

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LAM RESEARCH CORP.,
Petitioner,

v.

INPRIA CORP.,
Patent Owner.

Case IPR2025-00256
Patent No. 11,537,048

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,537,048**

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PETITIONER’S EXHIBIT LIST

Exhibit	Description
1001	U.S. Patent No. 11,537,048 (“’048 Patent”)
1002	‘048 Patent Prosecution History
1003	Expert Declaration of Seán Barry, Ph.D. (“Barry Declaration”)
1004	<i>Curriculum Vitae</i> of Seán Barry, Ph.D.
1005	U.S. Patent No. 8,536,068 (“Weidman”)
1006	U.S. Patent Application No. 2017/0102612 (“Meyers”)
1007	U.S. Patent No. 9,328,416 (“Dhas”)
1008	B. Cardineau, et al., <i>Photolithographic properties of tin-oxo clusters using extreme ultraviolet light (13.5 nm)</i> , Microelectronic Engineering 127 (2014) 44-50 (“Cardineau”)
1009	K. Molloy, <i>Precursors for the formation of tin(IV) oxide and related materials</i> , J. Chem. Research (Oct. 2008) 549-554 (“Molloy”)
1010	<i>Inpria Corp. v. Lam Research Corp.</i> , No. 1-22-cv-01359, Dkt. No. 199, Joint Claim Construction Brief (D. Del. Oct. 18, 2024)
1011	R. Del Re, <i>Molecular organometallic resists of tin and tellurium</i> , Legacy Theses & Dissertations (2009 - 2024), 1370 (Jan. 1, 2015)
1012	J. Son, et al., <i>Acid-Stable Peroxonitobophosphate Clusters To Make Patterned Films</i> , Chemistry - A European Journal, 21(18) (Apr. 27, 2015)
1013	J. Jiang, <i>Organic Inorganic Photoresist And Laser Induced Heating Process For Next Generation Lithography</i> (July 2015)
1014	R Del Re, et al., <i>Low-line edge roughness extreme ultraviolet photoresists of organotin carboxylates</i> , Journal of Micro/Nanolithography, MEMS, and MOEMS, Vol. 14, Issue 4, 043506 (Nov. 9, 2015),

1015	R. Del Re, et al., <i>Low-LEER Tin Carboxylate Photoresists using EUV</i> , Extreme Ultraviolet (EUV) Lithography VI (2015).
1016	Maeng et al., <i>Atomic Layer Deposition of Ta-Based Thin Films: Reactions of Alkylamide Precursor with Various Reactants</i> , J. Vacuum Sci. & Technol. B 24:2276 (2006)
1017	November 2024 email chain between Alison Patitucci and Elsevier
1018	Summons for <i>Inpria Corp. v. Lam Research Corp.</i> , 1-22-cv-01359
1019	Declaration of Alison Patitucci
1020	PCT published Application WO 2020263750 (“Berney”)
1021	<i>Inpria Corp. v. Lam Research Corp.</i> , No. 1-22-cv-01359, Dkt. No. 59, Scheduling Order (D. Del. Jan. 1, 2024)

I. INTRODUCTION

Lam Research Corporation (“Petitioner”) files this petition for *inter partes* review (“Petition”), seeking cancellation of claims 1-20 (“Challenged Claims”) of U.S. Patent No. 11,537,048 to Stephen T. Meyers, et al. (“’048 patent,” EX1001) of Inpria Corporation (“Inpria”). This Petition is supported by the expert declaration of Dr. Barry (EX1003), and exhibits submitted herewith.

The ’048 patent purports to describe a system for forming an organotin oxide hydroxide layer used as radiation-sensitive materials for high-resolution lithography. These layers are well suited to form high resolution patterns using Ultraviolet (UV), electron beam, or extreme ultraviolet (EUV) exposure.

During prosecution, Inpria argued that the cited prior art *Maeng* reference (incorporated by reference) failed to disclose the claimed apparatus. Yet, when confronted with a lack of structure for means-plus-function (“MPF”) limitations, Inpria improperly inserted into the specification a modified version of an apparatus figure from the *Maeng* reference and argued that the *Maeng* reference supplied the very structure Inpria previously argued it lacked. Inpria should not benefit from its contradictory positions that misled the Examiner into allowing the Challenged Claims. While the Board cannot base an unpatentability finding simply on an applicant having improperly added new matter to the specification, the Board is required to evaluate whether the ’048 Patent is entitled to its earliest claimed priority

date. If it is not, then the '048 Patent is unpatentable over a combination of Inpria's own earlier published application in the same patent family and other vapor deposition prior art that discloses the claimed structures.

II. MANDATORY NOTICES

A. Real Party-in-Interest (§ 42.8(b)(1))

Petitioner is the sole real-party-in-interest.

B. Related Matters (§ 42.8(b)(2))

Inpria has asserted claims of infringement based on the '048 Patent against Petitioner. *Inpria Corp. v. Lam Research Corp.*, 1:22-cv-01359 (D. Del.). This Petition is timely, having been filed within one year of service of the complaint. EX1018.

C. Identification of Counsel (§ 42.8(b)(3))

Petitioner designates Dion M. Bregman (Reg. No. 45,645) as lead counsel, and Michael J. Lyons (Reg. No. 37,386), Ahren C. Hsu-Hoffman (Reg. No. 50,862), and Alison P. Patitucci (Reg. No. 73,370) as back-up counsel.

Service of any documents may be made at Morgan, Lewis & Bockius LLP, 1400 Page Mill Rd., Palo Alto, CA 94304 (Telephone: 650.843.4000; Fax: 650.843.4001). Petitioner consents to email service at: MLB-Lam-IPR-Team@morganlewis.com.

D. Service (§ 42.8(b)(4))

This Petition is being served by Priority Mail Express to the correspondence address of record for the '048 Patent: CHRISTENSEN, FONDER, DARDI & HERBERT PLLC, 11322 86th Ave. N., Maple Grove, MN 55369.

III. POWER OF ATTORNEY (§ 42.10(B))

Petitioner's Power of Attorney is filed in accordance with 37 C.F.R. § 42.10(b).

IV. GROUNDS FOR STANDING (37 C.F.R. § 42.204(A))

Petitioner certifies that the '048 Patent is available for IPR and that the Petitioner is not barred or estopped from requesting this IPR on the grounds identified herein.

V. FEES (§ 42.15(a))

The required fee is paid under § 42.103, and the Commissioner is hereby authorized to charge all fees pertaining to this matter to Deposit Account No. 50-0310 (Order No. 134507-8004).

VI. IDENTIFICATION OF CLAIMS AND GROUNDS

Ground	Basis	Reference(s)	Claims
1	§103	Meyers and Weidman	1-20
2	§102	Berney	1-5, 8-20
3	§103	Berney and Molloy	6, 7

VII. DETAILED EXPLANATION OF GROUNDS

A. Level of Skill

A suitable POSA would have at least a graduate degree, *e.g.*, M.Sc. or Ph.D., in a relevant discipline such as chemistry, materials science, chemical engineering, physics, or an equivalent field, and 2-3 years of experience in the research, design, development, and/or testing of resist materials. EX1003, ¶23.

B. Claim Construction

Without conceding whether they satisfy the requirements of 35 U.S.C. § 112, the following MPF constructions apply solely to the '048 Patent petitions. While claims 1, 4, and 12 include numerous MPF “structure” terms, even if Inpria argues these terms fall outside §112 ¶6, the limitations are still taught by the prior art. *Analog Devices, Inc. v. Xilinx, Inc.*, IPR2020-01625, Paper 43 at 11-12 (PTAB Apr. 14, 2022).

The rebuttable presumption that §112(6) does not apply to terms lacking the word “means” is overcome because the claims fail to recite sufficiently definite structure for the “structure” or “configuration” terms. *See Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348-50 (Fed. Cir. 2015). The terms “structure” and “configuration” act as generic placeholders for unspecified functions, similar to “means.” EX1003 at ¶25.

1. “structure configured to deliver flow from a supply of inert gas” (claim 1)

Function: “to deliver flow from a supply of inert gas.”

Structure: For this Petition only, Petitioner partially agrees with Inpria’s district court identification of the alleged structure as tied to Figure 16: a **conduit** to “supply of inert gas 170” and equivalents thereof, but this structure need not include the “vessel 168,” which is a distinct structure that does not perform the function of delivering inert gas. EX1010 at 31 (citing EX1001, 19:19-23, Fig. 16). Inpria’s annotated version of Figure 16 (below) from the parallel district court proceedings purports to show “Structure Configured to Deliver Flow from a Supply of Inert Gas” annotated in yellow with accompanying dark blue text (left). *Id.*, 32.

If Figure 16 was new matter, as discussed in Section VII.C., then the structure without regard to Figure 16, but based on Inpria’s arguments in the district court proceedings, is a **conduit** (e.g., pipe) to supply inert gas, e.g., a conduit between an interconnected vessel (e.g., vaporization chamber) and a supply of inert gas, and equivalents thereof. *See id.*, 30, 39. Either way, the term means a **conduit**, or equivalents, for supplying an inert gas.

2. “structure configured to deliver flow of a first precursor vapor from the supply of the organotin compound with the inert gas as a carrier gas to the inlet ...” (claim 1)

Function: “to deliver flow of a first precursor vapor from the supply of the

organotin compound with the inert gas as a carrier gas to the inlet.”

Structure: For this Petition only, Petitioner relies on Inpria’s identification of the alleged structure as tied to Figure 16: “**conduit** extending from the vessel 168 to the inlet 152” and equivalents thereof. EX1010 at 40. Inpria’s annotated version of Figure 16 (above) purports to show the structure with green annotations and text. The claimed structure, however, does not include the supply of the organotin compound itself, but only the conduit.

If Figure 16 was new matter, as discussed in Section VII.C, then Petitioner relies on Inpria’s identification of the alleged structure without regard to Figure 16: “a POSITA would have understood that the claimed ‘structure’ is a **class of structures for delivering flow**, *i.e.*, an interconnected vessel (such as a vaporization chamber, as recited in claim 4) and conduit (such as a pipe)” and equivalents thereof. *Id.*, 30; *id.*, 39 (“The claim language itself thus conveys a well-known class of structure to a POSA: an interconnected vessel (like a vaporization chamber) and a conduit (like a pipe).”). Again, the claimed structure, however, does not include the interconnected vessel supply of the organotin compound itself, but only the class of structures for delivering flow.

Stated differently, the term means (i) a **conduit** for performing the claimed function, or (ii) a **class of structures for delivering flow** and equivalents thereof.

3. “structure to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first precursor vapor...” (claim 1)

Function: “to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first precursor vapor.”

Structure: The corresponding structure is, as shown in Figure 16, a **conduit** 174 to deliver a “second precursor vapor comprising water, hydrogen peroxide or a combination thereof”, e.g., to inlet 154 of deposition chamber 151, and equivalents thereof. *See* EX1001 at 19:23-25, Fig. 16.

If Figure 16 was new matter, as discussed in Section VII.C, then the structure without regard to Figure 16 but based on Inpria’s arguments in the parallel proceedings is a **conduit** (like a pipe) for delivering a “second precursor vapor comprising water, hydrogen peroxide or a combination thereof” and equivalents thereof. *See* EX1010 at 30, 39. Either way, the term means a **conduit** for performing the claimed functions and equivalents thereof.

4. “configuration providing for selection of the pressure and/or the temperature in the deposition chamber” (claim 10)

Function: “selection of the pressure and/or the temperature in the deposition chamber.”

Structure: For this Petition only, the corresponding structure is best understood as a first and second vessel and/or a controller for selecting the pressure and/or the temperature in the deposition chamber, and equivalents thereof. *See* EX1001, 20:1-10 (“By **controlling** [first and second] vessel **temperatures**, inert gas flow rate, and total system **pressure**, vapor-phase $\text{RSn}(\text{NR}'_2)_3$ and H_2O are transported independently to a chamber....”).

5. “one or more vapor inputting structures” (claim 12)

Function: “vapor inputting”

Structure: For this Petition only, based on Inpria’s arguments in the parallel proceedings, the corresponding structure the recited “vapor inputting structures” (“VIS”) is best understood as, per Figure 16, as inlet 154 or inlet 176 connecting a deposition chamber 151 to a source of vapor and equivalents thereof. EX1001, 19:23-27.

If Figure 16 was new matter, then the structure without regard to Figure 16 but based on Inpria’s arguments in the district court proceedings is an **inlet** connecting a deposition chamber to a source of vapor and equivalents thereof. *See, e.g.*, EX1010, 30, 39. Either way, the term means an **inlet** for inputting a vapor and equivalents thereof.

C. The '048 Patent

The Challenged Claims—notably, claim 1—contain numerous limitations that are not supported by the original specification filed on August 6, 2020, the filing date of the application resulting in the '048 Patent, or any of the earlier provisional or non-provisional applications to which the '048 Patent claims priority. Stated differently, the Challenged Claims are not entitled to any of these filing dates.

During prosecution, the Examiner issued a rejection on the grounds that the original specification failed to provide support for multiple MPF limitations in the independent claim: “Claim limitation ‘structure configured to deliver flow from a supply of an organotin compound,’”¹ “Claim limitation ‘structure configured to deliver flow from a supply of an inert gas,’” and “Claim limitation ‘structure to deliver a second precursor vapor.’” EX1002, 480-81. In response, on January 20, 2021, Inpria added a new Figure 16 and explained it had “amended [the specification] to refer to **new** Fig. 16” and that “[a]s amended, the specification discloses the structures in items 6-8 . . . on page 4 of the Office Action.” EX1002, 459; *see id.*, 454-55, 472. Responding to further rejections, Inpria later revised

¹ Before issuance, PO amended this limitation to clarify that it was “a first precursor vapor” being delivered. *See* Ex. 1002 at 198.

Figure 16 and related text in an April 5, 2021 amendment to add a third inlet to the depicted deposition chamber *Id.*, 252-53, 265.

Inpria's January 20, 2021 and April 5, 2021 amendments to the specification do not provide support for claim 1 or the other Challenged Claims because they were not a part of the original specification filed on August 6, 2020. Instead, as Inpria admitted during prosecution, Figure 16 and related text are "**new**," thereby admitting that this matter was improperly added during prosecution after the original application was filed in violation of 35 U.S.C. § 132. And "[w]hen the applicant adds a claim or otherwise amends his specification after the original filing date ... the new claims or other added material *must* find support in the original specification." *Enzo Biochem, Inc. v. Gen-Probe Inc.*, 323 F.3d 956, 987 (Fed. Cir. 2002). Therefore, if the patent is not invalid based on improperly adding new matter, then the earliest priority date for the Challenged Claims is January 20, 2021—the date the first version of Figure 16 and related text were added. *Muncie Gear Works v. Outboard, Marine & Mfg. Co.*, 315 U.S. 759, 768 (1942) (claims to features not described in the original specification but described in amendments would not receive benefit of original application's filing date).

To sidestep its improper introduction of new matter, Inpria asserted that Figure 16 and related text were supported by disclosures in a prior art article, Maeng et al., *Atomic Layer Deposition of Ta-Based Thin Films: Reactions of Alkylamide*

Precursor with Various Reactants, J. Vacuum Sci. & Technol. B 24:2276 (2006) (“Maeng,” EX1016), purportedly incorporated by reference into the original specification. EX1002, 456-57 (asserting the amendments supported “via the incorporation by reference of Maeng et al. ... in particular to Fig. 1 of Maeng et al.”), 459 (“Applicant has amended the specification and figured based on incorporation by reference to provide the asserted missing disclosure.”).

But Figure 16 did not come from Maeng. Instead, Inpria materially altered Maeng’s Figure 1, not once, but twice during prosecution—to create new Figure 16. *See* EX1002, 265, 472. These alterations were substantial, including adding a third inlet absent from Maeng’s Figure 1. EX1003, ¶¶30-33 (comparing Figure 1 and Figure 16). Inpria also added a new description for Figure 16 that was not in the original specification or Maeng.² EX1002, 454, 253. In the district court, Inpria

² Inpria cannot circumvent this new matter problem with Figure 16 and related text by relying on Maeng’s unaltered figure to supply the missing structure, even if the original specification states that Maeng had been incorporated by reference. “Essential material” is that material necessary to provide a claim with the required support under Section 112 and “can be incorporated by reference but only by way of a U.S. patent or U.S. patent application publication.” *Droplets, Inc. v. E*TRADE Bank*, 887 F.3d 1309, 1318 (Fed. Cir. 2018) (citing 37 C.F.R. § 1.57(c)).

did not dispute that Figure 16 was an altered version of Maeng's Figure 1. EX1010, 41. Inpria was forced to acknowledge this because, during prosecution, Inpria repeatedly argued Maeng's apparatus was unable to perform the claimed function of delivering an organotin compound.³ Inpria argued instead that "the alterations [to Maeng's apparatus] are supported by the originally filed specification," *id.*, 41, but cited nothing in the specification that supports modifying Maeng's apparatus to provide structures performing the recited functions. For example, Inpria relied on 19:64-20:4 of the '048 Patent. *Id.*, 31. But this passage only mentions the "inert gas source" and the precursor ("bubbler vessels"); it does not describe **structures configured to deliver flow** of an organotin compound or a second precursor vapor,

³ Specifically, Inpria argued that "Maeng is limited to one Ta-based precursor," "PDMAT," and that "[u]sing the same equipment with a different reactant...resulted in a 'considerable incorporation of [carbon] impurity.'" EX1002 at 275. For this reason, Inpria asserted that "there is not a reasonable expectation of success in using a different reagent in a given apparatus." *Id.* Inpria further argued that a POSA "would have even less expectation of success if [the claimed] organotin compound...were used in place," and went further still, arguing "Maeng teach[es] away" and that using "an organotin compound would render Maeng unsuitable for its intended purpose...." *Id.*

as claim 1 requires, and thus cannot support the modifications made to the Maeng's figure to include structures performing the recited functions. EX1003, ¶30-33.

Thus, Figure 16 and related text—which Inpria argued provided support for multiple limitations in the independent claim—are new matter introduced after the original specification's filing. As nothing in the original specification supports these limitations, the earliest priority date (or effective filing date) for the Challenged Claims is **January 20, 2021**—the date that the first version of Figure 16 and related text were added.

D. Asserted Prior Art

U.S. Patent No. 8,536,068 to **Weidman**, et al. (“Weidman”) (Ex1005) published on April 12, 2012, and is prior art under at least post-AIA § 102(a)(1).

U.S. Patent Application No. 20170102612 to Meyers, et al. (“**Meyers**”) (EX1006), which published on April 13, 2017, and is prior art under at least post-AIA § 102(a)(1). The '048 Patent claims priority to Meyers as a continuation application, and Meyers discloses everything except for the new matter added by Inpria during prosecution.

WO2020263750 to Berney (“**Berney**”) (Ex1020), which published on December 30, 2020, is prior art under at least post-AIA § 102(a)(2).

Precursors for the formation of tin(IV) oxide and related materials, by Kieran C. Molloy (“**Molloy**”) (EX1009), which published online on October 1, 2008, is prior art under at least post-AIA § 102(a)(1).

E. Ground 1: Claims 1-20 are Rendered Obvious by Meyers in view of Weidman

1. Motivation to Combine Meyers and Weidman

Meyers and Weidman relate to vapor deposition of photoresists for UV/EUV. As Meyers only partially discloses equipment, a POSA wanting to perform the method described in Meyers would naturally look to other references that disclose vapor deposition equipment and components thereof, like Weidman, to determine what vapor deposition equipment and components to use. EX1006, ¶00179 (generically describing “[c]ommercial CVD apparatuses” for vapor deposition).

Because Weidman also discloses depositing metallic resists, etc., it would have been a natural choice for further development to use Weidman’s apparatus to perform Meyers’ methods. EX1003, ¶31.

Moreover, a POSA would have a reasonable expectation of success, as Weidman describes depositing metal-based photoresist layers (derived, for example, from Tin precursors) on the surface of a substrate in a vapor deposition apparatus. EX1003, ¶40.

Meyers discloses everything except for the structures that Inpria added with Figure 16 during prosecution. EX1002, 459, 454-55, 459, 472. The '048 patent is a continuation of the patent application that resulted in the Meyers publication and, thus, includes subject matter identical to that disclosed in the '048 Patent aside from the structural features discussed in newly-added Figure 16. Thus, the limitations not related to Figure 16 are based on the subject matter described in Meyers. Weidman discloses any missing structures from Meyers needed to perform Meyer's methods, and as discussed above, is a "CVD apparatus" as is explicitly contemplated by Meyers for performing its disclosed process. EX1003, ¶40.

2. Claim 1

a. Preamble: "system comprising"

Meyers discloses a "method for forming a radiation patternable coating comprising a metal oxo-hydroxo network with metal cations having organic ligands with metal carbon bonds and metal oxygen bonds, the method comprising inputting into a **deposition chamber**...." EX1006, ¶9.

A POSA would understand that the deposition chamber is part of a system for performing vapor deposition methods. EX1003, 42. Meyers notes that "[c]ommercial CVD apparatuses can be adapted for this use or specific equipment can be used." EX1006, ¶0079.

Weidman's "**apparatus** for deposition of a film on a substrate" has "a

deposition chamber for atomic layer deposition of a film on a substrate” and “a chamber configured to operate in both an ALD mode as well as a conventional CVD mode....” EX1005, 8:43-45; 9:12-15. Weidman notes:

the apparatus comprises a deposition chamber for atomic layer deposition of a film on a substrate. The chamber comprises a process area for supporting a substrate. The apparatus includes a first precursor inlet in fluid communication with a supply of a first precursor containing substituents with cross-linkable moieties...[and] a reactant gas inlet in fluid communication with a supply of a reactant gas selected from ozone, H₂O, H₂O₂, NH₃, reactive oxygen, reactive nitrogen, and reactive hydrogen.

Id., 8:48-52; EX1003, ¶¶41-44.

b. “deposition chamber having an interior isolated from the ambient atmosphere”

Meyers’s “deposition chamber [is] closed from the ambient atmosphere.” EX1006 ¶0009. The pressure and temperature in the chamber can be selected, indicating that the deposition chamber is isolated from the ambient atmosphere. *Id.* ¶0082; EX1001, claim 1.

Additionally, Weidman’s apparatus has a deposition chamber that may be “pressurized” (e.g., “at a pressure within a range from about 0.1 Torr to about 10 Torr”) and/or heated (e.g., “such as within a range from about 50° C to about 400° C”), indicating that the chamber is “isolated from the ambient atmosphere.” EX1003,

¶¶45-46.

c. “a substrate within the interior of the deposition chamber configured to receive a deposition on a surface of the substrate”

Meyers discloses that “a **substrate** can be configured with a **surface** to receive the hydrolyzed or oxidized composition.” EX1006, ¶9; *id.*, ¶78 (“In CVD methods, two or more reactant gases are generally mixed in the chamber in the vicinity of the **substrate** surface.”). Meyers notes that “any suitable solution coating process can be used to **deliver the precursor solution to a substrate** in addition to the vapor deposition processes.” *Id.* ¶0070; *see id.*, ¶0069.

A POSA would understand the substrate is within the deposition chamber’s interior to receive the deposition. EX1003, ¶¶48 (“in situ hydrolysis process” (*i.e.*, in the chamber”)), 78 (“In CVD methods, two or more reactant gases are generally mixed in the chamber in the vicinity of the substrate surface.”).

Weidman also discloses “a deposition chamber for atomic layer deposition of a film on a substrate.” EX1005, 8:43-45; EX1003, ¶¶47-49.

d. “wherein the substrate is maintained at a temperature of less than 200° C”

Meyers teaches maintaining a substrate at a temperature from about 40 °C to about 175 °C, and from about 50 °C to about 160 °C, both ranges are temperatures of less than 200° C, and notes that a POSA would recognize that “additional ranges

of pressure and temperature within the explicit ranges above are contemplated and re [*sic*, “are”] within the present disclosure.” EX1006, ¶0082; EX1003, ¶50. Additionally, Weidman’s “chamber or substrate may be heated to a temperature of ... less than about 200° C ... or less than about 100°.” EX1005, 9:21-26.

Additionally, a POSA would be motivated to maintain the substrate at less than 200 °C because, as Meyers explains, reaction temperatures below about 200 °C limit dealkylation and/or prevent excessive dehydration and condensation of an oxide hydroxide. EX1006 at ¶0082; EX1003, ¶51.

e. “an inlet into the deposition chamber”

Meyers teaches a secondary reactant can enter the deposition chamber through an inlet into the chamber. EX1006, ¶0079; EX1003, ¶52. Meyers describes how “[t]he secondary reactant to drive hydrolysis/oxidation can be introduced through a **separate inlet into the chamber.**” *Id.*, ¶¶78-79.

Additionally, Weidman’s apparatus can include one or more **inlets** into the deposition chamber. EX1005, 8:47-61 (“a **first precursor inlet,**” “a **reactant gas inlet,**” “a **purge gas inlet,**” and “an **auxiliary gas inlet**”). EX1003, ¶53.

f. “a structure configured to deliver flow from a supply of an inert gas”

As discussed in Section VII.B., the structure as tied to Figure 16 of the ’048 Patent is a conduit to deliver from a supply of inert gas, e.g., connecting “vessel 168”

to “supply of inert gas 170,” and equivalents thereof or, if not tied to Figure 16, a conduit (like a pipe) a supply of inert gas, e.g., connecting an interconnected vessel (like a vaporization chamber) to a supply of inert gas, and equivalents thereof.

Although Meyers discloses a CVD machine, it does not explicitly disclose a conduit (e.g., pipe) connecting a vessel to a supply of inert gas or equivalents thereof. Weidman’s apparatus for performing vapor deposition includes one or more inlets into the deposition chamber, EX1005, 8:47-61, and “the various gases for the process may be pulsed into **an inlet** through a **gas channel**, from various holes or **outlets**, and into a **central channel**.” *Id.*, 8:16-20. In Weidman, “[e]ach inlet may be controlled by an appropriate **flow controller** such as a mass flow controller or volume flow controller in communication with a central processing unit (CPU) that allows flow of each of the reactants to the substrate to perform a[n] ALD process.” *Id.*, 7:53-56. Weidman’s “processing chamber would include separate supplies of the A, B, and C reactants, along with a **supply of** carrier, purge and **inert gases** such as **argon** and nitrogen in fluid communication with gas inlets for each of the reactants and gases” and that “[t]he substrate...can be exposed to a metal-containing “A” precursor gas or vapor formed by **passing a carrier gas** (for example, nitrogen or **argon**) **through an ampoule of the precursor**...can be delivered at any suitable flow rate...” EX1005, 11:66-12:6. Thus, Weidman discloses conduits like gas channels, outlets, central channels and conduits through flow controllers to supply

an inert carrier gas to a vessel, e.g., from the source of the precursor. Thus, Meyers+Weidman discloses the claimed “structure [e.g., Weidman’s gas channels] configured to deliver flow from a supply of an inert gas.”

A POSA would be motivated to use Weidman’s gas channels to couple an inert gas supply through the precursor ampoule to the inlet to the deposition chamber to deliver Meyer’s precursors because Meyers teaches that inert gases (e.g., Nitrogen and Argon) can be used as carrier gases in ALD (sequential) and CVD (continuous) systems. EX1006, ¶0079; EX1003, ¶¶54-56.

g. “a supply of an organotin composition comprising a compound described by the formula R_nSnX_{4-n} , where R is an organic ligand with 1-31 carbon atoms and is bound to Sn with a metal-carbon bond”

Meyers teaches inputting into a deposition chamber a first precursor vapor including a compound having the formula R_nSnX_{4-n} where $n=1$ in which R is a hydrocarbyl group with 1-31 carbon atoms (hydrocarbyl is an organic ligand bound to tin with a metal-carbon bond). EX1006, ¶0080. Accordingly, a POSA would understand the deposition apparatus would include a supply of the compounds of R_nSnX_{4-n} to prepare the first precursor vapor. *Id.*, ¶0009; EX1003, ¶57.

Meyers also teaches specific examples of compounds of R_nSnX_{4-n} (e.g. $(CH_3)_2CHSn(NMe_2)_3$, where $n = 1$ and R is $(CH_3)_2CH-$ (isopropyl group, which has 3 carbon atoms) and where the CH group is bonded directly to tin forming a metal-

carbon bond. EX1006, ¶¶0080, 0144; EX1003, ¶58. In the combination, this compound could be provided in Weidman's ampoule.

- h. “wherein X is selected from the group consisting of alkylamido or dialkylamido ($\text{—NR}^1\text{R}^2$, where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms or hydrogen), siloxo ($\text{—OSiR}^1\text{R}^2\text{R}^3$, where $\text{R}^1, \text{R}^2, \text{R}^3$ are independently hydrocarbon groups with 1-10 carbon atoms), silylamido ($\text{—N(SiR}^1_3\text{)(R}^2\text{)}$, where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms), disilylamido ($\text{—N(SiR}^1_3\text{)(SiR}^2_3\text{)}$ where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms), alkoxo and aryloxo (—OR , where R is an alkyl or aryl group with 1-10 carbon atoms), azido (—N_3), alkynido ($\text{—C}\equiv\text{CR}$, where R is a hydrocarbon group with 1-9 carbon atoms), amidato ($\text{—NR}^1(\text{COR}^2)$ where R^1 and R^2 are independently hydrocarbon groups with 1-7 carbon atoms or hydrogen), amidinato ($\text{—NR}^1\text{C(NR}^2\text{)R}^3$) where R^1 and R^2 are independently hydrocarbon groups with 1-8 carbon atoms or hydrogen), imido ($\text{—N(COR}^1\text{)(COR}^2\text{)}$, where R^1 and R^2 are independently hydrocarbon groups with 1-8 carbon atoms or hydrogen), or fluorinated analogues thereof, or combinations thereof” (hereinafter, “X group limitation”)**

Meyers teaches the claimed X group limitation because it discloses a method for forming a radiation patternable coating using vapor deposition, including inputting into a deposition chamber a first precursor vapor including a compound having the formula $\text{R}_n\text{SnX}_{4-n}$ where $n=1$ in which R is a hydrocarbyl group with 1-31 carbon atoms and X is a hydrolysable or oxidizable ligand. *Id.*, ¶¶0009, 0055-

0056, 0080 (describing list of suitable ligands identical to claim language); EX1003 ¶59.

- i. **“a structure configured to deliver flow of a first precursor vapor from the supply of the organotin compound with the inert gas as a carrier gas to the inlet”**

As discussed in Section VII.B, the structure for this MPF term based on Figure 16 is “the conduit extending from the vessel 168 to the inlet 152” and equivalents thereof or, if not tied to Figure 16, “a class of structures for delivering flow, e.g., a conduit (such as a pipe)” from an interconnected vessel (such as a vaporization chamber, as recited in claim 4), and equivalents thereof.

Meyers discloses the source and chamber, and Weidman discloses the structure for delivering flow between them. Weidman describes “[p]urge and inert gases such as argon and nitrogen in fluid communication with gas inlets for each of the reactants and gases,” and notes “[e]ach inlet may be controlled by an appropriate flow controller such as a mass flow controller or volume flow controller in communication with a central processing unit (CPU) that allows flow of each of the reactants to the substrate to perform a[n] ALD process.” EX1005, 7:48-57. Weidman's “processing chamber would include separate supplies of the **A, B, and C reactants**, along with a **supply of** carrier, purge and **inert gases**...in fluid communication with gas inlets for each of the reactants and gases” and that “[t]he

substrate...can be exposed to a metal-containing ‘A’ **precursor** gas or vapor formed by **passing a carrier gas...through an ampoule** of the precursor...can be delivered at any suitable flow rate...” *Id.*, 11:65-12:2. Weidman also discloses that “the various gases for the process may be pulsed into **an inlet** through a **gas channel**, from various holes or **outlets**, and into a **central channel**.” *Id.*, 8:16-20. As such, Weidman discloses conduits like gas channels, outlets, central channels with flow controllers to supply precursor gases to the chamber. EX1003, ¶61.

Thus, Meyers+Weidman discloses a structure to deliver a first precursor vapor (e.g., above precursors) from the supply of the organotin compound (e.g., the ampoule with Meyer’s precursor) with the inert gas as a carrier gas (e.g., argon) to the inlet. *Id.*, 60-62.

j. “to provide for formation of an organotin layer on the substrate surface within the deposition chamber”

Meyers describes “vapor deposition methods for deposition of organotin oxide hydroxide thin-film photoresists. Potential deposition methods include, for example, physical vapor deposition (PVD), **chemical vapor deposition (CVD)**, **atomic layer deposition (ALD)**, or modifications thereof” where “**one or more gaseous $R_nSnX_{(4-n)}$ compounds can be introduced to a reaction chamber** and reacted with a co-precursor such as H_2O ... thereby **producing a radiation sensitive organotin oxide hydroxide coating**.” EX1006, ¶0033. Meyers notes that the ALD

process can include sequentially adsorbing, chemisorbed, or decomposed the precursor on a “substrate surface.” EX1003, ¶¶63-64.

- k. “a structure to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first precursor vapor”**

As discussed in Section VII.B, the structure based on Figure 16 of the '048 Patent is a conduit 174 connecting a source of a “second precursor vapor comprising water, hydrogen peroxide or a combination thereof” to inlet 154 of deposition chamber 151 and equivalents thereof or, if not tied to Figure 16, a conduit (e.g., pipe) connecting a source of a “second precursor vapor comprising water, hydrogen peroxide or a combination thereof” to an inlet of a deposition chamber and equivalents thereof.

Meyers teaches **an inlet** (i.e., a pipe) for delivering into the chamber a secondary precursor vapor (secondary reactant) that is capable of reacting (hydrolysis/oxidation) with the composition comprising a compound described by the formula RSnX_3 . Meyers teaches that the second precursor vapor can include water. EX1006, ¶¶0077, 0079; EX1003, ¶66.

Alternatively, Weidman discloses that the apparatus includes supplies of A, B, and C reactants. B reactants can include water (H_2O) or hydrogen peroxide (H_2O_2). EX1005, 5:55-65, 8:48-52, 10:1-10, 16:4-7. Weidman's B reactant is

delivered to the substrate by passing a gas through an ampoule (*i.e.*, a structure configured to deliver a second precursor vapor). *Id.*, 12:38-41. As Weidman describes, “the various gases for the process may be pulsed into **an inlet** through a **gas channel**, from various holes or **outlets**, and into a **central channel**.” *Id.*, 8:16-20.

Thus, Meyers+Weidman discloses a structure (e.g., gas channels etc.) to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first precursor vapor. EX1003, ¶¶65-68.

l. “under conditions in the deposition chamber to form a composition with non-volatile components and a volatile component comprising hydrolysis reaction product with X”

Meyers’s method for forming a radiation patternable coating using vapor deposition includes inputting a first precursor vapor comprising R_nSnX_{4-n} (n can be 1, EX1006, ¶¶142-143, where “X is a ligand having a hydrolysable bond with Sn” under conditions in the chamber “to form a composition with non-volatile components and a volatile component comprising a reaction product with X ligand or ligands.” *Id.*, ¶¶144-145; EX1003 ¶69.

m. “wherein the substrate is configured with a surface to receive the non-volatile components of the composition”

Meyers discloses “wherein a substrate is configured with a surface to receive the non-volatile components of the composition.” *Id.*, ¶¶0143-0145 (as part of a recitation of a method for forming a radiation patternable coating); EX1003, ¶70.

3. Claim 2

Meyers+Weidman discloses claim 2, which recites “the substrate comprises a **silicon wafer**.” Meyers states: “substrates of particular interest include, for example, **silicon wafers**.” *Id.*, ¶0069. Additionally, Weidman’s substrate can be a silicon wafer. EX1005, 7:30-41; EX1003, ¶71.

4. Claim 3

Claim 3, which depends from claim 1, recites that “the inert gas comprises nitrogen or argon.” Meyers states: “[i]nert gases such as N₂, Ar or the like may be used in appropriate capacities as carrier gases.” EX1006, ¶0079. And Weidman’s apparatus includes a supply of inert gases such as argon and nitrogen. EX1005, 8:48-52; EX1003, ¶72.

5. Claim 4

- a. “the structure configured to deliver flow comprises: an aerosol generator configured to generate an aerosol from a liquid comprising the organotin compound, a vaporization chamber configured to receive an injection of organotin compound, a flash evaporator configured to evaporate the organotin compound, or a bubbler configured for bubbling an inert carrier gas through a liquid comprising the organotin compound, and”

This claim is written in the alternative, and Meyers discloses “bubbler vessels...” EX1006, ¶0082. Meyers also teaches a method for forming a radiation patternable film using CVD, including methods for delivering flow that result from the claimed structures configured to deliver flow. *Id.*, ¶0079 (“precursors with relatively low vapor pressures may be introduced using flow of vapor, aerosol, and/or direct liquid injection into a vaporization chamber”). Weidman also teaches a bubbler (an ampoule of precursor liquid through which a carrier gas is passed). EX1006, 13:16-20; EX1003, ¶73.

b. “wherein the deposition on the surface of the substrate comprises chemical vapor deposition”

Meyers’s deposition (the hydrolyzed or oxidized composition formed in the deposition chamber) on a substrate’s surface was conducted using chemical vapor deposition (“CVD”). *Id.*, ¶¶0009, 0144-145. Weidman also discloses devices “configured to operate in both an ALD mode as well as a conventional CVD mode” “to deposit photoresist materials.” 1005, 12-15; EX1003, ¶74.

6. Claim 5

Meyers+Weidman discloses claim 5, which depends on claim 1 and recites “the second precursor vapor comprises **water vapor**.” Meyers lists H₂O as a small molecule gas-phase reagent used in vapor deposition. *Id.*, ¶0077. Weidman also discloses a non-metal reactant “B” can include “vapors of water.” EX1005, 5:55-

62; EX1003, ¶75.

7. Claim 6

Meyers+Weidman discloses claim 6, which depends on claim 1 and recites “further comprising a flow comprising a third precursor vapor comprising a composition represented by the formula ML_v , where v is $2 \leq v \leq 6$ and L is an oxidizable ligand or a ligand having a hydrolysable M-L bond or a combination thereof, and M is a metal selected from groups 2-16 of the periodic table.” Meyers teaches inputting into a deposition chamber a third precursor vapor with the formula ML_v . Meyers discusses at ¶0145:

The method of additional inventive concept 1 where a third precursor is separately inputted to the chamber the precursor comprising ML_v , where v is $2 \leq v \leq 6$ and L is an oxidizable ligand or a ligand having a hydrolysable M-L bond or a combination thereof, and M is a metal selected from groups 2-16 of the periodic table.

EX1003, ¶76.

8. Claim 7

Meyers+Weidman discloses claim 7, which depends on claim 6 and recites that “the third precursor vapor comprises **SnL₄**.” Meyers teaches compounds of formula SnL_4 ($Sn(NMe_2)_4$ or $Sn(OtBu)_4$ wherein $L_4 = (NMe_2)_4$ or $(OtBu)_4$). Meyers teaches a third precursor comprising ML_v can be inputted into the chamber (third precursor vapor). $Sn(NMe_2)_4$ and $Sn(OtBu)_4$ are compounds of ML_v where v is 4 and L is a ligand having a hydrolysable M-L bond and M is a metal of group 14 of

the periodic table. EX1006, ¶¶0078, 0080. Accordingly, a POSA would understand that the third precursor vapor can comprise $\text{Sn}(\text{NMe}_2)_4$ or $\text{Sn}(\text{OtBu})_4$. *Id.*, ¶¶0131, 0134; EX1003, ¶77.

9. Claim 8

Meyers+Weidman discloses claim 8, which depends on claim 1 and recites “the interior has a pressure from about 0.01 Torr to about 25 Torr.” Meyers teaches a chamber having the claimed interior pressure: “” *Id.*, ¶0082; *see also id.*, ¶¶0143-0145; EX1003 ¶¶78-79.

10. Claim 9

Meyers+Weidman discloses claim 9, which depends on claim 1 and recites “the interior has a temperature from about 40° C. to about 175° C.”⁴ Meyers teaches the interior of the deposition chamber (e.g., chamber walls) has “a temperature from about 40° C. to about 175° C.” *Id.*, ¶0082; EX1003, ¶80.

11. Claim 10

Meyers+Weidman discloses claim 10, which depends on claim 1 and recites the system of claim 1 “comprising a **configuration** providing **for** selection of the pressure and/or the temperature in the deposition chamber.” In Meyers, the temperature in the reaction chamber can be selected to control the reaction process.

⁴ Petitioner preserves right to argue indefiniteness of claim 9 as a mixed claim type.

Id., ¶0078. Weidman’s “substrate temperature and chemistry can be selected specifically not to promote formation of an insoluble oxide precursor material, but to remain soluble unless exposed to far UV or EUV radiation.” EX1005, 15:56-60. And Weidman’s CPU “can be used in an industrial setting for controlling various chambers and sub-processors.” EX1005, 7:57-60. It would be obvious to a POSA to use this CPU to select and control substrate temperature and pressure. EX1003, ¶¶81-83.

12. Claim 11

Meyers+Weidman discloses claim 11, which depends from claim 1 and recites “the flow comprises a **vapor**.” Meyers teaches CVD methods including bubbler vessels to deliver flow of a liquid alkyl tris(dialkylamido) tin compound (a compound of R_nSnX_{4-n} where n is 1, R is alkyl, and X is dialkylamido) in an inert carrier gas, and a flash evaporator that can be used to deliver precursor vapors into the chamber. EX1006, ¶0082. Additionally, Weidman’s “substrate...can be exposed to a metal-containing ‘A’ precursor gas or vapor...delivered at any suitable flow rate...” EX1005, 11:65-12:6; EX1003, ¶84.

13. Claim 12

Meyers+Weidman discloses claim 12, which depends from claim 1 and recites “the structure configured to deliver flow comprises one or more [VIS].”

As discussed *supra* at Section VII.B, the VIS limitations in this and claims 13-

17 are MPF terms whose function is “vapor inputting” and structure is “an inlet for inputting a vapor and equivalents thereof.”

Meyers describes various **inputting structures**, such as a bubbler, a flow controller, various **valves and inlets**. *E.g.*, EX1006, ¶¶0079-0082.

Weidman’s “processing chamber is configured to expose the substrate to a sequence of gases and/or plasmas” and includes “**gas inlets** for each of the reactants and gases.” EX1005, 8:48-52. Additionally, Weidman’s deposition chamber has “a **first precursor inlet** in fluid communication with a supply of precursor,” and “a reactant gas inlet in fluid communication with a supply of a reactant gas.” *Id.*, 8:47-52; EX1003, ¶¶85-88.

14. Claim 13

Meyers+Weidman discloses claim 13, which depends from claim 12 and recites the system of claim 12 where “the **[VIS] provide for control of the flow.**” As discussed for claim 12, Weidman’s apparatus has inlets in communication with supply content. EX1005, 8:48-52. Per Weidman, “[e]ach inlet may be controlled by an appropriate **flow controller**...in communication with a **central processing unit (CPU)**.” *Id.*, 8:52-57; EX1003, ¶89.

15. Claim 14

Meyers+Weidman discloses claim 14, which depends from claim 1 and recites “a **first [VIS]** is configured to deliver a first vapor flow and a **second [VIS]** is

configured to deliver a second vapor flow **at the same time.**”

Meyers teaches inputting a second precursor vapor “at the same time” as a first precursor vapor. EX1006, ¶¶0143-0145. Meyers also teaches CVD as a potential deposition method, which includes a continuous deposition process. EX1006, ¶¶0033; *see id.*, ¶¶0078 (“In CVD methods, two or more reactant gases are generally mixed in the chamber in the vicinity of the substrate surface”).

Weidman describes “a first precursor **inlet** in fluid communication with a supply of a first precursor containing substituents with cross-linkable moieties.” *Id.*, 8:47-49. Additionally, Weidman’s “‘A’, ‘B’, and purge gases can flow **simultaneously**, and the substrate and/or gas flow nozzle can oscillate such that the substrate is sequentially exposed to the A, purge, and B gases as desired.” *Id.*, 6:17-21; EX1003, ¶¶90-92.

16. Claim 15

Meyers+Weidman discloses claim 15, which depends on claim 1 and recites the aforementioned first and second VIS and that “the first vapor flow and the second vapor flow are **sequential.**”

Meyers teaches inputting a first precursor vapor and a second precursor vapor sequentially. EX1006, ¶¶0143-0145. Meyers also teaches ALD as a potential deposition method, which includes a sequential deposition process. EX1006, ¶¶0033; EX1003, ¶94.

Further, Weidman's "method for forming a radiation sensitive photoresist on a substrate" includes "exposing a substrate sequentially to alternating pulses of a first precursor containing substituents with cross-linkable moieties and a reactant selected from...H₂O, H₂O₂...to form a deposited layer..." EX1005, claim 1; EX1003, ¶¶93-95.

17. Claim 16

Meyers+Weidman discloses claim 16, which depends on claim 1 and recites the system of claim 1 where "a first [VIS] is configured to deliver a first vapor flow and a second [VIS] is configured to deliver a second vapor flow, wherein [the first, the second, and a third] vapor flow...are **sequential**."

Meyers teaches (i) a first and second vapor flow can be delivered sequentially, and (ii) inputting a third precursor vapor flow into a deposition chamber. Meyers's "one or more vapor-phase precursor compounds ... such as Sn(NMe₂)₄ or Sn(OtBu)₄" "may be reacted sequentially ... with the organotin-containing precursors." EX1006, ¶0080.

Meyers also teaches that ALD (which includes sequential deposition) is a suitable method. *Id.*, ¶0077. Accordingly, a POSA would understand that the third vapor flow could also be delivered sequentially along with a first and second vapor flow using ALD. EX1003, ¶98.

Weidman's "apparatus includes a first precursor inlet in fluid communication

with a supply of a first precursor containing substituents with cross-linkable moieties.” EX1005 at 8:47-49, 9:29-42 (“an ALD process cycle may include **alternating pulses** of ‘A’ precursor..., ‘B’ reactant, ‘C’ precursor..., and ‘B’ reactant”). Weidman’s “‘A’, ‘B’, and purge gases can flow simultaneously, and the substrate and/or gas flow nozzle can **oscillate** such that the substrate is sequentially exposed to the A, purge, and B gases as desired.” *Id.*, 6:17-21.

A POSA would also understand that there are a limited number of obvious choices of continuous or alternating delivery methods, which would have been obvious-to-try. EX1003, ¶¶96-100.

18. Claim 17

Meyers+Weidman discloses claim 17, which recites the system of claim 1 where “a first [VIS] is configured to deliver a first vapor flow and a second [VIS] is configured to deliver a second vapor flow, wherein the first vapor flow and the second vapor flow are at the **same time** and a third vapor flow is **sequential**.”

Meyers teaches a first precursor vapor (first vapor flow) and a second precursor vapor (second vapor flow) can be delivered at the same time and also teaches a third precursor vapor being “separately inputted” into a deposition chamber (a third vapor flow). EX1006, ¶¶0078, and 0145. Meyers also teaches CVD, which includes a continuous deposition process, and ALD, which includes a sequential deposition process. *Id.*, ¶0033; EX1003, ¶102.

Meyers teaches the first and second vapor flows can be “input sequentially” and that the third vapor flow can be “separately inputted to the chamber.” *Id.*, claims 1, 6. Specifically, vapor-phase precursors such as $\text{Sn}(\text{NMe}_2)_4$ or $\text{Sn}(\text{OtBu})_4$ can be input sequentially with organotin-containing precursors to alter the R:Sn ratio. *Id.*, ¶0080. And both CVD (which includes a continuous deposition process) and ALD (which includes a sequential deposition process) are suitable deposition methods. EX1003, ¶103.

Weidman also discloses “both an ALD mode as well as a conventional CVD mode may be used to deposit photoresist material” and that ALD process cycles may include alternating pulses of different precursors. EX1005, 9:12-15. Thus, a POSA would know that varying which precursors are introduced at the same time or sequentially is a simple design choice that would be obvious to try. EX1003, ¶¶101-105.

19. Claim 18

Meyers+Weidman discloses claim 18, which depends from claim 1 and recites “the interior has a temperature from about 45° C. to about 200° C.” Meyers’ deposition chamber has a temperature from about 40° C. to about 175° C, which overlaps with the claimed range. *Id.*, ¶0082. Additionally, Weidman’s “chamber or substrate may be heated to a temperature of...less than about 200° C ... or less than about 100°.” EX1005, 9:21-26; EX1003, ¶106.

20. Claim 19

Meyers+Weidman discloses claim 19, which depends from claim 1, and recites “wherein X is alkylamido or dialkylamido.” Meyers teaches that useful X ligands include alkylamido and dialkylamido, and discloses specific examples of compounds of RSnX_3 where X is dialkylamido ($\text{—NR}^1\text{R}^2$, where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms or hydrogen; —NMe_2 is a dialkylamido group where R^1 and R^2 are each methyl (Me), which is a hydrocarbon group with 1 carbon atom). EX1006, ¶0080; EX1003, ¶107.

21. Claim 20

Meyers+Weidman discloses claim 20, which depends from claim 1, and recites the system of claim 1 where “X is alkoxo and aryloxo.” Meyers teaches that useful X ligands include alkoxo and aryloxo, and discloses specific examples of compounds of RSnX_3 where X is alkoxo (—OR , where R is an alkyl group with 1-10 carbon atoms; $\text{—O}^t\text{Bu}$ is an alkoxo group where R is t-butyl, which is an alkyl group with 4 carbon atoms). *Id.*, ¶0080 EX1003, ¶108.

F. Ground 2: Claims 1-5 And 8-20 Are Anticipated by and/or Obvious Over Berney

1. Claim 1

a. Preamble: “system comprising”

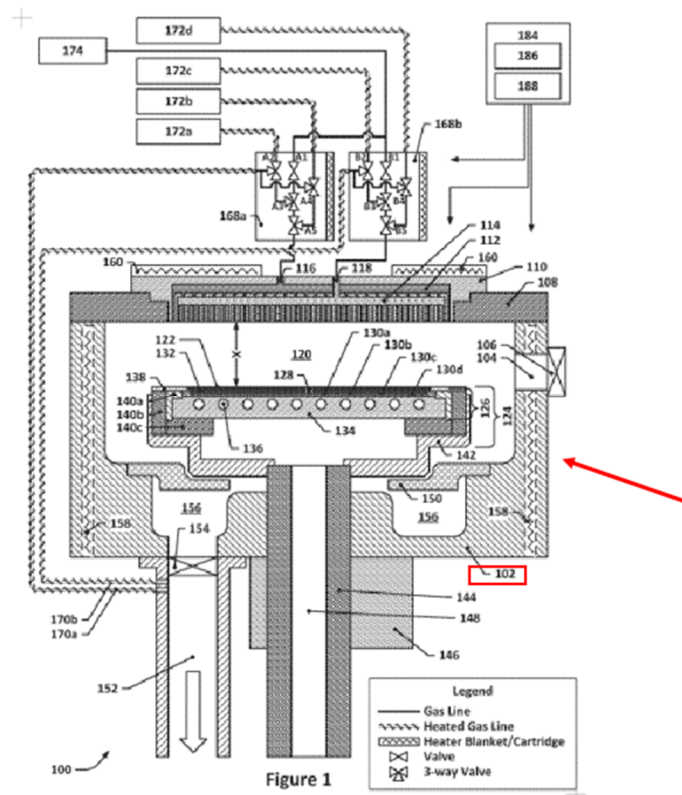
Berney discloses “an example dry deposition apparatus for generating EUV-sensitive photoresist layers.” EX1020 ¶0009, Fig. 1. Berney thus discloses “[a] system comprising.” *Id.*, ¶¶0072, 0074; EX1003, ¶109.

b. “deposition chamber having an interior isolated from the ambient atmosphere”

Berney’s “apparatus 100...has a **processing chamber 102**,” as shown in Figure 1 below. EX1020, ¶0038. Berney’s processing chamber may be “isolated from the environment” using a gate valve to seal the wafer transfer passage. *Id.* A POSA would know that the other side of the gate valve (or, if present, more than one gate valves or other mechanisms) is at ambient atmosphere, and sealing the wafer transfer passage would isolate the processing chamber from the ambient atmosphere. *Id.*, ¶0018; EX1003, ¶110.

Berney also discloses that dry deposition processes “may be performed in a range of different temperature and pressure environments, and are often performed at **sub-atmospheric conditions**.” *Id.*, ¶0014. A POSA would understand that a deposition chamber would be isolated from the ambient atmosphere to attain

different temperature and pressure environments, including sub-atmospheric conditions, for processing. *Id.*, ¶¶0018, 0037; EX1003, ¶111.

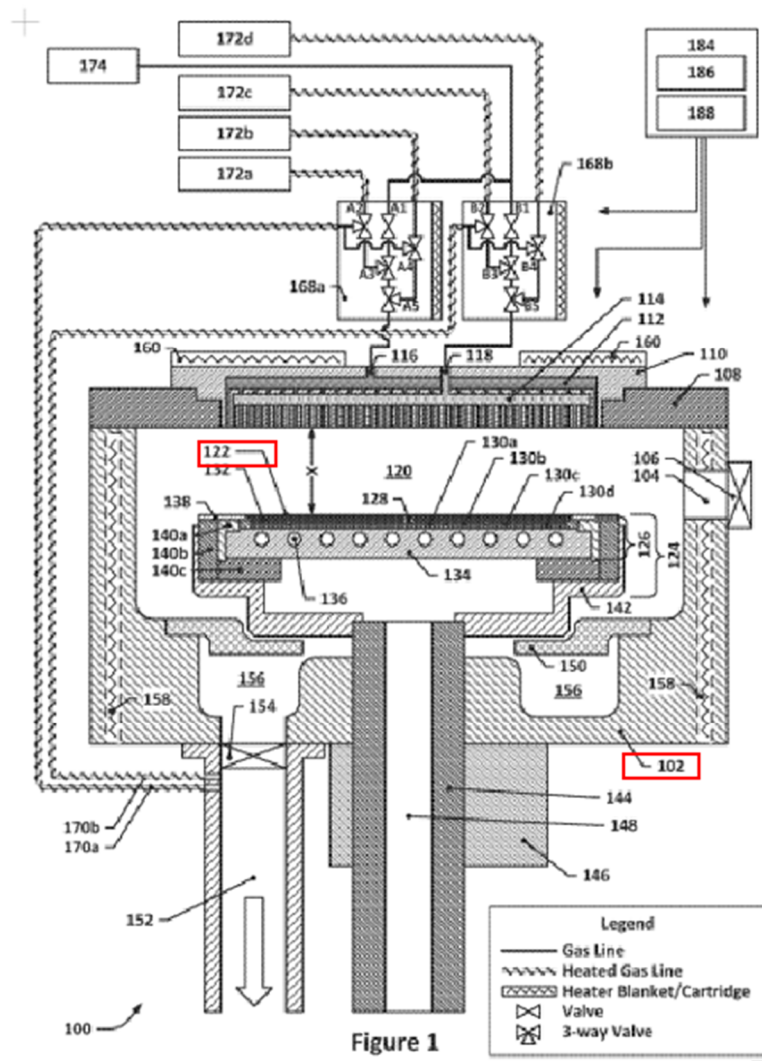


EX1020, Figure 1 (annotated).

- c. “substrate within the interior of the deposition chamber configured to receive a deposition on a surface of the substrate”

Berney’s substrate is “passed...into the interior of the processing chamber 102,” as shown below. *Id.*, ¶0038. The substrate “may include any material construct suitable for photolithographic processing.” *Id.*, ¶0019. “The EUV-sensitive metal or metal oxide-containing film may be **dry-deposited on the substrate.**” *Id.*, ¶0017. “EUV-patternable films may be deposited on the substrate using vapor deposition

equipment....” *Id.*, ¶0027. A POSA would understand that if films are deposited on Berney’s substrates, these substrates are configured to receive a deposition on their surface. *Id.*, ¶¶0017, 0019; EX1003, ¶112.



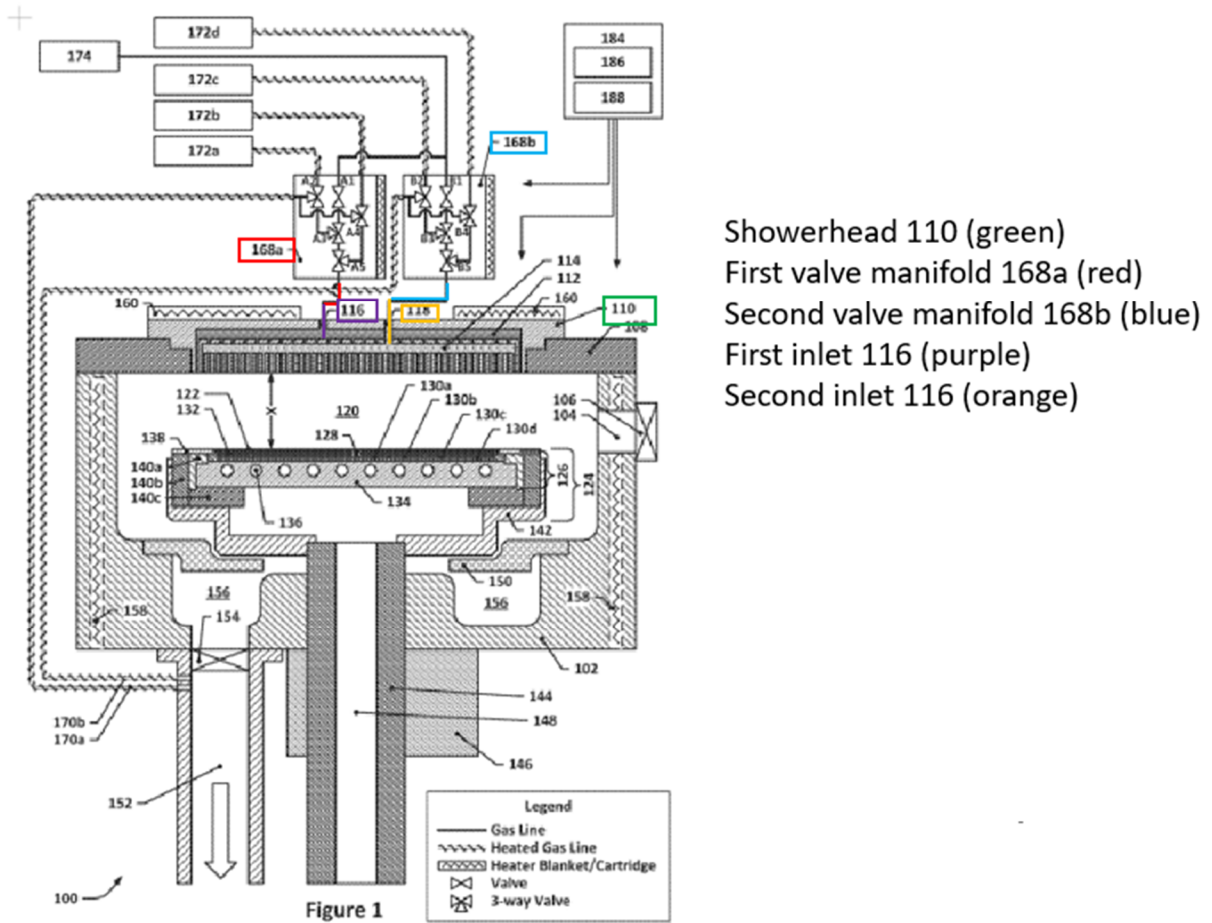
EX1020, Figure 1 (annotated).

d. “the substrate is maintained at a temperature of less than 200° C”

Berney teaches that the substrate temperature can be maintained at a temperature “from 0°C to 250°C, or **from ambient temperature (23 °C) to 150 °C**” . *Id.*, ¶0030; EX1003, ¶113.

e. “an inlet into the deposition chamber”

Berney’s “showerhead 110...includes **a first plenum 112** that is provided process gas **via a first inlet 116,**” and “[e]ach plenum may have a **corresponding set of gas distribution ports that fluidically connect the respective plenum with the reaction space 120,**” as shown below. EX1020, ¶0047., EX1003, ¶114.



EX1020, Figure 1 (annotated); EX1003, ¶114.

f. “structure configured to deliver flow from a supply of an inert gas”

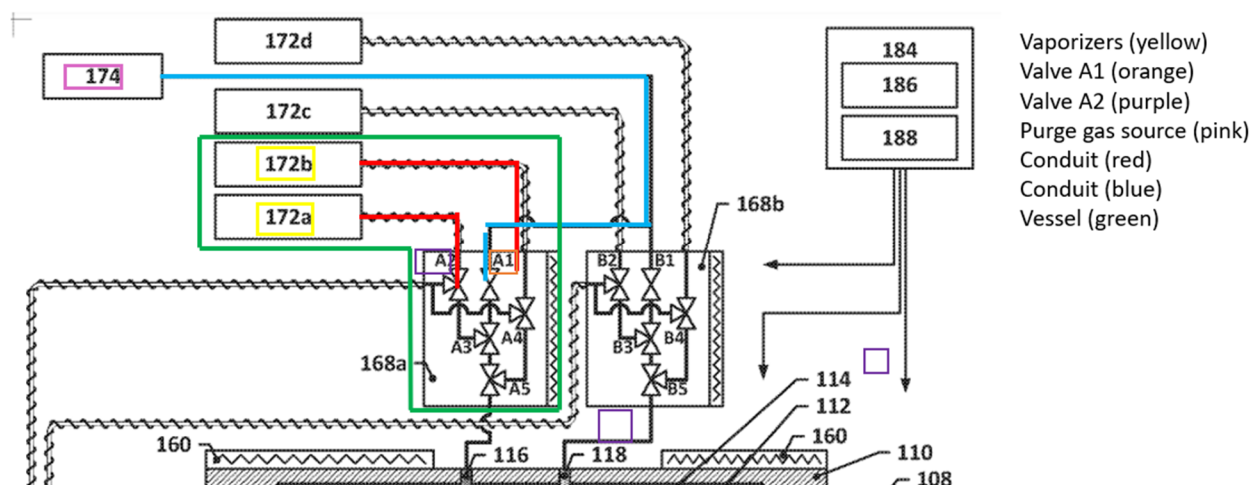
Petitioner refers to the MPF analysis in Section VII.B.

Berney discloses an apparatus for vapor deposition including conduits and a manifold that can cause the flow of a purge gas. EX1020, ¶52. The purge gas can be “any suitable inert gas.” *Id.*, ¶50.

Berney's valves cause the flow of a purge gas: "...it may be desirable to purge one of the vapors...by actuating the valves A1, A3, and A5 so as to cause the purge gas from the purge gas source 174 to be flowed into the first inlet 116." *Id.*, ¶53. The purge gas source also has a conduit that delivers flow of the purge gas to first valve manifold 168a, as shown in Figure 1 below. Since the claim element of the "structure configured to deliver flow" does not require the "structure" connecting to anything, a POSA would understand that the "structure" is simply a conduit for delivering a supply of inert gas, and that the valves and conduit disclosed by Berney are "structures configured to deliver flow."

Moreover, although the limitation does not require that the structure includes the precursor vessel as Inpria seems to argue, a POSA would appreciate that the precursor source includes the precursor vessel and its mixer valve manifold, and as such the source of inert gas connects through a conduit to the precursor source (that includes its mixer/valve), as shown in Figure 1 below. EX1003, ¶118.

Thus, Berney discloses this limitation. EX1003, ¶115-119.



EX1020, Figure 1 (annotated and cropped).

- g. “a supply of an organotin composition comprising a compound described by the formula RSnX_3 , where R is an organic ligand with 1-31 carbon atoms and is bound to Sn with a metal-carbon bond”

Berney discloses “a supply of an organotin composition” because it discloses inlets 116 inlets 118 that “may be provided processing gases via a **gas supply system, which may be configured to provide one or more organometallic precursors...**” EX1020, ¶0048. Moreover, the organometallic precursors may be “**dispensed from their respective vaporizers 172...into the reaction space 120.**” *Id.*, ¶64.

Berney’s organometallic precursors disclose the “organotin composition.” In particular, Berney’s precursors can be of “formula $\text{M}_a\text{R}_b\text{L}_c$ where **M is a metal with**

a high EUV absorption cross-section; R is alkyl⁵...; L is a ligand, ion or other moiety which is reactive with the counter-reactant; $a > 1$; $b > 1$; and $c > 1$.” *Id.*, ¶0022. The metal M can be tin. *Id.*, ¶¶0021, 0023. R may be alkyl groups such as i-propyl (3 carbon atoms), t-butyl (4 carbon atoms), and other alkyl groups with 3-5 carbon atoms. *Id.*, ¶0023. A POSA would understand that, in formula $M_aR_bL_c$, the alkyl group R is bound to the metal M with a metal-carbon bond. *Id.*, ¶0022; EX1003, ¶¶120-121.

h. X Group Limitation

Berney discloses that ligand L can be “a moiety that is an amine (such as a **dialkylamino or monoalkylamino group**)” or “an **alkoxy** group.” EX1020, ¶0023. A POSA would understand that the ligand L of Berney is analogous to the claimed X in **$RSnX_3$** . EX1003, ¶122.

Berney also discloses specific examples of tin precursors with dialkylamido and alkoxo groups of X: “where M is tin, such precursors include...i-propyl(tris)**dimethylamino** tin⁶...and... alkyl(tris)(**t-butoxyl**) tin compounds such

⁵ The '048 patent acknowledges that the organic ligand R can be an alkyl group. EX1001, 11:46-52.

⁶ The '048 patent also teaches i-propyltris(dimethylamino)tin ((iPrSn(NMe₂)₃) as an organometallic precursor. EX1001, 27:10-23.

as t-butyl tris(**t-butoxy**) tin⁷.” EX1020, ¶0024. A POSA would understand that Berney’s dimethylamino is the claimed dialkylamido ($\text{—NR}^1\text{R}^2$, where R^1 and R^2 are each methyl (hydrocarbon group with 1 carbon atom)), and Berney’s t-butoxy is the claimed alkoxo (—OR , where R is t-butyl (hydrocarbon group with 4 carbon atoms)). EX1001, claim 1; EX1003, ¶122. Berney also discloses the “organometallic precursors may be partially fluorinated,” EX1020, ¶0024, which discloses the “fluorinated analogues thereof.” EX1003, ¶122.

- i. **“structure configured to deliver flow of a first precursor vapor from the supply of the organotin compound with the inert gas as a carrier gas to the inlet”**

Petitioner refers to the MPF analysis in Section VII.B.

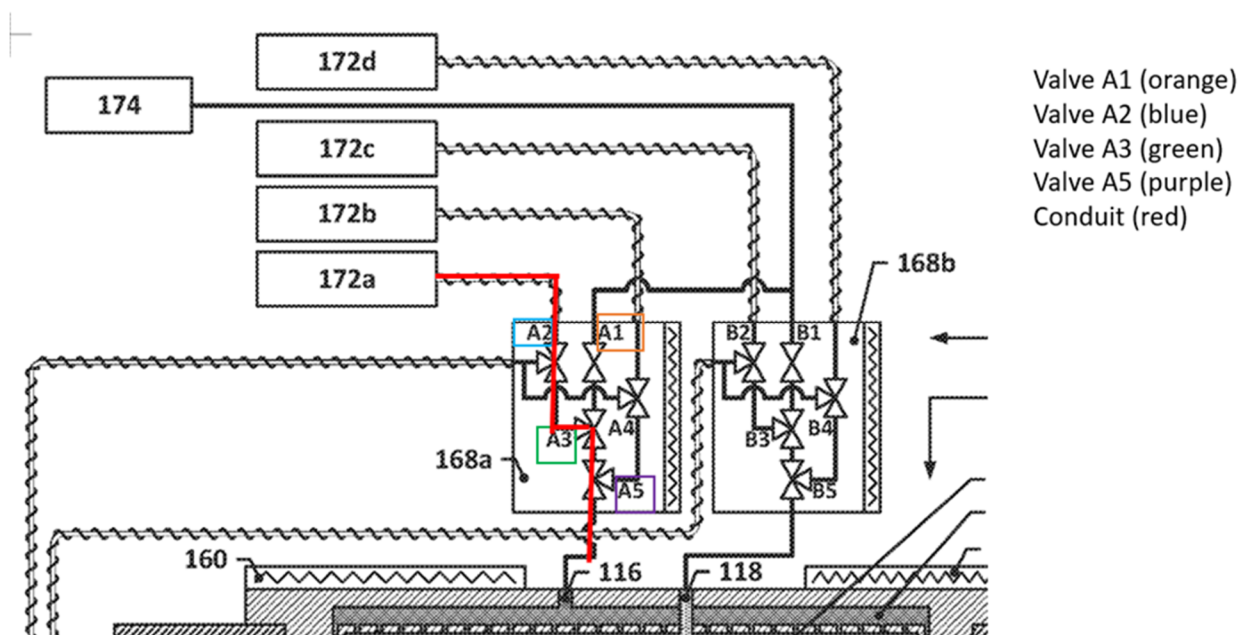
Berney discloses simultaneously flowing vapor from a vaporizer with a purge gas. EX1020, ¶53. The purge gas is “nitrogen, argon, or other suitably inert gas.” *Id.*, ¶50.

Berney discloses an apparatus for performing vapor deposition that includes a conduit (or series of conduits) fluidically connecting a vessel (i.e. “first vaporizer 172a”) to an inlet (i.e., “first inlet 116”) by way of three valves (valve A2, valve A3,

⁷ The ’048 patent also teaches $(\text{CH}_3)_3\text{CSn}(\text{O}^t\text{Bu})_3$ (t-butyl tris(t-butoxy) tin) as a precursor compound for use of vapor deposition. EX1001, 18:42.

and valve A5), as shown in Figure 1 below. EX1020, ¶¶0049-0050. A POSA would therefore understand that Berney discloses a conduit. EX1003, ¶126.

Berney discloses that the flow from the vaporizer can be delivered through the conduit (or series of conduits) and valves to the first inlet: “[T]o flow vapor from the first vaporizer 172a into the reaction space 120, the valve A2 may be actuated to cause the vapor from the first vaporizer 172a to first flow into the first bypass line 170a. This flow may be maintained for a period of time After sufficient time has passed..., valves A2, A3, and A5 may be actuated to cause the vapor flow from the first vaporizer 172a to be directed to the first inlet.” *Id.*, ¶0053; EX1003, ¶¶123-128.



Id., Figure 1 (annotated and cropped).

- j. **“to provide for formation of an organotin layer on the substrate surface within the deposition chamber”**

Berney discloses that “[t]he thin films are, in various embodiments, **organometallic** materials, for example **organotin materials** comprising **SnO_x**, or other **metal oxides** materials/moieties,” which may be made **“in a vapor phase reaction of an organometallic precursor with a counter-reactant.”** *Id.*, ¶0021. Berney states that “gas streams...of **organometallic precursor and source of counter-reactant** may be introduced into a deposition chamber of a CVD apparatus, where they may **mix and react in the gas phase** to form agglomerated polymeric materials,” and “it is believed that **the product from such vapor-phase reaction becomes heavier in molecular weight** as metal atoms are crosslinked by counter-reactants, **and is then condensed or otherwise deposited onto the substrate.**” *Id.*, ¶0029; EX1003, ¶129.

- k. **“structure to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first precursor vapor”**

Petitioner refers to the MPF analysis in Section VII.B. Berney performs the function: “to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first

precursor vapor.” Berney discloses an apparatus for vapor deposition that includes vaporizers for dispensing counter reactants. *Id.*, ¶64. Counter-reactants react with an organometallic precursor, and may be water or hydrogen peroxide. *Id.*, ¶25; EX1003, ¶130.

As discussed in Section VII.B, the structure for this Petition as tied to Figure 16 of the '048 Patent is a conduit 174 connecting a source of a “second precursor vapor comprising water, hydrogen peroxide or a combination thereof” to inlet 154 of deposition chamber 151 and equivalents thereof or, if not tied to Figure 16, a conduit (like a pipe) connecting a source of a “second precursor vapor comprising water, hydrogen peroxide or a combination thereof” to an inlet of a deposition chamber and equivalents thereof.

Berney discloses an apparatus for performing vapor deposition that includes a conduit fluidically connecting a vessel to an inlet by way of valves: **“Valve A2 may, for example, be a three-way valve that has one port fluidically connected with a first vaporizer 172a... and a third port fluidically connected with a port on another 3-way valve A3... One of the other ports on valve A5 may be fluidically connected with the first inlet 116 while the remaining port on valve A5 may be fluidically connected with one of the remaining ports on the valve A3.”** EX1020, ¶50. Berney discloses that a “second valve manifold 168b may be controlled in a

similar manner, e.g., by controlling valves B1-B5, to provide vapors from vaporizers 172c and 172d to the second inlet 118.” *Id.*, ¶54. Accordingly, a POSA would understand that valves B1-B5 can function analogously to valves A1-A5, and vapors from vaporizers 172c and 172d can flow to inlet 118 which connects to processing chamber 102. EX1020, ¶49;

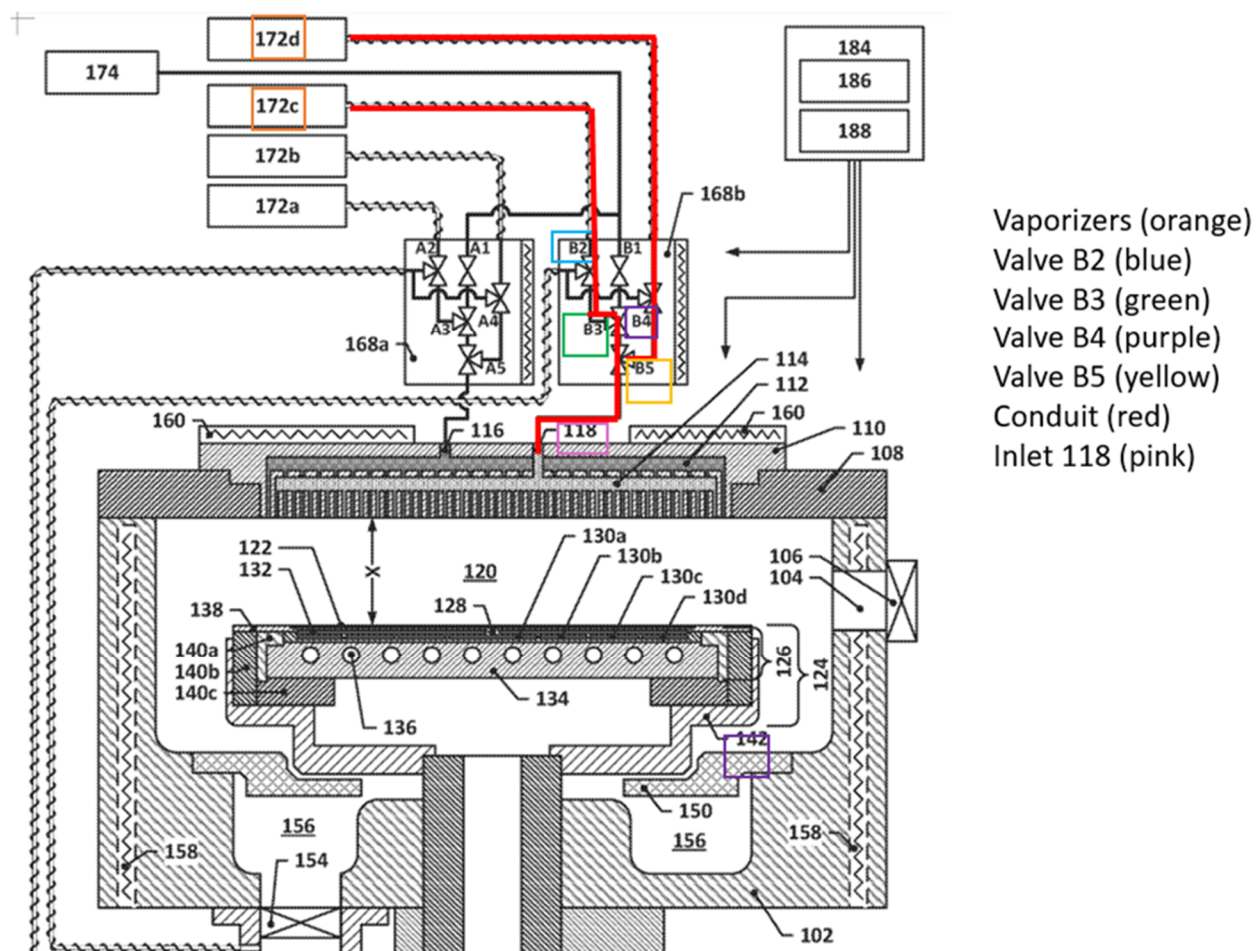
Berney’s “a second valve manifold 168b may be configured to provide counter-reactants to the second inlet 118.” EX1020, ¶49. Counter-reactants can include “water, peroxides (e.g., hydrogen peroxide)...” *Id.*, ¶25. A POSA would understand that vaporizers 172c and 172d, which are connected to second valve manifold 168b, provide counter reactants such as water or hydrogen peroxide to the second inlet 118. *Id.*, ¶49; EX1003, ¶133.

Berney discloses that “**a second valve manifold 168b may be configured to provide counter-reactants to the second inlet 118,**” as shown in Figure 1 below. EX1020 ¶0049. “[T]he second inlet 118...may be provided processing gases via a gas supply system, which may be configured to provide...one or more counter-reactants...” *Id.*, ¶0048. Counter-reactants can be “dispensed from their **respective vaporizers 172...**” *Id.*, ¶0064; EX1003, ¶134.

Thus, Berney discloses a vessel (i.e., “second vaporizer 172b”) and the conduit extending from the vessel to the inlet (i.e., “second inlet 118”). And Berney discloses “a structure configured to deliver flow of a first precursor vapor from the

supply of the organotin compound with the inert gas as a carrier gas to the inlet.” *Id.*,

¶¶130-136.



EX1020, Figure 1 (annotated and zoomed in).

- I. “under conditions in the deposition chamber to form a composition with non-volatile components and a volatile component comprising hydrolysis reaction product with X”

Berney’s “gas streams...of organometallic precursor and source of counter-reactant may be introduced into a deposition chamber of a CVD

apparatus, where they may **mix and react in the gas phase** to form agglomerated polymeric materials,” and “**the product from such vapor-phase reaction becomes heavier in molecular weight** as metal atoms are crosslinked by counter-reactants, **and is then condensed or otherwise deposited onto the substrate.**” EX1020, ¶0029. A POSA would understand that the product of the reaction between the organometallic precursor and counter-reactant is a composition with non-volatile components deposited onto the substrate (assuming the components that have condensed onto the substrate are no longer a vapor), and the vapor-phase reaction also produces a volatile component with X through a hydrolysis reaction. EX1003, ¶137.

- m. **“wherein the substrate is configured with a surface to receive the non-volatile components of the composition.”**

Berney’s film constituent is delivered “to the substrate as a **vapor-phase reactant, where it then condenses or adsorbs onto the exposed surface of the substrate.**” EX1020, ¶0014. “[T]he substrate 122 temperature may be controlled to a level that promotes condensation, or at least deposition, of the reactants on the substrate 122.” *Id.*, ¶0056. From this, a POSA would understand the substrate is configured with a surface to receive the non-volatile components of the composition. EX1003, ¶138.

2. Claim 2

Claim 2 depends on claim 1 and recites that “the substrate comprises a **silicon wafer**.” Berney discloses that “such substrates may be **silicon wafers**.” EX1020 ¶0019; EX1003, ¶139.

3. Claim 3

Claim 3 depends on claim 1 and recites that “the inert gas comprises **nitrogen** or **argon**.” Berney discloses that examples of a purge gas source includes “**nitrogen, argon, or other suitably inert gas**.” EX1020 ¶0050; EX1003, ¶140.

4. Claim 4

- a. “the structure configured to deliver flow comprises an aerosol generator configured to generate an aerosol from a liquid comprising the organotin compound, a vaporization chamber configured to receive an injection of organotin compound, a flash evaporator configured to evaporate the organotin compound, or a bubbler configured for bubbling an inert carrier gas through a liquid comprising the organotin compound”

Berney discloses that organometallic precursors can be “dispensed from their **respective vaporizers 172...**” EX1020 ¶0064. A POSA would understand the vaporizer to be any of the “aerosol generator, vaporization chamber, a flash evaporator, or bubbler” that converts the organotin into a vapor. EX1003, ¶141. If Inpria contends this limitation refers to a class of structures for delivering flow (i.e., an interconnected vessel and conduit), Berney discloses this structure as discussed

supra for this limitation. At a minimum, Berney discloses an equivalent structure because the vaporizer delivers flow. *Id.*

b. “wherein the deposition on the surface of the substrate comprises chemical vapor deposition”

Berney discloses that “[s]uitable processes for forming... **polymerized organometallic material on a substrate include**, for example, **depositing it using chemical vapor deposition....**” EX1020 ¶0027; EX1003, ¶142.

5. Claim 5

Claim 5 depends on claim 1 and recites that “the second precursor vapor comprises water vapor.” Berney discloses that the counter-reactants provided via the supply system can include “**water.**” *Id.*, ¶0025, ¶0048; EX1003, ¶143.

6. Claim 8

Claim 8 depends on claim 1 and recites “the interior has a pressure from about 0.01 Torr to about 25 Torr.” Berney’s “CVD process is **generally conducted at reduced pressures, such as from 10 milliTorr⁸ to 10 Torr,**” including “**0.5 to 2 Torr.**” EX1020, ¶0030. Thus, a POSA would understand that Berney’s CVD process is conducted at the reduced pressures of “**0.5 to 2 Torr**” which falls within the claimed range. EX1003, ¶144.

7. Claim 9

⁸ 10 milliTorr is equivalent to 0.01 Torr.

Claim 9 depends on claim 1 and recites that “the interior has a temperature from about 40° C. to about 175° C.”⁹ Berney discloses “maintain[ing] the **temperature of the [chamber’s] interior wall surfaces...to between 80 °C and 120 °C.**” EX1020, ¶0062; EX1003, ¶145.

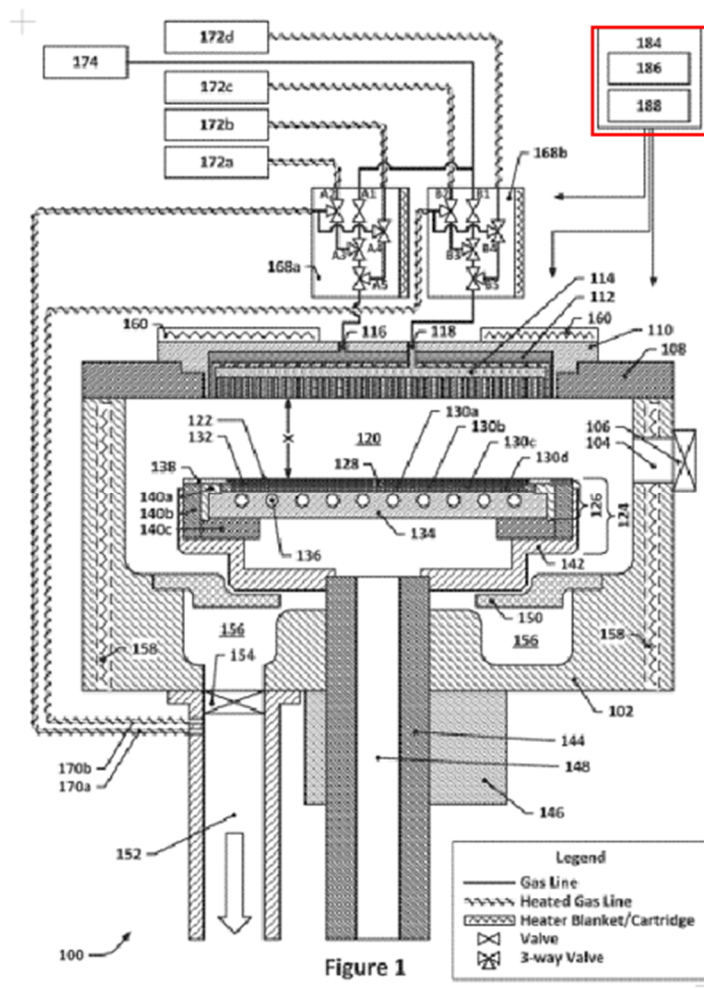
8. Claim 10

Claim 10 depends on claim 1 and recites “comprising a **configuration** providing for selection of the pressure and/or the temperature in the deposition chamber.”

As discussed at Section VII.B, this limitation is a MPF term. Berney performs the function: “selection of the pressure and/or the temperature in the deposition chamber.” Berney discloses a controller that **may be programmed to control...the...temperature settings (e.g., heating and/or cooling), pressure settings...** *Id.*, ¶0077.

As discussed in Section VII.B, the structure for this Petition is a first and second vessel and/or a controller and equivalents thereof. Berney discloses a “**controller 184 may control the various heater systems of the apparatus 100 to maintain the temperature of the [chamber’s] interior wall surfaces**” as shown in Figure 1 below. EX1020, ¶0062; *id.*, ¶0077; EX1003, ¶¶146-149.

⁹ Petitioner preserves right to argue indefiniteness of claim 9 as a mixed claim type.



EX1020, Figure 1 (annotated).

9. Claim 11

Claim 11 depends on claim 1 and recites “the flow comprises a vapor.” Berney discloses that “it may be desirable to **simultaneously flow vapor from one of the vaporizers...in tandem with flowing gas from the purge gas.**” *Id.*, ¶0053. The purge gas can be “**nitrogen [or] argon.**” *Id.*, ¶0050. Accordingly, Berney discloses this limitation. EX1003, ¶150.

10. Claim 12

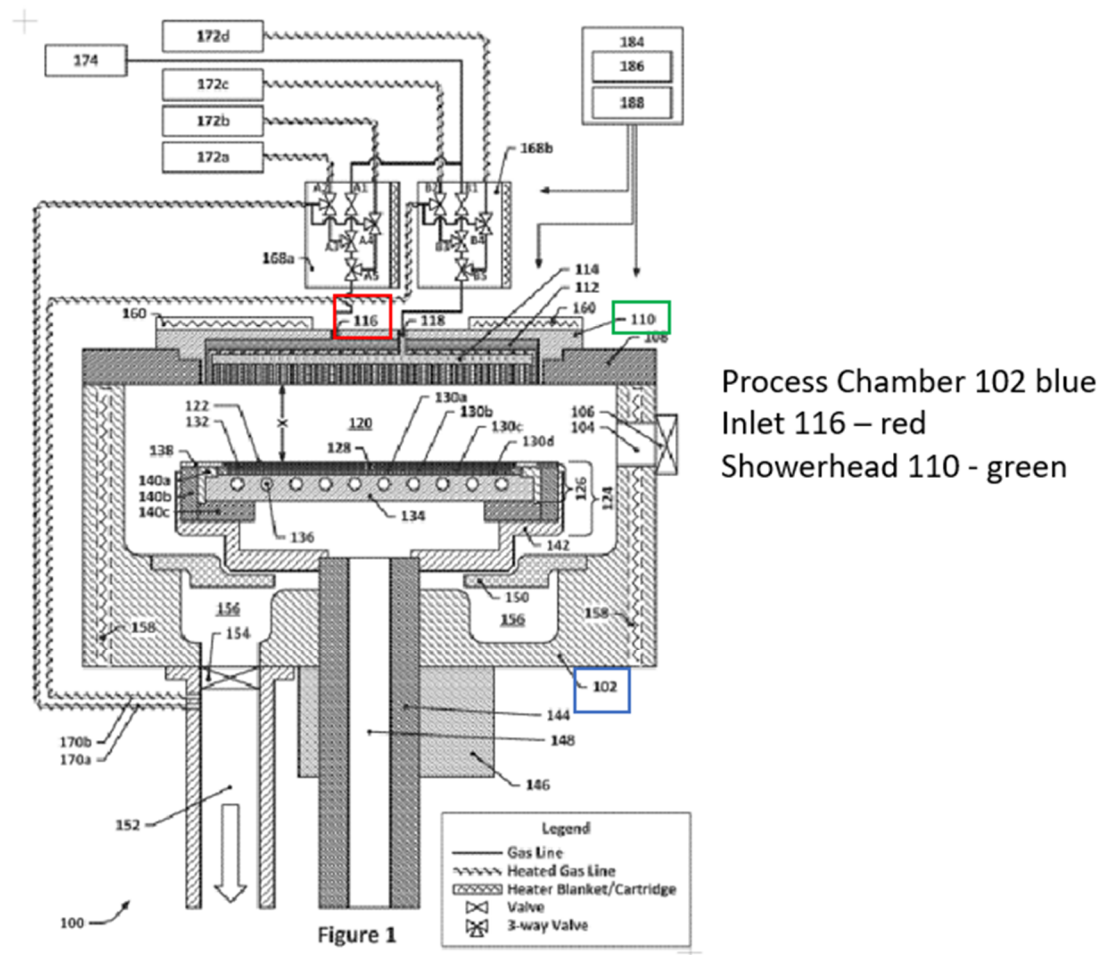
Claim 12 depends on claim 1 and recites “the structure configured to deliver flow comprises one or more [VIS].”¹⁰

As discussed supra at Section VII.B., the VIS limitations in this and claims 13-17 are MPF terms whose function is “vapor inputting” and structure is “an inlet for inputting a vapor and equivalents thereof.”

Berney performs the function: “vapor inputting.” Berney discloses valves and showerhead for providing flow of gas. EX1020, ¶53, 47. Berney discloses **a first inlet 116** that provides gas to a reaction space via a **showerhead 110**, as shown as Figure 1 below, and “[t]he showerhead 110 may...have more than two plenums, although two plenums is generally the minimum required to maintain separation between the organometallic precursor and the counter-reactant prior to **release of the organometallic precursor and the counter-reactant into the reaction space 120 of the processing chamber 102.**” *Id.*, ¶47.

Berney also discloses multiple valves that deliver flow of a purge gas: “the first valve manifold 168a...includes multiple valves A1-A5,” and “the valve A1...may be fluidically interposed between the valve A3 and a purge gas source 174.” *Id.*, ¶0063; EX1003, ¶¶151-156.

¹⁰ Petitioner preserves right to argue indefiniteness of claim 12.



EX1020, Figure 1 (annotated).

11. Claim 13

Claim 13 depends on claim 12 and recites “the [VIS] provide for control of the flow.”

Berney’s “**gas flow** from the vaporizers 172 supplying the gas to be used in the dry deposition process **may be initiated and allowed to reach steady state, e.g., by causing the valves A1-A5 ... to be selectively actuated...**” *Id.*, ¶0063. Therefore, Berney teaches the VIS (i.e., “valves A1-A5”) provide for control of the

flow (i.e., “gas flow...may be initiated and allowed to reach steady state”). EX1003, ¶¶157-159.

12. Claim 14

Claim 14 depends from claim 1 and recites “a first [VIS] is configured to deliver a first vapor flow and a second [VIS] is configured to deliver a second vapor flow at the same time.”

Berney discloses a first structure that performs the function of “deliver[ing] a first vapor flow,” and a second structure that performs the function of “deliver[ing] a second vapor flow at the same time.” Berney discloses that **“the controller may be configured to cause an organometallic precursor and a corresponding counter-reactant to be simultaneously dispensed from their respective vaporizers 172 and through respective plenums of the showerhead 110 into the reaction space 120 for a given duration of time”** as described in block 308 of Figure 3 below. EX1020, ¶0064. Berney also discloses “a controller having one or more processors...to a) cause...**a first valve...to be actuated to cause a vapor-phase of a first organometallic precursor to be flowed...into the reaction space...and b) cause...a second valve...to be actuated to cause a vapor-phase of a first counter reactant to be flowed...into the reaction space...**” *Id.*, 32:1-23. Berney discloses “perform[ing] (a) and (b) simultaneously.” *Id.*, 34:12.

From this, a POSA would understand Berney to disclose a first VIS (i.e., “a first valve”) is configured to deliver a first vapor flow (i.e., “a vapor-phase of a first organometallic precursor”) and a second VIS (i.e., “a second valve”) is configured to deliver a second vapor flow (i.e., “a vapor-phase of a first counter reactant”), wherein the first vapor flow and the second vapor flow are at the same time (i.e., “cause an organometallic precursor and a corresponding counter-reactant to be simultaneously dispensed”; “perform[ing] (a) and (b) simultaneously”). EX1003, ¶¶160-163.

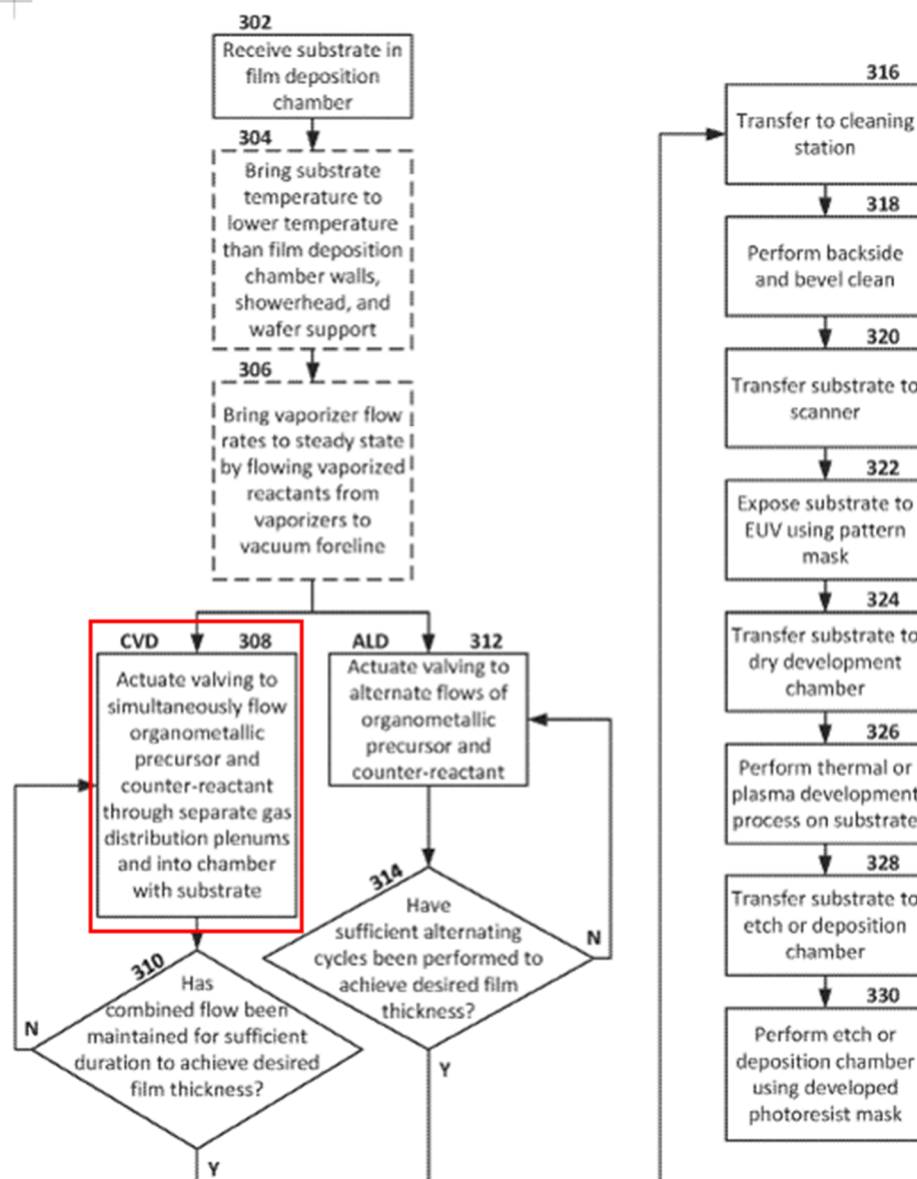


Figure 3

EX1020, Figure 3 (annotated).

13. Claim 15

Claim 15 depends on claim 1 and recites “a first [VIS] is configured to deliver a first vapor flow and a second [VIS] is configured to deliver a second vapor flow, wherein the first vapor flow and the second vapor flow are **sequential**.”

Berney’s “**valving of the apparatus 100 may be actuated to *alternate flows of the organometallic precursor and the corresponding counter-reactant*, e.g, **first flow the organometallic precursor** through the showerhead 110 and **then stop the flow of the organometallic precursor and start the flow of the counter-reactant** through the showerhead 110” as described in Figure 3’s block 312 (below). *Id.*, ¶0065. Berney also discloses “a controller having one or more processors...to a) cause...**a first valve...to be actuated to cause a vapor-phase of a first organometallic precursor to be flowed...**into the reaction space...and b) cause...**a second valve...to be actuated to cause a vapor-phase of a first counter reactant to be flowed...**into the reaction space...” *Id.*, 32:10-23. Berney discloses “perform[ing] (a) and (b) in an alternating fashion...” *Id.*, 34:14-17. Figure 3 specifically identifies “[a]ctuate valving to **alternate flows** of organometallic precursor and counter-reactant.” *Id.*, Figure 3.**

From this, a POSA would understand Berney to disclose a first VIS (i.e., “first valve”) is configured to deliver a first vapor flow (i.e., “vapor-phase of a first organometallic precursor”) and a second VIS (i.e., “second valve”) is configured to deliver a second vapor flow (i.e., “vapor-phase of a first counter reactant”), wherein

the first vapor flow and the second vapor flow are sequential (i.e., “stop the flow of the organometallic precursor and start the flow of the counter-reactant through the showerhead 110”; “alternate flows of organometallic precursor and counter-reactant”). EX1003, ¶¶164-167.

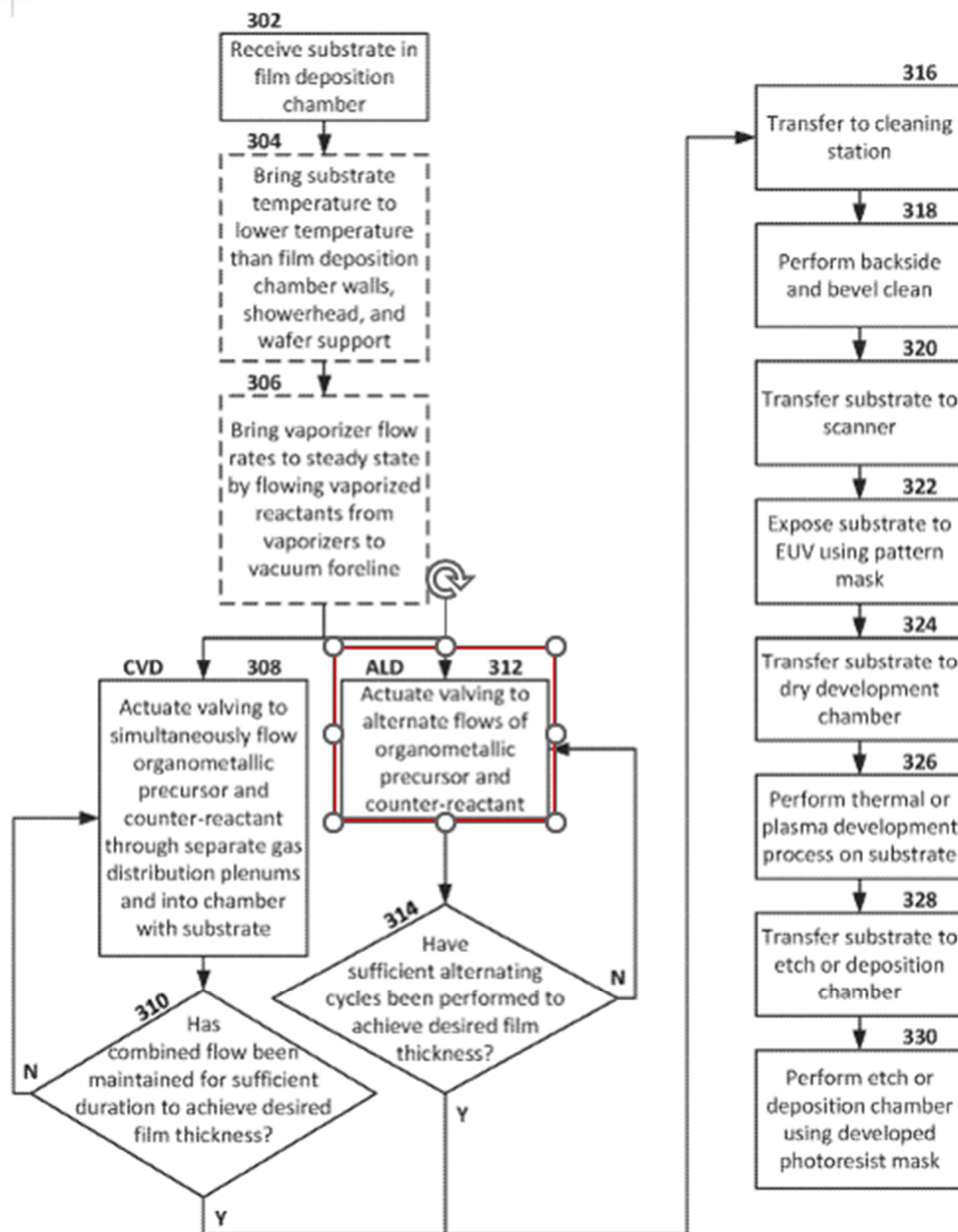


Figure 3

EX1020 at Figure 3 (annotated).

14. Claim 16

Claim 16 depends on claim 1 and recites “a first [VIS] is configured to deliver a first vapor flow and a second [VIS] is configured to deliver a second vapor flow, wherein the first vapor flow, the second vapor flow, and a third vapor flow are **sequential.**”

In Berney, “the **valving of the apparatus 100** may be actuated to **alternate flows of the organometallic precursor and the corresponding counter-reactant, e.g, first flow the organometallic precursor** through the showerhead 110 and **then stop the flow of the organometallic precursor and start the flow of the counter-reactant** through the showerhead 110” as described in block 312 of Figure 3 below. EX1020, ¶0065. A POSA would understand that the valving represents a first VIS and a second VIS, and the first vapor flow (i.e., “vapor-phase of a first organometallic precursor”) and the second vapor flow (i.e., “vapor-phase of a first counter-reactant”) are sequential and form a sub-layer on the substrate. EX1003, ¶170.

Berney also discloses “[a] **second organometallic precursor** (different from the first) **may then be flowed across the substrate to create a second sub-layer.**” EX1020, ¶0066. A POSA would understand that first sub-layer would include the layer formed from the sequential flow of the first vapor flow (i.e., “vapor-phase of a first organometallic precursor”) and the second vapor flow (i.e., “vapor-phase of a

first counter-reactant”), and therefore the third vapor flow (i.e., “vapor-phase of a second organometallic precursor”) is also sequential. EX1003, ¶170.

Additionally, Berney’s apparatus for providing photoresist films includes “a controller...to a) cause...**a first valve...to be actuated to cause a vapor-phase of a first organometallic precursor to be flowed**...into the reaction space...and b) cause...**a second valve...to be actuated to cause a vapor-phase of a first counter reactant to be flowed**...into the reaction space...” EX1020, 32:1-23. The apparatus also is capable of “controlling the one or more processors to: c) cause...**a third valve...to be actuated to cause a vapor-phase of a second organometallic precursor to be flowed**...into the reaction space...” *Id.*, 34:19-24. A POSA would understand that the first and second valves represent the first and second VIS, respectively. EX1003, ¶171.

Thus, a POSA would understand that Berney’s first VIS (i.e. “first valve”) is configured to deliver a first vapor flow (i.e. “vapor-phase of a first organometallic precursor”) and a second VIS (i.e., “second valve”) is configured to deliver a second vapor flow (i.e., “vapor-phase of a first counter reactant”), wherein the first vapor flow (i.e., “vapor-phase of a first organometallic precursor”), the second vapor flow (i.e., “vapor-phase of a first counter reactant”), and a third vapor flow (i.e., “vapor-phase of a second organometallic precursor”) are sequential (i.e., “stop the flow of the organometallic precursor and start the flow of the counter-reactant through the

showerhead 110”; “alternate flows of organometallic precursor and counter-reactant”). *Id.*, ¶173.

A POSA would also understand that there are a limited number of obvious choices of continuous or alternating delivery methods, which would have been obvious-to-try based on the disclosure of Berney. *Id.*, ¶168-174.

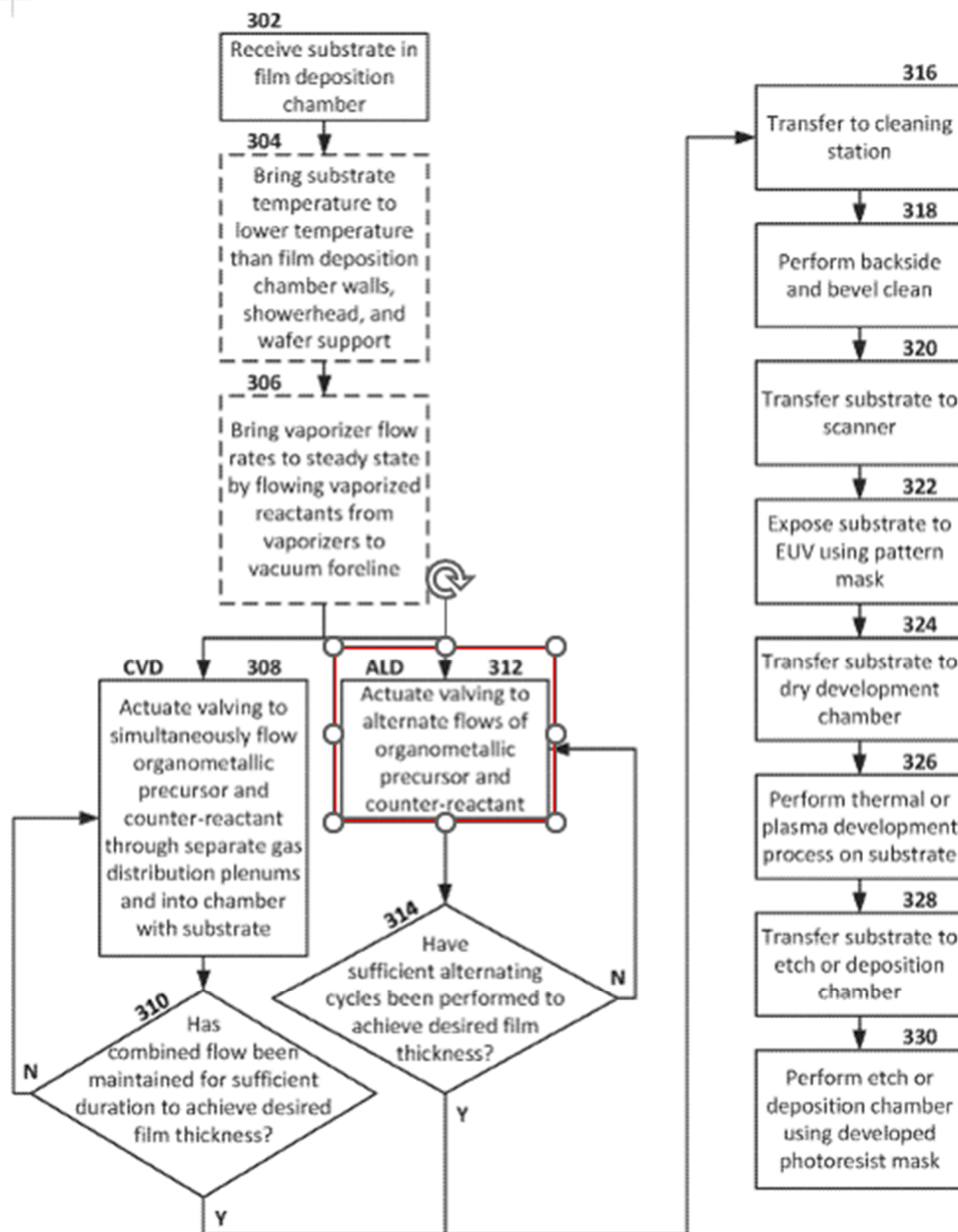


Figure 3

EX1020 at Figure 3 (annotated).

15. Claim 17

Claim 17 depends on claim 1 and recites “a first [VIS] is configured to deliver a first vapor flow and a second [VIS] is configured to deliver a second vapor flow, wherein the first vapor flow and the second vapor flow are **at the same time** and a **third vapor flow is sequential.**”

Berney’s “controller may be configured to cause **an organometallic precursor** and a **corresponding counter-reactant to be simultaneously dispensed from their respective vaporizers 172** and through respective plenums of the showerhead 110 **into the reaction space 120** for a given duration of time” as described in block 308 of Figure 3 below. EX1020, ¶0064. A POSA would understand that the first vapor flow (i.e., flow of the organometallic precursor from its respective vaporizer) and the second vapor flow (i.e., flow of the counter-reactant from its respective vaporizer) are at the same time and form a sub-layer on the substrate. EX1003, ¶177.

Berney also discloses “[a] **second organometallic precursor** (different from the first) **may then be flowed across the substrate to create a second sub-layer.**” EX1020, ¶0066.

Additionally, Berney’s apparatus for providing photoresist films includes “a controller having one or more processors...to a) cause...**a first valve...to be actuated to cause a vapor-phase of a first organometallic precursor to be flowed...into the reaction space...and b) cause...a second valve...to be actuated**

to cause a vapor-phase of a first counter reactant to be flowed...into the reaction space...” *Id.*, 32:1-23. The apparatus also is capable of “controlling the one or more processors to: c) cause...**a third valve...to be actuated to cause a vapor-phase of a second organometallic precursor to be flowed...**into the reaction space...” *Id.*, 34:19-24. A POSA would understand that the first valve and the second valve represent the first and second VIS, respectively. EX1003, ¶179.

The apparatus further includes a “first vaporizer,” “second vaporizer,” and “third vaporizer, and located within each vaporizer is a quantity of “the first organometallic precursor,” “the first counter-reactant,” and “the second organometallic precursor,” respectively. EX1020, 35:7-9. The apparatus can be used to “**perform (a) and (b) to form a first sublayer on a substrate...and f) perform...(c)...to form a second sub-layer on top of the first sub-layer.**” *Id.*, 35:15-18. Berney discloses “perform[ing] (a) and (b) simultaneously.” *Id.*, 34:12. A POSA would understand that first sub-layer would include the layer formed from the flow of the first vapor flow (i.e., “vapor-phase of a first organometallic precursor”) and the second vapor flow (i.e., “vapor-phase of a first counter reactant”) at the same time, and the second sub-layer would be formed after formation of the first sub-layer, and therefore the third vapor flow (i.e., “vapor-phase of a second organometallic precursor”) is sequential. EX1003, ¶180.

Thus, a POSA would understand that Berney discloses a first VIS (i.e., “first valve”) is configured to deliver a first vapor flow (i.e., “vapor-phase of a first organometallic precursor”) and a second VIS (i.e., “second valve”) is configured to deliver a second vapor flow (i.e., “vapor-phase of a first counter reactant”), wherein the first vapor flow (i.e., “vapor-phase of a first organometallic precursor”) and the second vapor flow (i.e., “vapor-phase of a first counter reactant”) are at the same time (i.e., “cause an organometallic precursor and a corresponding counter-reactant to be simultaneously dispensed”; “perform[ing] (a) and (b) simultaneously”), and a third vapor flow (i.e., “vapor-phase of a second organometallic precursor”) is sequential (i.e., “stop the flow of the organometallic precursor and start the flow of the counter-reactant through the showerhead 110”; “alternate flows of organometallic precursor and counter-reactant”). EX1003, ¶¶175-182. A POSA would also understand that there are a limited number of obvious choices of continuous or alternating deliver methods, which would have been obvious-to-try. *Id.*, ¶182.

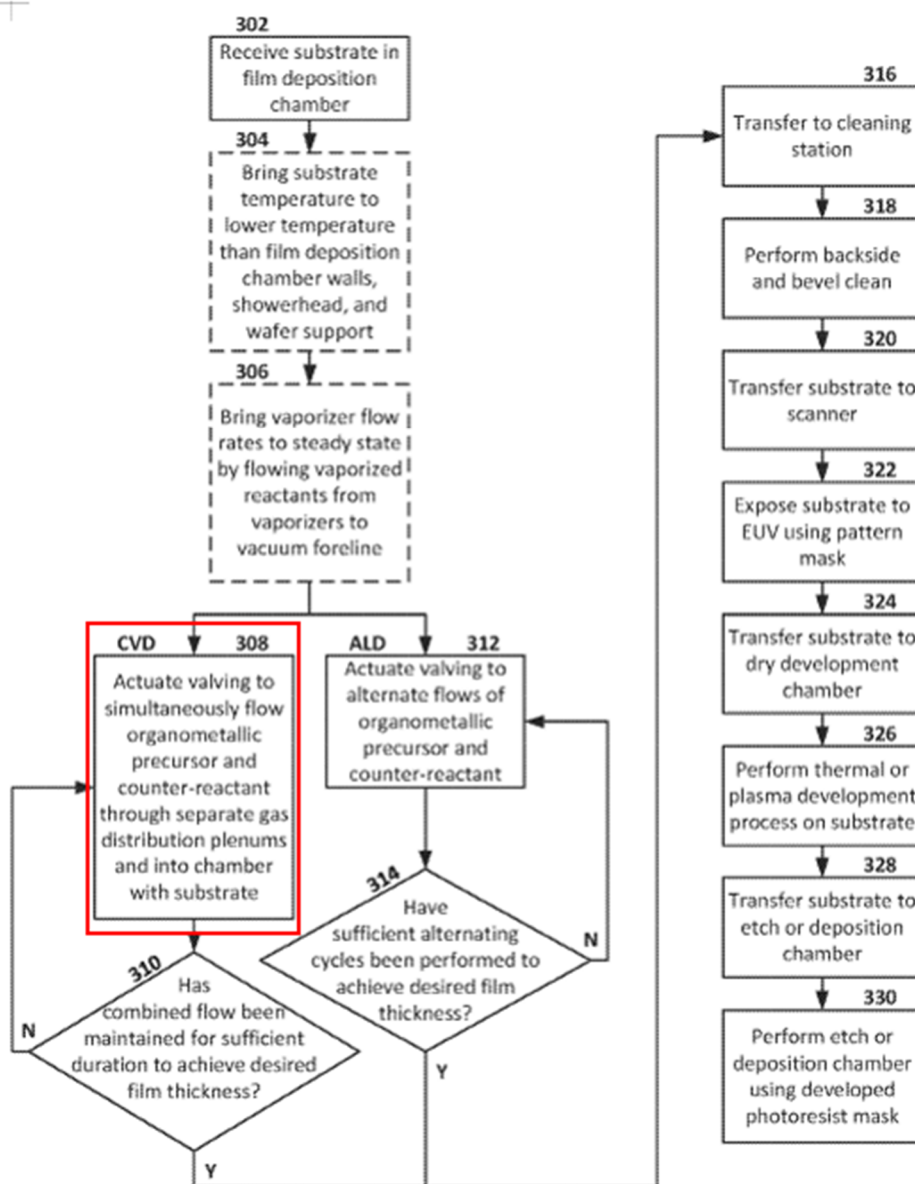


Figure 3

EX1020, Figure 3 (annotated).

16. Claim 18

Claim 18 depends on claim 1 and recites “the interior has a temperature from about 45° C. to about 200° C.” Berney discloses “maintain[ing] the **temperature of**

the [chamber's] interior wall surfaces...to between 80 °C and 120 °C.” *Id.*, ¶0062; EX1003, ¶183.

17. Claim 19

Claim 19 depends on claim 1 and recites “X is alkylamido or dialkylamido.” Berney discloses that L can be “a moiety that is an amine (such as a **dialkylamino or monoalkylamino group**).” EX1020, ¶0023. A POSA would understand that Berney’s ligand L is analogous to X, and that Berney’s monoalkylamino and dialkylamino groups are alkylamino and dialkylamido groups, respectively. Berney also discloses tin precursors with dialkylamido groups of X: “where M is tin, such precursors include...i-propyltris(**dimethylamino**¹¹[OBJ]...)” *Id.*, ¶0024. A POSA would understand that dimethylamino is dialkylamido as defined in claim 1 (—NR¹R², where R¹ and R² are each methyl (hydrocarbon group with 1 carbon atom). EX1003, ¶184.

18. Claim 20

Claim 20 depends on claim 1 and recites “X is alkoxo and aryloxo.” Berney discloses that ligand L can be “an **alkoxy group**.” EX1020 ¶0023. A POSA would understand that ligand L of Berney is analogous to X, and the alkoxy groups of

¹¹ The ’048 patent also teaches i-propyltris(dimethylamino)tin ((iPrSn(NMe₂)₃) as an organometallic precursor. EX1001, 27:10-23.

Berney are alkoxo groups. EX1003, ¶185. Berney also discloses specific examples of tin precursors with alkoxo groups of X: “where M is tin, such precursors include...alkyl(tris)(**t-butoxy**) tin compounds such as t-butyl tris(**t-butoxy**) tin¹².” EX1020, ¶0024. A POSA would understand that t-butoxy is alkoxo as defined in claim 1 (—OR, where R is t-butyl (hydrocarbon group with 4 carbon atoms). EX1003, ¶185.

G. Ground 3: Claims 6 and 7 Are Obvious Over Berney in view of Molloy

1. Claim 6

Berney+Molloy discloses claim 6, which depends on claim 1 and recites “further comprising a flow comprising a third precursor vapor comprising a composition represented by the formula ML_v , where v is $2 \leq v \leq 6$ and L is an oxidizable ligand or a ligand having a hydrolysable M-L bond or a combination thereof, and M is a metal selected from groups 2-16 of the periodic table.”

Berney+Molloy discloses each limitation of claim 1 for the reasons discussed in Ground 2, incorporated here.

¹² The '048 patent also teaches $(CH_3)_3CSn(O^tBu)_3$ (t-butyl tris(t-butoxy) tin) as a precursor compound for use of vapor deposition. 1001 at 18:42.

Berney discloses that “**more than one organometallic precursor** is included in the vapor stream.” EX1020, ¶0017. And “**apparatus 100...is configured to provide multiple organometallic precursors.** *Id.*, ¶0017. From this, a POSA would understand Berney to disclose at least a third precursor vapor. EX1003, ¶188. Berney also discloses applying a “second organometallic precursor (different from the first)” on the substrate. EX1020, ¶0066. Although Berney does not disclose a composition represented by the formula ML_v , a POSA would have known that such compounds were used as precursors in vapor deposition techniques and would have expected that such compositions could successfully be included in a third precursor vapor. EX1003, ¶189.

Molloy discloses inorganic tin compounds for CVD purposes, including $SnMe_4$ a “precursor of choice” in dual-source CVD processes that provide films with desirable properties produced with high deposition rates (“polycrystalline with a refractive index of 2.00–2.10, have visible-light transmission of 84% and resistivity of $0.6 \Omega cm$ ” (citations omitted)) and deposition temperatures as low as $30^\circ C$. EX1009, 549-550.

A POSA would further understand that $SnMe_4$ is a composition represented by the formula ML_v , where M is tin (Sn; group 14 of the periodic table), v is 4, and L is methyl (Me), which is a ligand having a hydrolysable M-L bond.

A POSA would appreciate that Berney and Molloy are analogous art, and would have been motivated to combine them because Berney discloses beneficial properties with using a second organometallic precursor, and Molloy teaches organometallic (e.g., organotin) precursors. A POSA would have been motivated to select SnMe_4 (i.e., a compound of formula ML_v) for inclusion in the third vapor precursor in order to obtain a film with the desirable properties described by Molloy. Finally, a POSA would have had a reasonable expectation of success that Molloy's precursors could form a film using the apparatus of Berney since Molloy teaches that SnMe_4 is a precursor for vapor deposition methods. EX1003, ¶192.

2. Claim 7

Berney+Molloy discloses claim 7, which depends on claim 6 and recites that “the third precursor vapor comprises SnL_4 .” Berney discloses that “**more than one organometallic precursor** is included in the vapor stream.” EX1020, ¶0017. Also “**apparatus 100...is configured to provide multiple organometallic precursors.**” EX1020, ¶0017. From this, a POSA would understand Berney to disclose at least a third precursor vapor. EX1003, ¶193. Berney also discloses applying a “second organometallic precursor (different from the first)” on the substrate. EX1020 ¶0066. Berney discloses that using a second organometallic precursor can provide beneficial properties during exposure, such as offsetting potential gradient effects. EX1020, ¶0066. Although Berney does not disclose SnL_4 compounds, a POSA would have

known that such compounds were being used as precursors for vapor deposition and would have had an expectation that the compositions of formula ML_v could successfully be included in a third precursor vapor. *Id.*; EX1003, ¶194.

Molloy discloses organotin compounds for CVD purposes, including $SnMe_4$ a “precursor of choice” in dual-source CVD processes that provide films with desirable properties produced with high deposition rates (“polycrystalline with a refractive index of 2.00–2.10, have visible-light transmission of 84% and resistivity of $0.6 \Omega cm$ ” (citations omitted)) and deposition temperatures as low as $30^\circ C$. EX1009, 549-550.

A POSA would further understand that $SnMe_4$ is a composition represented by the formula SnL_4 , where M is tin (Sn; group 14 of the periodic table) and L is methyl (Me), which is a ligand having a hydrolysable M-L bond. EX1003, ¶196.

A POSA would appreciate that Berney and Molloy are analogous art, and would have been motivated to combine them because Berney discloses the benefits of using a second organometallic precursor, and Molloy teaches organometallic (e.g. organotin) precursors. A POSA would have been motivated to select $SnMe_4$ (i.e. a compound of formula SnL_4) for inclusion in the third vapor precursor in order to obtain a film with the desirable properties described by Molloy. Finally, a POSA would have had a reasonable expectation of success that Molloy’s precursors could

form a film using Berney's apparatus since Molloy teaches that SnMe_4 is a precursor for vapor deposition methods. EX1003, ¶197.

VIII. DISCRETIONARY DENIAL IS INAPPROPRIATE

A. 35 U.S.C. § 325(d)

Section 325(d) denial would be improper because this Petition presents new prior art, grounds, and arguments not yet presented to the Office. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 8 (Feb. 13, 2020). None of the art at issue here was cited or relied upon during prosecution.

B. 35 U.S.C. § 314(a)

The Board should reject any argument for denial under 35 U.S.C. § 314(a), as the *Fintiv* factors favor institution

Factor 1. This factor is neutral because “there is no evidence as to whether there will be a stay in the parallel case.” *Amazon v. Zentian*, IPR2023-01195, Paper 10 at 9 (Jan. 10, 2024).

Factor 2. Factor 2 is neutral. The scheduled trial date is more than a year away, much can change during that time, and filing a *Sotera* stipulation will avoid

duplicative arguments in district court.¹³ EX2021. If trial is delayed for any reason, this factor would further weigh in favor of institution. *Dish Network v. Broadband iTV*, IPR2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021) (“We cannot ignore the fact that the currently scheduled trial date is more than nine months away and much can change during this time.”).

Factor 3. Although the district court held a *Markman* hearing on November 6, 2024, it has not yet construed any terms of the ’048 Patent, nor analyzed any prior art-based invalidity issues. Fact discovery will not close until February 26, 2025, and trial will not begin until at least December 15, 2025. EX1021, 4, 18.

Factor 4. This factor favors institution. This Petition challenges all claims of the ’048 Patent, and thus is more extensive than the invalidity challenges that will be raised in district court. Also, filing a *Sotera* stipulation will avoid any duplicative arguments and conflicting decisions.

Factor 5. This factor favors institution or is neutral. “[T]he parties in the parallel proceeding are not different from the parties [in the IPR].” *Amazon v. Zentian*, IPR2023-01195, Paper 10 at 9 (Jan. 10, 2024).

¹³ Petitioner is considering filing a *Sotera* stipulation; if it decides to file one, it will do so well in advance of the institution decision.

Factor 6. This Petition presents compelling merits, with no grounds previously considered by the Office or courts. *Cf. Comcast Cable Commn's, LLC v. Rovi Guides, Inc.*, IPR2019-00231, Paper 14 at 11 (PTAB May 20, 2019). ven if Factors 1-5 favored denial (they do not), the Board should not discretionarily deny institution given the compelling merits presented here.

IX. CONCLUSION

Trial should be instituted, and the Challenged Claims cancelled as unpatentable.

Dated: December 13, 2024

Respectfully Submitted,

/ Dion M. Bregman /
Dion M. Bregman (Reg. No. 45,645)

LISTING OF CHALLENGED CLAIMS

Claim No.	Claim Language
1	A system comprising: a deposition chamber having an interior isolated from the ambient atmosphere; a substrate within the interior of the deposition chamber configured to receive a deposition on a surface of the substrate, wherein the substrate is maintained at a temperature of less than 200° C.; an inlet into the deposition chamber; structure configured to deliver flow from a supply of an inert gas; a supply of an organotin composition comprising a compound described by the formula $R\text{Sn}X_3$, where R is an organic ligand with 1-31 carbon atoms and is bound to Sn with a metal-carbon bond and wherein X is selected from the group consisting of alkylamido or dialkylamido ($-\text{NR}^1\text{R}^2$, where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms or hydrogen), siloxo ($-\text{OSiR}^1\text{R}^2\text{R}^3$, where R^1, R^2, R^3 are independently hydrocarbon groups with 1-10 carbon atoms), silylamido ($-\text{N}(\text{SiR}^1)_3(\text{R}^2)$, where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms), disilylamido ($-\text{N}(\text{SiR}^1)_3(\text{SiR}^2)_3$ where R^1 and R^2 are independently hydrocarbon groups with 1-10 carbon atoms), alkoxo and aryloxo ($-\text{OR}$, where R is an alkyl or aryl group with 1-10 carbon atoms), azido ($-\text{N}_3$), alkynido ($-\text{C}\equiv\text{CR}$, where R is a hydrocarbon group with 1-9 carbon atoms), amidato ($-\text{NR}^1(\text{COR}^2)$ where R^1 and R^2 are independently hydrocarbon groups with 1-7 carbon atoms or hydrogen), amidinato ($-\text{NR}^1\text{C}(\text{NR}^2)\text{R}^3$ where R^1 and R^2 are independently hydrocarbon groups with 1-8 carbon atoms or hydrogen), imido ($-\text{N}(\text{COR}^1)(\text{COR}^2)$, where R^1 and R^2 are independently hydrocarbon groups with 1-8 carbon atoms or hydrogen), or fluorinated analogues thereof, or combinations thereof;

	structure configured to deliver flow of a first precursor vapor from the supply of the organotin compound with the inert gas as a carrier gas to the inlet to provide for formation of an organotin layer on the substrate surface within the deposition chamber; and structure to deliver a second precursor vapor comprising water, hydrogen peroxide or a combination thereof capable of reacting with the composition in the first precursor vapor under conditions in the deposition chamber to form a composition with non-volatile components and a volatile component comprising hydrolysis reaction product with X, wherein the substrate is configured with a surface to receive the non-volatile components of the composition.
2	The system of claim 1 wherein the substrate comprises a silicon wafer.
3	The system of claim 1 wherein the inert gas comprises nitrogen or argon.
4	The system of claim 1 wherein the structure configured to deliver flow comprises an aerosol generator configured to generate an aerosol from a liquid comprising the organotin compound, a vaporization chamber configured to receive an injection of organotin compound, a flash evaporator configured to evaporate the organotin compound, or a bubbler configured for bubbling an inert carrier gas through a liquid comprising the organotin compound, and wherein the deposition on the surface of the substrate comprises chemical vapor deposition.
5	The system of claim 1 wherein the second precursor vapor comprises water vapor.
6	The system of claim 1 further comprising a flow comprising a third precursor vapor comprising a composition represented by the formula ML_v , where v is $2 \leq v \leq 6$ and L is an oxidizable ligand or a ligand having a hydrolysable M-L bond or a combination thereof, and M is a metal selected from groups 2-16 of the periodic table.
7	The system of claim 6 wherein the third precursor vapor comprises SnL_4 .

8	The system of claim 1 wherein the interior has a pressure from about 0.01 Torr to about 25 Torr.
9	The system of claim 1 wherein the interior has a temperature from about 40° C. to about 175° C.
10	The system of claim 1 comprising a configuration providing for selection of the pressure and/or the temperature in the deposition chamber.
11	The system of claim 1 wherein the flow comprises a vapor.
12	The system of claim 1 wherein the structure configured to deliver flow comprises one or more vapor inputting structures.
13	The system of claim 12 wherein the vapor inputting structures provide for control of the flow.
14	The system of claim 1 wherein a first vapor inputting structure is configured to deliver a first vapor flow and a second vapor inputting structure is configured to deliver a second vapor flow at the same time.
15	The system of claim 1 wherein a first vapor inputting structure is configured to deliver a first vapor flow and a second vapor inputting structure is configured to deliver a second vapor flow, wherein the first vapor flow and the second vapor flow are sequential.
16	The system of claim 1 wherein a first vapor inputting structure is configured to deliver a first vapor flow and a second vapor inputting structure is configured to deliver a second vapor flow, wherein the first vapor flow, the second vapor flow, and a third vapor flow are sequential.
17	The system of claim 1 wherein a first vapor inputting structure is configured to deliver a first vapor flow and a second vapor inputting structure is configured to deliver a second vapor flow, wherein the first vapor flow and the second vapor flow are at the same time and a third vapor flow is sequential.

18	The system of claim 1 wherein the interior has a temperature from about 45° C. to about 200° C.
19	The system of claim 1 wherein X is alkylamido or dialkylamido.
20	The system of claim 1 wherein X is alkoxo and aryloxo.

CERTIFICATION OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Petition includes 13,965 words as counted by Microsoft Word and is therefore in compliance with the 14,000 word limit established by 37 C.F.R.

42.24(a)(1)(i). Accordingly, pursuant to 37 C.F.R. 42.24(d), lead counsel for the Petitioner hereby certifies that this Petition complies with the type-volume limits established for a petition requesting IPR.

Dated: December 13, 2024

Respectfully Submitted,

/ Dion M. Bregman /
Dion M. Bregman (Reg. No. 45,645)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4) and 42.105, lead counsel for Petitioner hereby certifies that on December 12, 2024, a copy of this Petition and all supporting exhibits were sent via Priority Mail Express to the correspondence address of record for the '048 patent:

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A courtesy copy of this Petition and all supporting documents were also served via email on December 12, 2024 on Patent Owner's counsel of record in the district court litigation against Lam Research Corp.:

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