ 75–77. Zond also argues that Gillette fails to provide experimental data or other objective evidence to show that Mozgrin's system as modified would produce the claimed result. *Id*. at 33–34 (citing *Epistar v. Trs. of Boston Univ.*, Case IPR2013-00298 (PTAB Nov. 15, 2013) (Paper 18)).

We are not persuaded by Zond's arguments. Zond's reliance on its interpretation of *Epistar*, a non-precedential Board decision, is misplaced. Zond's arguments predicate on bodily incorporating Kudryavtsev's entire system into Mozgrin's system. *See Mouttet*, 686 F.3d at 1332. Moreover, Zond improperly attempts to tie Kudryavtsev's model on plasma characteristics to the particular dimensions and components of the apparatus used in the experiments that support Kudryavtsev's model. In fact, 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*." Ex. 1006, 34 (emphasis added).

As discussed above, Mozgrin discloses applying a voltage pulse between the cathode and anode in a magnetron plasma system to generate a strongly-ionized plasma from a weakly-ionized plasma. Ex. 1002, 402, 409, Fig. 3(b). Mr. DeVito testifies that one of ordinary skill in the art would have recognized that "secondary electrons are necessarily generated" in Mozgrin's plasma formed in regime 2 for sputtering, because it was known that secondary electrons are released from the target "by the inelastic collision of impacting ions to the target." Ex. 1005 ¶¶ 208–09. Indeed, the Admitted Prior Art explains that "secondary electrons . . . are produced by ion bombardment of the target surface." Ex. 1001, 1:34–36.

As Gillette notes, Kudryavtsev discloses the effect of secondary electrons on the ionization of the excited atoms in a multiple-step ionization process that generates a strongly-ionized plasma from a weakly-ionized plasma using a voltage pulse. Pet. 52–55; Ex. 1006, Abs., Fig. 1. Specifically, Kudryavtsev discloses a multi-step ionization plasma process, 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, and is reproduced below, with annotations added by Gillette (Pet. 53):

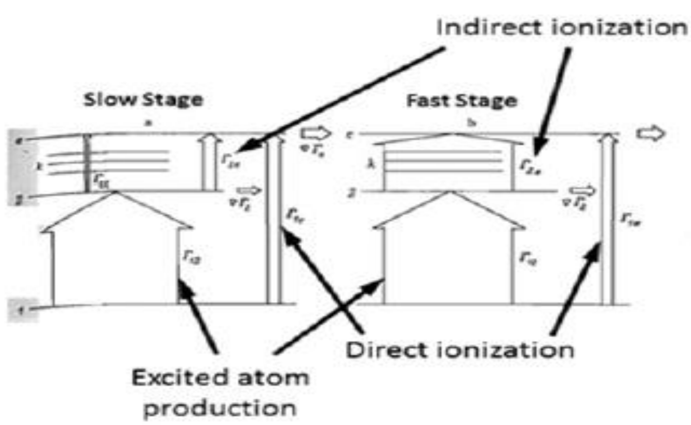


Figure 1a Figure 1b

As shown in annotated Figure 1 of Kudryavtsev, ionization occurs with a "slow stage" (Figure 1a) followed by a "fast stage" (Figure 1b).

Ex. 1006, 31. During the initial slow stage, direct ionization provides a significant contribution to the generation of plasma ions from the ground state. Mr. DeVito explains that, once the density of excited atoms becomes sufficiently high, the multi-step ionization, shown in Figure 1b of Kudryavtsev as the fast stage, becomes the dominant ionization process. Ex. 1005 ¶ 211. Kudryavtsev discloses that the ionization increases rapidly once multi-step ionization becomes the dominant process. Ex. 1006, Abs. ("It is shown that the *electron density increases explosively in time due to accumulation of atoms in the lowest excited states*.") (emphasis added). Mr. DeVito also explains that Kudryavtsev discloses in Equation (1) that one of the factors that leads to the increase in plasma density includes the collision of excited atoms with secondary electrons. Ex. 1005 ¶ 212 (citing Ex. 1006, 30, Fig. 1). We credit Mr. DeVito's testimony (Ex. 1005 ¶¶ 211–12), as it is consistent with Kudryavtsev's disclosure.

Furthermore, Mr. DeVito testifies that a person having ordinary skill in the art would have found it obvious to combine Mozgrin with Kudryavtsev, as Mozgrin itself cites Kudryavtsev. Ex. 1005 ¶ 210. Indeed, as Gillette notes, not only would a person having ordinary skill in the art have combined Mozgrin with Kudryavtsev, Mozgrin explicitly states that in "[d]esigning the unit, [Mozgrin's authors] took into account the dependencies which had been obtained in [Kudryavtsev] of ionization relaxation on pre-ionization parameters, pressure, and pulse voltage amplitude." Pet. 54–55; Ex. 1002, 401. This illustrates that one with ordinary skill in the art at the time of the invention was capable of applying the teachings of Kudryavtsev to Mozgrin's magnetron sputtering system with a reasonable expectation of success. Moreover, Dr. Bravman explains that such an artisan would have known how to apply Kudryavtsev's model to Mozgrin's system by making any necessary changes to accommodate the differences through routine experimentation. Ex. 1028 ¶ 71. Based on the evidence before us, we credit the testimony of Mr. DeVito and Dr. Bravman (Ex. 1005 ¶ 210; Ex. 1028 ¶ 71) because their explanations are consistent with the prior art of record.

For the reasons stated above, we are persuaded Gillette has demonstrated, by a preponderance of the evidence, that the combination of Mozgrin, Fortov, and Kudryavtsev discloses "the voltage pulse generated between the anode and the cathode assembly excites atoms in the weakly-ionized plasma and generates secondary electrons from the cathode assembly, the secondary electrons ionizing the excited atoms, thereby creating the strongly-ionized plasma," as recited in claim 7. Gillette also has articulated a reason with rational underpinning why one of ordinary skill in the art would have combined the collective teachings of Mozgrin, Fortov, and Kudryavtsev.

Accordingly, we determine that Gillette has demonstrated, by a preponderance of the evidence, that claim 7 is unpatentable over Mozgrin, Fortov, and Kudryavtsev.

G. Obviousness over the Combination of Mozgrin, Fortov, Mozgrin Thesis, and Raizer

Gillette asserts that claim 2 is unpatentable under § 103(a) as obvious over the combination of Mozgrin, Fortov, the Mozgrin Thesis, and Raizer. Pet. 56–58.

Printed Publication under 35 U.S.C. § 102

As an initial matter, we address the issue of whether the Mozgrin Thesis is available as prior art under 35 U.S.C. § 102(b)[8] for purposes of this Final Written Decision. The determination of whether a given reference qualifies as a prior art "printed publication" involves a case-by-case inquiry into the facts and circumstances surrounding the reference's disclosure to members of the public. *In re Klopfenstein*, 380 F.3d 1345, 1350 (Fed. Cir. 2004). "Because there are many ways in which a reference may be disseminated to the interested public, 'public accessibility' has been called the touchstone in determining whether a reference constitutes a 'printed publication' bar under 35 U.S.C. § 102(b)." *In re Hall*, 781 F.2d 897, 898–99 (Fed. Cir. 1986). To qualify as a prior art printed publication, the reference must have been disseminated or otherwise made accessible to persons interested and ordinarily skilled in the subject matter to which the document relates prior to the critical date. *Kyocera Wireless Corp. v. Int'l Trade Comm'n*, 545 F.3d 1340, 1350 (Fed. Cir. 2008).

Gillette asserts that the Mozgrin Thesis is a doctoral thesis at Moscow Engineering Physics Institute, published in 1994, and, thus, it is prior art under § 102(b). Pet. 3. To support its assertion, Gillette proffers a copy of the catalog entry for the Mozgrin Thesis at the Russian State Library, and a certified English-language translation thereof. Ex. 1014. Gillette also alleges that the Mozgrin Thesis was cataloged by the Russian State Library

[8] Paragraph (b) of 35 U.S.C. § 102 was replaced with newly designated § 102(a)(1) when § 3(b)(1) of AIA took effect on September 16, 2012. Because the application that issued as the '773 patent was filed before that date, we refer to the pre-AIA version of § 102.

either by the imprint date of 1994 or at least by 1995, as shown on the catalog entry ("Catalog of Dissertations in Russian (since 1995)"). Reply 15. Gillette further asserts that the Russian State Library is an institution "by definition established to share the information that it houses with any interested person." *Id*. Mr. DeVito testifies that Mozgrin—an article that was published in 1995 (Ex. 1002)—summarizes the research presented in the Mozgrin Thesis, and contains figures created from the photographs in the Mozgrin Thesis. Ex. 1005 ¶ 217.

In its Response, Zond counters that Gillette fails to demonstrate that the Mozgrin Thesis is prior art under § 102. PO Resp. 58–60. Zond contends that Gillette provides no evidence that the phrase "Imprint Moscow 1994" appearing on the catalog entry means that the Mozgrin Thesis was cataloged on that particular date. *Id*.

Upon consideration of the evidence in the present record, we are persuaded by Gillette's contentions and supporting evidence. Although evidence establishing a *specific* date of cataloging and shelving before the critical date would have been desirable, it is not required in a public accessibility determination. *See Hall*, 781 F.2d at 899. Here, the critical date is *November 14, 2002*—the filing date of the application that issued as the '773 patent. Ex. 1001, at [22]. The certified English-language translation of the catalog entry is reproduced below with green annotations added (Ex. 1014, 1):

Logotype of RSL **Catalog of Dissertations in Russian (since 1995)**

Full View of Record

Global Holdings	All items
Holdings	Department of dissertations (Khimki) 61 95-1/593-2
Author	**Mozgrin** Dmitriy Vitalievich
Title	High-current low-pressure quasi-stationary discharge in a magnetic field: experimental research: ph.d. thesis in physics and mathematics: 01.04.08
Imprint	Moscow 1994
Description	122 pages, illustrations
Language	Russian
Bibliography	Bibliography: pages 111-122
Subject – Other	Plasma physics and chemistry
Electronic Location	http://dlib.rsl.ru/rsl01000000000/rsl01000165000/rsl01000165287/rsl01000165287.pdf ;
Parallel record	Synopsis of a thesis

As depicted above, the catalog entry shows that it is an entry from the Russian State Library's catalog of dissertations in Russian. Ex. 1014, 2. As we determined previously in the Decision on Institution (Dec. 8–11), the catalog entry shows a publication date of 1994 ("Imprint Moscow 1994"), well before the critical date of November 14, 2002. *Id*.

Zond had the opportunity, during this trial, to object to evidence and file a motion to exclude the evidence submitted by Gillette. Zond, however, did not object under 37 C.F.R. § 42.64(b) to the admissibility of the catalog entry or the Mozgrin Thesis. Notably, Zond does not challenge the authenticity of these documents, nor allege that they constitute inadmissible hearsay. Therefore, the information set forth in the catalog entry can be relied upon by Gillette as evidence supporting its contention that the Mozgrin Thesis was sufficiently accessible to the public before the critical date and it is a printed publication within the meaning of § 102.

Furthermore, Zond does not provide sufficient explanation or credible evidence to rebut the information disclosed in the Russian State Library's catalog entry, including the 1994 publication date. For instance, Zond does not explain why a library, such as the Russian State Library here, would take more than seven years to catalog and index a thesis.

Zond further alleges that the Mozgrin Thesis was not sufficiently accessible to be considered a printed publication under § 102. PO Resp. 59–60. According to Zond, even if the thesis had been cataloged in a library in Russia, Gillette "would not have demonstrated that [the thesis] could have been obtained by any interested person outside of Russia or the countries under Russia's control." *Id*. at 60.

Zond's argument is misplaced, as it is predicated on the notion that the availability of a cataloged thesis in Russia, a foreign country, does not constitute sufficient accessibility to interested persons exercising reasonable diligence. Zond does not cite, nor do we discern, any authority that requires a cataloged thesis to be located physically in this country. Notably, the Federal Circuit has rejected the argument that a cataloged thesis shelved at a university library in Germany does not constitute sufficient accessibility to those interested in the art exercising reasonable diligence. *Hall*, 781 F.2d at 899–900. The Federal Circuit also has held that an Australian patent application—classified and laid open to public inspection by the Australian Patent Office—was sufficiently accessible to interested persons to qualify as a prior art printed publication under § 102. *In re Wyer*, 655 F.2d 221, 225–26 (Fed. Cir. 1981). Zond does not proffer any specific explanation as to why we should treat Russia differently than any other foreign country.

Based on the evidence before us, we observe that the Mozgrin Thesis was cataloged and indexed in a meaningful way, by the author's name, the title of the thesis ("High-Current Low-Pressure Quasi-Stationary Discharge in a Magnetic Field"), and the subject matter of the thesis ("Plasma Physics and Chemistry"). Ex. 1014. As such, the catalog entry demonstrates that the Mozgrin Thesis was made available to interested persons by virtue of its title and "Subject" characterization. Upon consideration of the facts before us, we determine that the Russian State Library's catalog entry is credible evidence to establish that the Mozgrin Thesis was made sufficiently accessible to the public interested in the art before the critical date of November 14, 2002.

Based on the totality of the circumstances, we are persuaded that Gillette has established, by a preponderance of the evidence, that the Mozgrin Thesis is a printed publication under § 102.

Mozgrin Thesis

Mozgrin Thesis is directed to research undertaken to "study the current-voltage characteristics and the regimes of existence of the high-current quasi-stationary low-pressure discharge in magnetic fields of different configurations" and "using a high-current discharge plasma to generate dense plasma formations and intense flows of charged particles." Ex. 1015, 4. Mozgrin Thesis discusses the possibility of intensive cathode sputtering and the creation of high density flows of sputtered material particles. *Id.* at 5. In Mozgrin Thesis, high-power, low-pressure discharges with homogeneous plasma structure are generated; however, the ability to generate these high-power discharges is limited by the presence of different types of instabilities leading to the contraction of the discharge and the transition to the arc regime. *Id.* at 25.

Mozgrin Thesis further discusses an experimental setup of a high-current, quasi-stationary regime of low-pressure discharge in a magnetic field by applying a square voltage pulse to a discharge gap. *Id.* at 59. Figure 3.2(b) is reproduced below.

б.

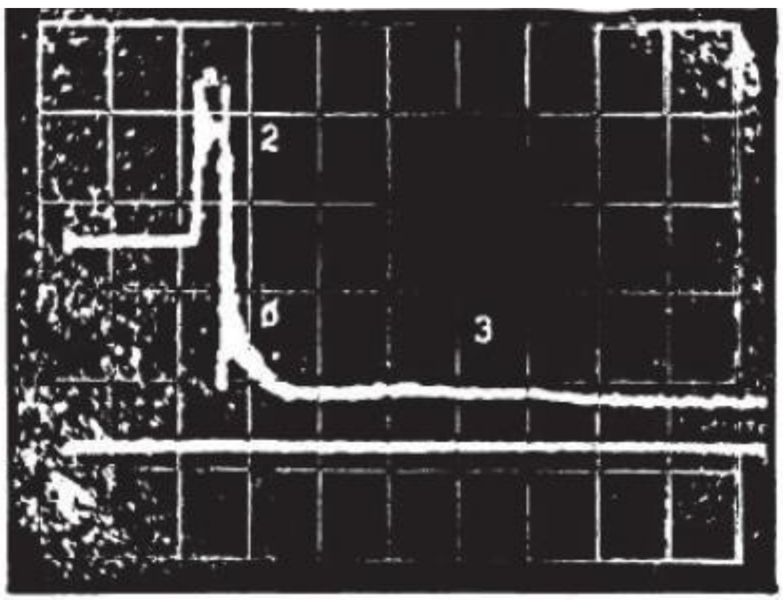


Figure 3.2 (b) illustrates a typical voltage oscillogram of quasi-stationary discharge voltage. *Id.* at 62. In the voltage oscillogram of Figure 3.2(b), part 1 illustrates the voltage of the stationary discharge (pre-ionization); part 2a illustrates the square voltage pulse application to the gap; part 2b illustrates the plasma density growing and reaching its quasi-stationary value; and part 3 represents the voltage attaining its quasi-stationary value. *Id.* at 62–63. Each of the time divisions (x-axis) represents 50 µs/div and the voltage divisions (y-axis) represents 180 V/div. *Id.* at 63.

Raizer

Raizer, a text book, teaches how to calculate collision time for a particular gas and pressure, specifically setting forth the calculation for argon. Ex. 1012, 11, § 2.1.4, Table 2.1. Specifically, Raizer indicates the collision frequency v_m is proportional to the density (*N)* of the gas, or to its pressure (*p)*. *Id.* at 11. Table 2.1 illustrates for argon: $v_m / p = 5.3 \times 10^9 s^{-1} Torr^{-1}$. *Id*.

Quasi-static electric field

Claim 2 depends directly from claim 1, and further recites "wherein an electric field between the anode and the cathode assembly comprises a quasi-static electric field." Ex. 1001, 21:24–26. The Specification of the '773 patent defines the claim term "a quasi-static electric field" as "an electric field that has a characteristic time of electric field variation that is much greater than the collision time for electrons with neutral gas particles." *Id*. at 9:34–38.

Gillette asserts Mozgrin summarizes research presented in Mozgrin Thesis. Pet. 56–57. Specifically, Gillette relies on details provided with photographs in Mozgrin Thesis, that Mr. DeVito testifies were used to create the figures in Mozgrin. Ex. 1005 ¶¶ 217–18. Gillette also cites to Raizer, a reference cited in Mozgrin, as teaching how to calculate the collision time for argon gas, used in Mozgrin. Pet. 57, Ex. 1012, 11, § 2.1.4.

Gillette contends that part 3, as shown in Figure 3.2 of Mozgrin Thesis, lasts longer than 250 μs. Pet. 57–58. According to Mr. DeVito, because 250 μs is much greater than 1.88 nanoseconds (the "collision time for electrons and neutral gas particles," as taught by Raizer (Ex. 1012, 11,

§ 2.1.4)), the electric field of Mozgrin Thesis is quasi-static, as required by claim 2. Pet. 57–58; Ex. 1005 ¶¶ 218, 220. Based on the record before us, we are persuaded the combination of Mozgrin, Fortov, Mozgrin Thesis, and Raizer teaches the aforementioned limitation recited in claim 2.

Gillette asserts that it would have been obvious for a person of ordinary skill in the art to combine Mozgrin with Mozgrin Thesis (which is more detailed), as both are written by the same author, address similar subject matter, and describe the same research. Pet. 58. Mr. DeVito testifies that a person of ordinary skill in the art reading Mozgrin would have looked to Mozgrin Thesis to determine additional details not present in Mozgrin, such as the division lines shown in Fig. 3.2. Ex. 1005 ¶ 220.

With respect to this ground of unpatentability, Zond essentially relies upon the same arguments presented in connection with independent claim 1, and its arguments that Mozgrin Thesis is not a prior art. PO Resp. 58–60. We addressed those arguments in our analysis above, and found them unavailing. Based on the evidence before us, we determine that Gillette has demonstrated, by a preponderance of the evidence, that claim 2 is unpatentable over Mozgrin, Fortov, Mozgrin Thesis, and Raizer.

III. CONCLUSION

For the foregoing reasons, we conclude that Gillette has demonstrated, by a preponderance of the evidence, that claims 1–20 and 34–39 of the ’773 patent are unpatentable based on the following grounds of unpatentability:

Claim(s)	**Basis**	**References**
1, 6, and 8–20	§ 103	Mozgrin and Fortov
5	§ 103	Mozgrin, Fortov, and Kawamata
3, 4, and 34–39	§ 103	Mozgrin, Fortov, and Lantsman
7	§ 103	Mozgrin, Fortov, and Kudryavtsev
2	§ 103	Mozgrin, Fortov, Mozgrin Thesis, and Raizer

IV. ORDER

In consideration of the foregoing, it is

ORDERED that claims 1–20 and 34–39 of the ’773 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.

STEPHENS, *Administrative Patent Judge, dissenting-in-part.*

I respectfully disagree with the Majority's determination that the Mozgrin Thesis is prior art under 35 U.S.C. § 102(b). For a reference to qualify as a printed publication within the meaning of § 102, "the reference must have been sufficiently accessible to the public interested in the art," before the critical date. *In re Cronyn*, 890 F.2d 1158, 1160 (Fed. Cir. 1989) (quoting *Constant v. Adv. Micro–Devices, Inc.*, 848 F.2d 1560, 1568 (Fed. Cir. 1988)).

Zond argues Gillette failed to show the Mozgrin Thesis was disseminated or otherwise made available to interested persons as a printed publication more than one year prior to the filing date of the '773 patent. Prelim. Resp. 55–57. Specifically, Zond argues the catalog entry does not indicate the Mozgrin Thesis was available prior to the filing date of the '773 patent. *Id.*

"Because there are many ways in which a reference may be disseminated to the interested public, 'public accessibility' has been called the touchstone in determining whether a reference constitutes a 'printed publication' bar under 35 U.S.C. § 102(b)." *In re Hall*, 781 F.2d 897, 898–99 (Fed. Cir. 1986).

I am not persuaded Gillette has shown the Mozgrin Thesis was publicly accessible *more than one year prior to the date of the application* for patent. Specifically, Gillette relies on a catalog entry from the Russian State Library's catalog of dissertations, which shows an "Imprint" of 1994. Ex. 1014, 1. Gillette asserts the Russian Library is an institution established to share information it houses with interested persons and the imprint date of 1994 and "Catalog of Dissertations in Russian (since 1995))" on the catalog entry as evidence the Mozgrin Thesis is prior art under 35 U.S.C. § 102. Reply 15. However, nothing in the catalog entry speaks to the date on which the Mozgrin Thesis was incorporated into the Russian State Library's catalog of dissertations, or even that the Russian State Library catalog of dissertations existed at the time of invention. As our reviewing court has stated, "[a]lthough 'evidence establishing a *specific* date of cataloging' was not required in *Hall,* in that case we held that 'competent evidence of the general library practice' of cataloging and shelving established that the thesis became accessible prior to the critical date." *In re Lister*, 583 F.3d 1307, 1316 (Fed. Cir. 2009) (vacating and remanding the Board of Patent Appeals and Interferences' decision that a prior art reference registered with the U.S. Copyright Office and included in the Westlaw and Dialog databases was publicly accessible for the purposes of 35 U.S.C. § 102(b)). Here, neither the imprint date nor the labeling indicates the Mozgrin Thesis was publicly accessible prior to the critical date. Further, Gillette "has not identified any evidence of the general practice" of the Russian State Library with regard to catalog updates. *See id.* at 1316–17. Therefore, absent any evidence pertaining to when the Russian State Library received the Mozgrin Thesis, when the publicly accessible catalog was available, and what the general practices of the Russian State Library between receipt of a thesis and subsequent incorporation into a publicly accessible catalog are, the presumption the Mozgrin Thesis was publicly accessible more than one year prior to the date of the application for patent is pure speculation. *See id.* at 1316.

Furthermore, I respectfully disagree Zond was required to object under 37 C.F.R. § 42.64(b). Significantly, Zond does not contend that the

Mozgrin Thesis is inadmissible under any Federal Rule of Evidence. Instead, Zond argues the Mozgrin Thesis is not prior art under 35 U.S.C. § 102(b) because Gillette has not shown the Mozgrin Thesis was publicly accessible — a challenge to the sufficiency or weight to be given to the Mozgrin Thesis. Such argument is not proper in a motion to exclude, which is a challenge to the admissibility of evidence, not a challenge to sufficiency. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,767 (August 14, 2012) (stating that a motion to exclude may not be used to challenge the sufficiency of the evidence to prove a particular fact).

Zond properly provided arguments in the preliminary response and response asserting Gillette has not sufficiently demonstrated that the Mozgrin Thesis is prior art under 35 U.S.C. § 102(b). Accordingly, I am not persuaded Gillette has established sufficiently, that the Mozgrin Thesis is a printed publication under 35 U.S.C. § 102(b). It follows, I am not persuaded claim 2 is unpatentable under § 103(a) as obvious over the combination of Mozgrin, Mozgrin Thesis, Fortov, and Raizer.

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