

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner,

v.

DANIEL L. FLAMM,
Patent Owner.

Case IPR2016-01512
Patent RE40,264 E

Before MICHAEL R. ZECHER, CHRISTOPHER L. CRUMBLEY, and
JO-ANNE M. KOKOSKI, *Administrative Patent Judges*.

ZECHER, *Administrative Patent Judge*.

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

I. INTRODUCTION

Petitioner, Samsung Electronics Co., Ltd. (“Samsung”), filed a Petition requesting an *inter partes* review of claims 27, 31, 32, 34, 37, 40, 41, 44, 47, 48, and 50 of U.S. Patent No. RE40,264 E (Ex. 1001, “the ’264 patent”). Paper 1 (“Pet.”). Patent Owner, Daniel L. Flamm (“Flamm”), filed a Preliminary Response. Paper 5. Taking into account the arguments presented in Flamm’s Preliminary Response, we determined that the information presented in the Petition established that there was a reasonable likelihood that Samsung would prevail in challenging claims 27, 31, 32, 34, 37, 40, 41, 44, 47, 48, and 50 of the ’264 patent as unpatentable under 35 U.S.C. § 103(a). Pursuant to 35 U.S.C. § 314, we instituted this *inter partes* review on February 14, 2017, as to all of the challenged claims. Paper 6 (“Dec. on Inst.”).

During the course of trial, Flamm filed a Patent Owner Response (Paper 9, “PO Resp.”), and Samsung filed a Reply to the Patent Owner Response (Paper 12, “Pet. Reply”). An oral hearing was held on October 12, 2017, and a transcript of the hearing is included in the record. Paper 21 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 27, 31, 32, 34, 37, 40, 41, 44, 47, 48, and 50 of the ’264 patent. For the reasons discussed below, we hold that Samsung has demonstrated by a preponderance of the evidence that these claims are unpatentable under § 103(a).

A. Related Matters

The parties represent that the '264 patent is at issue in a district court case captioned *Flamm v. Samsung Electronics Co.*, No. 1:15-cv-613-LY (W.D. Tex.), which was transferred to the U.S. District Court for the Northern District of California on April 27, 2016, and then re-captioned No. 5:16-cv-2252-BLF (N.D. Cal.). Pet. 1; Paper 4, 2. Samsung further represents that the '264 patent was at issue in a number of *inter partes* review proceedings filed by a different petitioner; however, the Board only granted institution in two proceedings, each of which has since terminated following settlement. See Pet. 1 n.1.

In addition to this Petition, Samsung filed another petition challenging the patentability of claims 13–26, 64, and 65 of the '264 patent in Case IPR2016-01510. Pet. 1. We denied institution of an *inter partes* review in that proceeding because the information presented in the Petition did not establish that there was a reasonable likelihood that Samsung would prevail in challenging any of claims 13–26, 64, and 65 of the '264 patent as unpatentable under § 103(a). *Samsung Elecs. Co. v. Flamm*, Case IPR2016-01510 (PTAB Feb. 14, 2017) (Paper 6); see also *Samsung Elecs. Co. v. Flamm*, Case IPR2016-01510 (PTAB Apr. 14, 2017) (Paper 8) (denying Samsung's Request for Rehearing). Additional petitions challenging the patentability of certain subsets of claims of the '264 patent were filed by other petitioners, some of which were instituted and remain pending before the Board. See Cases IPR2017-00279, IPR2017-00280, IPR2017-00281, IPR2017-00282, IPR2017-01072.

B. The '264 Patent

The '264 patent, titled "Multi-Temperature Processing," reissued April 29, 2008, from U.S. Patent Application No. 10/439,245 ("the '245 application"), filed on May 14, 2003. Ex. 1001, at [54], [45], [21], [22]. The '264 patent is a reissue of U.S. Patent No. 6,231,776 B1 ("the '776 patent"), which issued on May 15, 2001, from U.S. Patent Application No. 09/151,163 ("the '163 application"), filed on September 10, 1998. *Id.* at [64]. The '264 patent is directed to a method "for etching a substrate in the manufacture of a device," where the method "provide[s] different processing temperatures during an etching process or the like." *Id.* at [57]. The apparatus used in the method is shown in Figure 1, reproduced below.

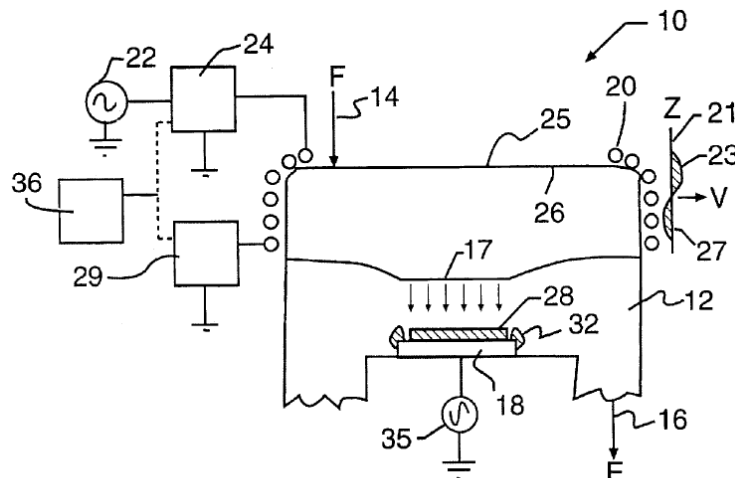
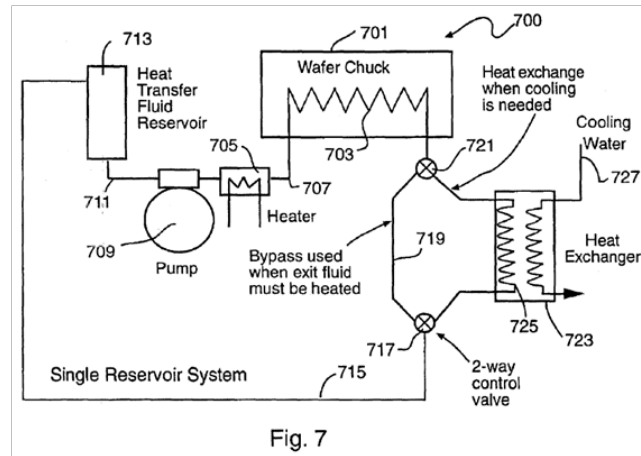
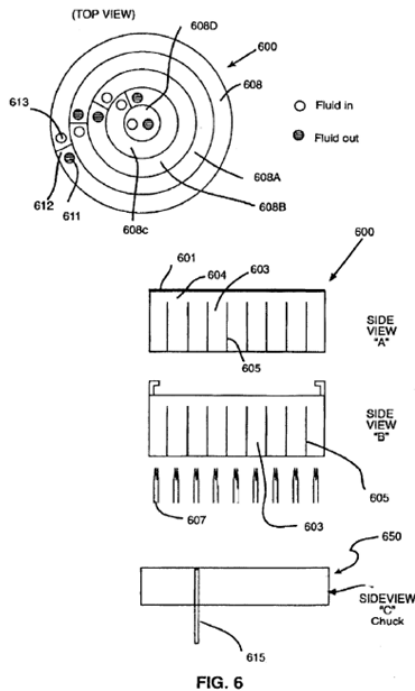


FIG. 1

Figure 1 depicts a substrate (product 28, such as a wafer to be etched) on a substrate holder (product support chuck or pedestal 18) in a chamber (chamber 12 of plasma etch apparatus 10). *Id.* at 3:24–25, 3:32–33, 3:40–41.

Figures 6 and 7, reproduced below, depict a temperature-controlled substrate holder and temperature control system.



Figures 6 and 7 depict temperature-controlled fluid flowing through substrate holder (600, 701), guided by baffles 605, where “[t]he fluid [is] used to heat or cool the upper surface of the substrate holder.” Ex. 1001, 14:28–63, 16:5–67. Figure 6 also depicts heating elements 607 underneath the substrate holder, where “[t]he heating elements can selectively heat one or more zones in a desirable manner.” *Id.* at 15:10–26. Referring to Figure 7, the operation of the temperature control system is described as follows:

The desired fluid temperature is determined by comparing the desired wafer or wafer chuck set point temperature to a measured wafer or wafer chuck temperature The heat exchanger, fluid flow rate, coolant-side fluid temperature, heater power, chuck, etc. should be designed using conventional means to permit the heater to bring the fluid to a setpoint temperature and bring the temperature of the chuck and wafer to predetermined

temperatures within specified time intervals and within specified uniformity limits.

Id. at 16:36–39, 16:50–67.

An example of a semiconductor substrate to be patterned is shown in Figure 9, reproduced below.

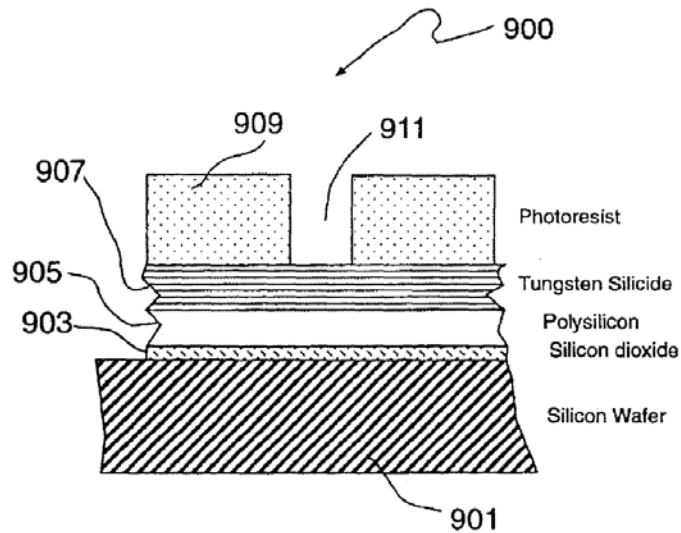


Figure 9 depicts substrate 901 having a stack of layers including oxide layer 903, polysilicon layer 905, tungsten silicide layer 907, and photoresist masking layer 909 with opening 911, from the treatment method shown in Figure 10, reproduced below. Ex. 1001, 17:58–18:57.

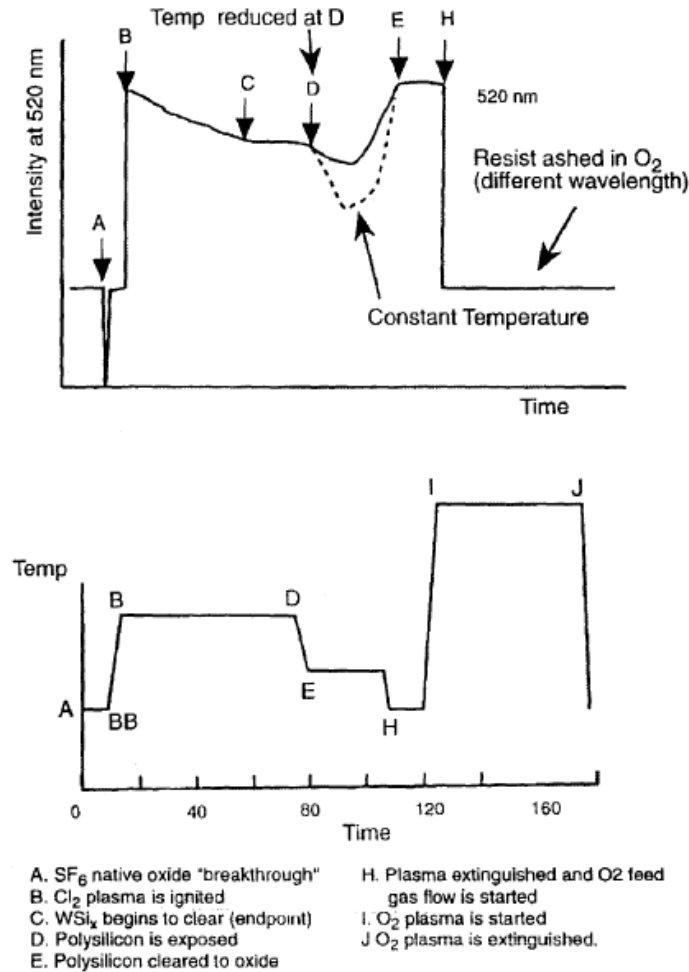


Fig. 10

Figure 10 depicts the tungsten silicide layer being etched between points B and D at a constant temperature; the polysilicon layer being exposed between Points D and E; the polysilicon layer being etched at a constant temperature beyond point E; and the resist being ashed beyond Point I. Ex. 1001, 18:58–19:64. The plasma's optical emission at 530 nanometers is monitored to determine when there is breakthrough to the polysilicon layer (Point D) and a lower etch temperature is required to etch the polysilicon layer (Point E). *Id.* at 19:8–24, 19:45–52.

C. Illustrative Claim

Of the challenged claims, claims 27 and 37 are the only independent claims at issue. Independent claim 27 is directed to a method of etching a substrate in the manufacture of a device, whereas independent claim 37 is directed to a method of processing a substrate during the manufacture of a device. Claims 31, 32, and 34 directly depend from independent claim 27; and claims 40, 41, 44, 47, 48, and 50 directly depend from independent claim 37. Independent claim 27 is illustrative of the challenged claims and is reproduced below:

27. A method of etching a substrate in the manufacture of a device, the method comprising:
heating a substrate holder to a first substrate holder temperature with a heat transfer device, the substrate holder having at least one temperature sensing unit,
placing a substrate having a film thereon on the substrate holder in a chamber;
etching a first portion of the film at a selected first substrate temperature; and
etching a second portion of the film at a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature;
wherein substrate temperature is changed from the selected first substrate temperature to the selected second substrate temperature, using a measured substrate temperature, within a preselected time interval for processing, and at least the first substrate temperature or the second substrate temperature, in single or in combination, is above room temperature.

Ex. 1001, 22:8–28 (*italics omitted*).

D. Prior Art Relied Upon

Samsung relies upon the following prior art references:

Inventor or Applicant¹	Patent or Publication No.	Relevant Dates	Exhibit No.
Kadomura	U.S. Patent No. 6,063,710	issued May 16, 2000, filed Feb. 21, 1997	1006
Matsumura	U.S. Patent No. 5,151,871	issued Sept. 29, 1992, filed June 15, 1990	1007
Narita	U.S. Patent No. 4,913,790	issued Apr. 3 1990, filed Mar. 21, 1989	1008
Wang (“Wang I”)	U.S. Patent No. 5,219,485	issued June 15, 1993, filed Oct. 17, 1991	1009
Wang (“Wang II”)	EP Patent Pub. No. 0272140 A2	published June 22, 1988, filed Dec. 18, 1987	1010

E. Instituted Grounds of Unpatentability

We instituted a trial based on the asserted grounds of unpatentability (“grounds”) set forth in the table below. Dec. on Inst. 32.

References	Basis	Challenged Claims
Kadomura and Matsumura	§ 103(a)	27, 32, 37, and 40
Kadomura, Matsumura, and Narita	§ 103(a)	31 and 50
Kadomura, Matsumura, and Wang I	§ 103(a)	27, 34, 37, 41, and 44
Kadomura, Matsumura, Wang I, and Wang II	§ 103(a)	47 and 48

¹ For clarity and ease of reference, we only list the first named inventor or applicant.

II. ANALYSIS

A. Claim Construction

In the Decision on Institution, we explained the standard of claim construction that applies to this proceeding. Dec. on Inst. 9–10. That is, the term of a patent grant begins on the date on which the patent issues and ends twenty (20) years from the date on which the application for the patent was filed in the United States, “or, if the application contains a specific reference to an earlier filed application or applications under section 120, 121, 365(c), or 386(c), from the date on which the earliest such application was filed.” 35 U.S.C. § 154(a)(2) (2012 & Supp. III 2015). The earliest patent application referenced for the benefit of priority under 35 U.S.C. § 120 for the ’264 patent was filed on December 4, 1995, and the patent has no term extensions. The term of the ’264 patent, therefore, expired no later than December 4, 2015. Neither party contested this conclusion during trial.

Because we conclude that the term of the ’264 patent expired prior to the filing of the Petition, we construe the claims of the ’264 patent under the standard applicable to expired patents. For claims of an expired patent, our claim interpretation is similar to that of a district court. *See In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc)). There is, however, a “heavy presumption” that a claim term carries its ordinary and

customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002).

During the course of trial, the parties did not propose constructions for any claim terms recited in the challenged claims of the '264 patent. Because there is no dispute between the parties regarding claim construction, we need not construe explicitly any claim term of the '264 patent. *See, e.g., Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

B. Earliest Priority Date for the Challenged Claims of the '264 Patent

As we explain above, the '264 patent reissued from the '245 application, filed on May 14, 2003. Ex. 1001, at [21], [22]. The '245 application is a reissue of the '776 patent, which issued May 15, 2001, from the '163 application, which was filed September 10, 1998. *Id.* at [64]. The '163 application is a continuation-in-part of the following two applications: (1) U.S. Provisional Application No. 60/058,650 (“the '650 provisional application”), filed on September 11, 1997; and (2) U.S. Patent Application No. 08/567,224 (“the '224 application”), filed on December 4, 1995. *Id.* at [60], [63], 1:11–15.

Samsung contends that Flamm may only claim the benefit of the filing date of the '650 provisional application (i.e., September 11, 1997) because that is the earliest filed application in the priority chain that includes sufficient written description support for certain limitations recited in the challenged claims. Pet. 8–9. Relying upon the testimony of its Declarant,

Dr. Stanley Shanfield, Samsung explains how the '224 application fails to disclose the following: (1) changing the substrate holder temperature from a first substrate temperature to a second substrate temperature in a preselected time interval, as required by independent claims 27 and 37; and (2) two separate temperature sensors, as required by independent claim 37. *Id.* at 9–10 (citing Ex. 1005, 45–46;² Ex. 1002 ¶¶ 22–24). Consequently, Samsung asserts that, because the '224 application does not provide sufficient written description support for certain limitations required by independent claims 27 and 37, the challenged claims only are entitled to the priority date of the '650 provisional application (i.e., September 11, 1997). *See id.*

Flamm does not dispute that the priority date of the challenged claims of the '264 patent is the September 11, 1997 filing date of the '650 provisional application. Consequently, because all the references that serve as the basis of the grounds instituted in this proceeding were filed before September 11, 1997, they qualify as prior art to the challenged claims of the '264 patent.

*C. Obviousness Based on the Combined Teachings of
Kadomura and Matsumura*

Samsung contends that claims 27, 32, 37, and 40 are unpatentable under § 103(a) over the combination of Kadomura and Matsumura. Pet. 19–47. Samsung explains how this proffered combination purportedly teaches the subject matter of each challenged claim, and asserts that a person of ordinary skill in the art would have had a sufficient reason to combine or

² All references to the page numbers in the '224 application refer to the page numbers inserted by Samsung at the bottom, left-hand corner of each page in Exhibit 1005.

modify the teachings of the references. *Id.* Samsung also relies upon the Declaration of Dr. Shanfield to support its positions. Ex. 1002 ¶¶ 42–83. In its Patent Owner Response, Flamm presents a number of arguments with respect to independent claims 27 and 37. PO Resp. 3–23. Flamm relies upon his own testimony, the Declaration of Daniel L. Flamm, Sc.D., to support his positions. Ex. 2001 ¶¶ 8–24.

We begin our analysis with the principles of law that generally apply to a ground based on obviousness, followed by an assessment of the level of skill in the art, proceeded by brief overviews of Kadomura and Matsumura, and then we address the parties’ contentions with respect to independent claims 27 and 37.

1. Principles of Law

A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze this asserted ground based on obviousness with the principles identified above in mind.

2. *Level of Skill in the Art*

There is evidence in the record before us that enables us to determine the knowledge level of a person of ordinary skill in the art. Samsung's declarant, Dr. Shanfield, testifies that a person of ordinary skill in the art as of September 1997 would be an individual who possesses the following:

- (i) a Bachelor's degree in engineering, physics, chemistry, materials science, or a similar field, and three or four years of work experience in semiconductor manufacturing or related fields[;] or (ii) a Master's degree in engineering, physics, chemistry, materials science, or a similar field[,], and two or three years of work experience of work experience in semiconductor manufacturing or related fields[.]

Ex. 1002 ¶ 18. According to Dr. Shanfield, “[m]ore education can supplement practical experience and vice versa.” *Id.* Conversely, the named inventor of the '264 patent, Dr. Flamm, does not offer an assessment of the level of skill in the art as of September 1997, nor does Dr. Flamm explicitly state his intent to adopt Dr. Shanfield's assessment. *See generally* Ex. 2001.³ Given Dr. Flamm's silence on this matter, we adopt Dr. Shanfield's assessment because it is consistent with the '264 patent and the asserted prior art, and apply it to our obviousness evaluation below.

³ Although Dr. Flamm's failure to assess or explicitly adopt a level of skill in the art as of September 1997 is problematic, we do not disregard his testimony for this reason alone. We do not credit the relevant portions of Dr. Flamm's testimony for the reasons that we discuss in this Final Written Decision. Dr. Flamm's failure to specify the level of skill in the art upon which his testimony is based is an additional factor that weighs against crediting his testimony. *See, e.g., Yorkey v. Diab*, 601 F.3d 1279, 1284 (Fed. Cir. 2010) (holding that the Board has discretion to give more weight to the testimony of one declarant over another “unless no reasonable trier of fact could have done so”).

3. *Kadomura Overview*

Kadomura generally relates to a dry etching method used primarily for the production of semiconductor devices and, in particular, to a dry etching method and apparatus that provides compatibility for anisotropic fabrication and high selectivity. Ex. 1006, 1:6–10. According to Kadomura, one objective of the disclosed dry etching method is to apply an etching treatment that includes a plurality of steps to a specimen within the same processing apparatus, wherein the temperature of the specimen is changed between etching in a first step and etching in a second step. *Id.* at 2:65–3:5. Because the disclosed dry etching method conducts each of the etching treatments in the same processing apparatus, the time for changing the specimen temperature between the steps may be shortened. *Id.* at 4:46–49. Moreover, by conducting the change of specimen temperature within a short period of time, dry etching treatment may be applied without deteriorating the throughput. *Id.* at 4:49–54.

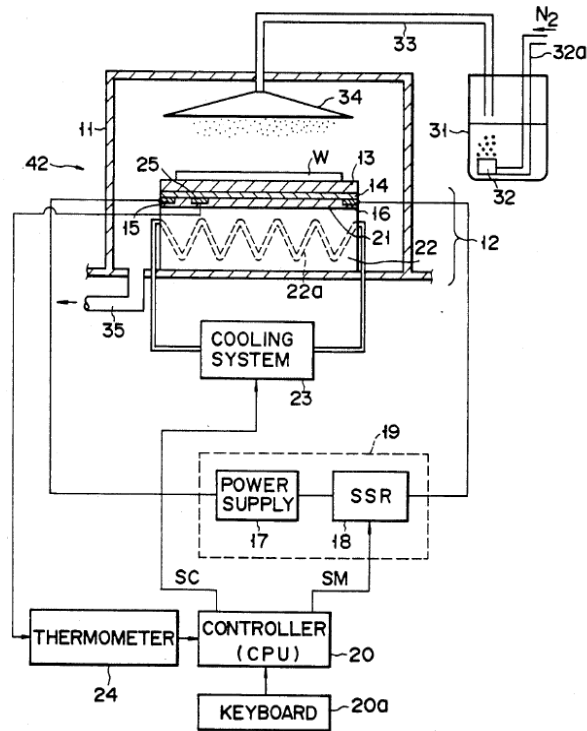
Kadomura discloses three embodiments, each of which applies its dry etching method in a different manner. Ex. 1006, 5:44–56, Figs. 1A–1C, 2A–2C, 3A–3C. In the third embodiment discussed in relation to Figures 3A–3C, Kadomura discloses a method of fabricating polysilicon on an SiO₂ layer having a high step. *Id.* at 9:36–10:27. The main etching in the first step is applied at a low temperature (i.e., -30°Celsius (“C”)), whereas the overetching in the second step is applied at a much higher temperature (i.e., 50°C) within a short period of time of about fifty (50) seconds. *Id.* at 9:54–62, 10:11–27. According to Kadomura, the change in temperature of specimen W is controlled by “the cooling means and the heater disposed to the stage 12.” *Id.* at 10:7–10. The functioning of the cooling means is

controlled by thermometer 18, which is “connected for measuring the temperature of the specimen W.” *Id.* at 11:48–51, 12:36–47.

4. *Matsumura Overview*

Matsumura generally relates to heat-processing a semiconductor wafer and, in particular, to controlling temperatures of the semiconductor wafer when it is heated or cooled. Ex. 1007, 1:8–13. According to Matsumura, one objective of the disclosed invention is to provide a “method of heat-processing semiconductor devices whereby temperatures of the semiconductor devices can be controlled at devices-heating and -cooling times so as to accurately control their thermal history curve.” *Id.* at 2:60–65. Matsumura discloses applying the method to plasma etching when it states that, although “the present invention has been applied to the adhesion and baking processes for semiconductor wafers in the above-described embodiments . . . , it can also be applied to any of the ion implantation, [chemical vapor deposition (‘CVD’)], etching and ashing processes.” *Id.* at 10:3–7.

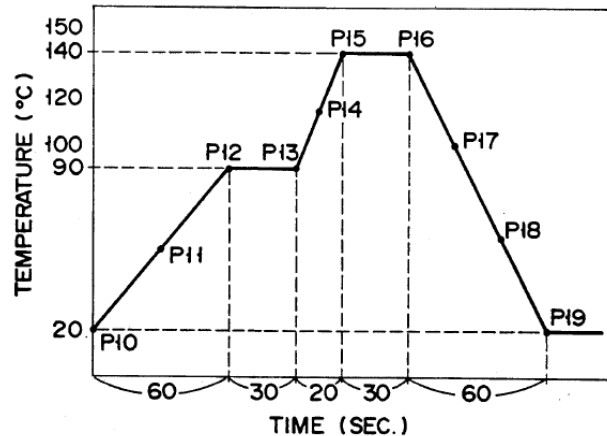
Figure 5A, reproduced below, is a schematic diagram of an embodiment for heat-processing a substrate (wafer W) on a substrate holder (wafer-stage 12, which includes upper plate 13 and conductive thin film 14) in chamber 11.



F I G. 5A

As shown in Figure 5A, adhesion unit 42 along with control system 20 measures the temperature of thin film 14 deposited on the underside of upper plate 13 by using thermal sensor 25. Ex. 1007, 5:13–17, 5:32–47, 5:67–6:4, 6:45–50. Control system 20 sends signals (SM) to power supply circuit 19 to heat semiconductor wafer W on upper plate 13 by conductive thin film 14, and sends signals (SC) to cooling system 23 to control the amount of coolant supplied to jacket 22. *Id.* at 5:52–6:32, Figs. 5A, 5B.

Inside the control system is a “recipe,” such as that shown in Figure 9, reproduced below.



F I G. 9

Figure 9 depicts a recipe with a thermal history curve showing temperature as a function of time. Ex. 1007, 4:42–43. At a given time (or pulse), the control system measures the substrate holder temperature with thermal sensor 25, compares this measurement to that of the recipe shown in Figure 9, and either (1) sends a signal (SM) to power supply circuit 19 to heat the substrate (wafer W) (e.g., heating wafer W from 20°C to 90°C within 60 seconds); (2) sends a signal (SC) to cooling system 23 to cool the substrate by allowing jacket 22 arranged under stage 12 to exchange heat with thin film 14 (e.g., cooling wafer W from 140°C to 20°C within 60 seconds); or (3) sends no signal and waits for the next measurement time (e.g., holding the temperature of wafer W at 140°C for 30 seconds). *Id.* at 5:52–6:32, Figs. 5A, 5B.

5. Claims 27 and 37

Samsung contends that Kadomura’s dry etching apparatus and method teaches all the limitations recited in independent claim 27, except “the substrate holder having at least one temperature sensing unit,” and changing from a first substrate temperature to a second substrate temperature “using a

measured substrate temperature, within a preselected time interval for processing.” Pet. 19–33. With respect to “the substrate holder having at least one temperature sensing unit,” Samsung contends that Kadomura in combination with Matsumura teaches or suggests this limitation. *Id.* at 19. Samsung argues that, although Kadomura discloses that thermometer 18 measures the temperature of specimen W, it does not disclose explicitly whether this thermometer is part of stage 12. *Id.* at 20 (citing Ex. 1006, 11:49–50, Fig. 4). Relying on the testimony of Dr. Shanfield, Samsung argues that Figure 4 of Kadomura would have suggested to one of ordinary skill in the art that thermometer 18 may be part of stage 12. *Id.* at 21 (citing Ex. 1002 ¶ 47).

Alternatively, Samsung argues that Matsumura’s sensor 25 is attached to stage 12 and is used to measure the temperature of thin film 14. Pet. 21 (citing Ex. 1007, 5:68–6:4, 7:20–24). Relying on the testimony of Dr. Shanfield, Samsung asserts that it would have been obvious to one of ordinary skill in the art to modify Kadomura’s stage 12 to include Matsumura’s sensor 25 in order to measure the temperature of the stage. *Id.* at 22–23 (citing Ex. 1002 ¶¶ 43, 49, 50). According to Samsung, this proffered combination would predictably result in better control of the heating and cooling process, as well as allow for measuring the temperature difference between Kadomura’s specimen W and stage 12. *Id.*

With respect to changing from a first substrate temperature to a second substrate temperature “using a measured substrate temperature, within a preselected time interval for processing,” Samsung contends that Kadomura in combination with Matsumura teaches or suggests this limitation. Pet. 26. Samsung argues that Kadomura’s dry etching method

involves a first or main etching step applied at -30°C , and a second or overetching step applied at 50°C that occurs in a short period of time of about 50 seconds. *Id.* (citing Ex. 1006, 9:36–10:27). Samsung further argues that Kadomura’s thermometer 18 reads the temperature of specimen W and functions to control both the cooling means and heater so that the temperature reading of specimen W changes from a first to a second temperature “using a measured substrate temperature.” *Id.* at 27 (citing Ex. 1006, 11:48–51, 12:36–47, Fig. 4).

Samsung turns to Matsumura’s temperature control system that uses predetermined recipes to heat or cool an object over a predetermined period of time to teach changing from a first substrate temperature to a second substrate temperature “within a preselected time interval for processing.” Pet. 27–29 (citing Ex. 1007, 3:1–7). For example, Samsung argues that Figure 9 of Matsumura shows a control recipe with a temperature change from 20°C to 90°C within 60 seconds. *Id.* at 29 (citing Ex. 1007, 8:56–9:19, Fig. 9). Alternatively, Samsung also argues that Matsumura’s disclosure of detecting the temperature of the wafer prior to changing the temperature according to the recipe teaches changing from a first to a second temperature “using a measured substrate temperature.” *Id.* at 30 (citing Ex. 1007, 9:16–23).

Relying on the testimony of Dr. Shanfield, Samsung asserts that it would have been obvious to one of ordinary skill in the art to modify Kadomura’s dry etching method by incorporating the use of Matsumura’s control recipes in order to control the temperature of specimen W (e.g., by changing the temperature of specimen W from a first temperature to a second temperature in a “preselected time interval for processing”).

Pet. 31–32 (citing Ex. 1002 ¶¶ 43, 60, 61). According to Samsung, one of ordinary skill in the art would have recognized that such a modification would improve the flexibility of Kadomura’s dry etching apparatus by allowing specimen W to be set to different temperatures in a controlled manner and allowing the system to process several different types of materials and substrates. *Id.* at 32. In addition, Samsung argues that one of ordinary skill in the art would have recognized that measuring and using the temperature of Kadomura’s wafer W—“using the measured substrate temperature”—during the heating and cooling process provides for the ability to better control (1) the wafer temperature and (2) the heating and cooling process. *Id.* at 32–33.

Turning to independent claim 37, Samsung contends that Kadomura teaches all the limitations recited in this claim, except “a substrate holder temperature sensor,” and changing from a first substrate temperature to a second substrate temperature “within a preselected time period to process the film.” Pet. 35–46. With the exception of “a substrate holder temperature sensor,” Samsung relies upon essentially the same analysis with respect to independent claim 27 discussed above to support its assertion that independent claim 37 would have been obvious over the combined teachings of Kadomura and Matsumura. *Compare id.* at 19–33, *with id.* at 35–46. Samsung, however, turns to Matsumura’s sensor 25 to teach or suggest “a substrate holder temperature sensor.” *Id.* at 40–41 (citing Ex. 1007, 7:19–26, Fig. 10).

In its Patent Owner Response, Flamm argues the following: (1) Samsung fails to provide a sufficient rationale to combine the teachings of Kadomura and Matsumura; (2) both Kadomura and Matsumura teach away

from the claimed invention; and (3) modifying Kadomura's dry etching method and apparatus with Matsumura's control recipes would change Kadomura's principle of operation or otherwise render it inoperable for its intended purpose. PO Resp. 3–23. We turn first to the limitations of independent claims 27 and 37, and then we address each of Flamm's arguments in turn.

a. Samsung Properly Accounts for Each and Every Limitation

Flamm does not address separately Samsung's explanations and supporting evidence as to how the combined teachings of Kadomura and Matsumura account for all the limitations recited in independent claims 27 and 37. *See generally* PO Resp. 9–23; *see also* Pet. Reply 3–4 (“Patent Owner does not contest that the combination [of Kadomura and Matsumura] discloses all limitations of independent claims 27 and 37.”). We have reviewed Samsung's explanations and supporting evidence in this regard, and we agree with and adopt Samsung's analysis showing that the combined teachings of Kadomura and Matsumura account for all the limitations recited in independent claims 27 and 37. *See* Pet. 19–33, 35–46; Ex. 1002 ¶¶ 42–62, 65–82.

b. Samsung Provides a Sufficient Rationale to Combine the Teachings of Kadomura and Matsumura

As we explained above, Samsung provides more than one reason as to why one of ordinary skill in the art would have been prompted to combine or modify the teachings of Kadomura and Matsumura. *See* Pet. 22–23, 31–33. Flamm contends that modifying Kadomura's dry etching apparatus and method to include Matsumura's control recipes would yield no benefit because the time period for changing the temperature during Kadomura's

two-step etching processes “does not constitute a factor” in the processes. PO Resp. 9–10 (quoting Ex. 1006, 6:55–62, 8:42–50, 10:13–16). Similarly, relying almost exclusively on his own testimony, Flamm contends that modifying Kadomura’s dry etching apparatus and method to include Matsumura’s control recipes would have no meaningful effect because there are notable differences between Kadomura and Matsumura. *Id.* at 15–18 (citing Ex. 2001 ¶¶ 18, 19, 25–29). Lastly, Flamm asserts that Samsung relies upon conclusory assertions and fails to articulate a reason why a person of ordinary skill in the art would combine the teachings of Kadomura with those of Matsumura to arrive at the claimed invention. *Id.* at 18–21.

In its Reply, Samsung counters by asserting that it disagrees with Flamm’s primary argument that modifying Kadomura’s dry etching apparatus and method to include Matsumura’s control recipes would yield no benefit. Pet. Reply 4–5. According to Samsung, the time required to change Kadomura’s substrate temperature between two etches constitutes an important factor and, therefore, must be controlled accurately to achieve Kadomura’s goal of not lowering throughput. *Id.* at 5. Samsung argues that both Kadomura and Dr. Flamm (during cross-examination) acknowledge as much. *Id.* at 5–7 (citing Ex. 1006, 6:58–60, 7:19–30; Ex. 1011, 101:13–25).

Samsung also reiterates its rationale, advanced in the Petition, that one of ordinary skill in the art would have understood the need to accurately control the time for temperature change and would have been motivated to use Matsumura’s control recipes to improve Kadomura’s dry etching apparatus and method because these recipes would “provide better temperature control.” Pet. Reply 8 (citing Pet. 32; Ex. 1002 ¶ 61). In particular, Samsung argues that one of ordinary skill in the art would have

known that Matsumura's control recipes would have been able to provide accurate temperature control because they allow "accurate control" of the "thermal history curve." *Id.* at 8–9 (citing Pet. 13, 21, 28–29; Ex. 1002 ¶¶ 31–35, 57–61).

The relevant inquiry here is whether Samsung has set forth "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006), *cited with approval in KSR*, 550 U.S. at 418. In *KSR*, the Supreme Court framed the question as whether "[one] of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to upgrading [the prior art]." 550 U.S. at 424. The Supreme Court explained that we "must ask whether the improvement is more than the predictable use of prior art elements according to their established functions." *Id.* at 417. The Supreme Court stated that, "[i]f a person of ordinary skill [in the art] can implement a predictable variation, § 103 likely bars its patentability." *Id.*

Based on the record developed during trial, we agree with Samsung that using Matsumura's control recipes in Kadomura's dry etching apparatus and method is a predictable use of prior art elements according to their established functions—an obvious combination that would provide better temperature control, particularly with respect to accurately controlling the thermal history curve. *See* Pet. 31–33; Pet. Reply 8–9; Ex. 1002 ¶¶ 43, 60, 61; *KSR*, 550 U.S. at 417. We begin our analysis by examining the problem addressed by Matsumura. In its "Background of the Invention" section, Matsumura discloses that the thermal history curve (i.e., the temperature changing pattern) of the wafer-stage has a large influence on the resolution

and light sensitivity of the photoresist, but conventional systems for heat-processing a semiconductor wafer “neglected” the thermal history curve of the wafer stage while this stage was heated or cooled. Ex. 1007, 2:41–46. Matsumura purportedly addresses this and other problems by developing a system capable of controlling the temperature of the wafer stage to obtain a desired thermal history curve. *Id.* at 2:46–49.

Although Samsung does not identify explicitly the problem addressed by Matsumura, it nonetheless includes specific citations in its Petition that direct us to Matsumura’s proposed solution to this problem, set forth as Matsumura’s stated objective. For instance, on two occasions Samsung directs us to the following disclosure in Matsumura: “*Matsumura discloses a ‘method of heat-processing semiconductor devices whereby temperatures of the semiconductor devices can be controlled at devices-heating and -cooling times so as to accurately control their thermal history curve.’*” Pet. 13, 21 (quoting Ex. 1007, 2:60–65) (emphasis added). Samsung also directs us specifically to Figure 9 of Matsumura, which, as we explain above, depicts a control recipe with a reproducible thermal history curve showing temperature as a function of time. *Id.* at 28–29 (citing Ex. 1007, 3:1–7, 8:56–68, Fig. 9); *see also* Ex. 1007, 8:56–59 (describing Figure 9 as illustrating that “[p]oints P10 to P19 are set in the recipe so as to surely reproduce the thermal history curve of the wafer W”). Matsumura further explains that, when heating or cooling semiconductor devices of the same kind, control recipes (such as the one illustrated in Figure 9) allow the thermal history curves to be controlled accurately, “thereby enhancing their reliability” and ensuring that “no irregularity can be found in the property of

their resists, and their qualities can be made [the] same.” Ex. 1007, 10:21–29; Pet. Reply 8–9 (citing Ex. 1007, 10:21–29).

During oral argument, when discussing how the time to change the gas is always longer than the time to change the temperature in Kadomura’s two-step etching processes, counsel for Flamm stated that “from reading Kadomura, . . . that’s an empirical statement” and “[i]t’s not that [Kadomura] planned to do it that way, that’s what happened.” Tr. 17:1–4. In light of the aforementioned discussion with counsel for Flamm, and based on our independent assessment of Kadomura, we find that Kadomura is silent with respect to how it exerts control over the time to change the temperature during the two-step etching processes.

Given Kadomura’s silence on this matter, we agree with Samsung that one of ordinary skill in the art would have recognized that modifying Kadomura’s dry etching apparatus and method to include Matsumura’s control recipes would yield the benefit of providing better temperature control. Pet. 32–33. As Samsung reinforced throughout its Petition and Reply, as well as consistent with Matsumura’s stated objective, modifying Kadomura in this manner would enhance the reliability of—and prevent irregularities in—semiconductor devices of the same kind that are subject to Kadomura’s two-step etching processes because Matsumura’s control recipes would allow accurate control of their thermal history curves. *See* Pet. 13, 21, 28–29; Pet. Reply 8–9; Ex. 1007, 2:60–65, 10:21–29.

We do not agree with Flamm’s argument that modifying Kadomura’s dry etching apparatus and method to include Matsumura’s control recipes would yield no benefit. *See* PO Resp. 9–10. Flamm’s argument in this regard is predicated on the notion that the time period for changing the

temperature during Kadomura's two-step etching processes "*does not constitute a factor.*" *Id.* at 9–10 (quoting Ex. 1006, 6:55–62, 8:43–50, 10:13–16) (emphasis added by Flamm). Despite making this assertion multiple times throughout its Patent Owner Response, counsel for Flamm conceded during oral argument that it never intended to indicate that the time period for changing the temperature was not a factor in Kadomura's two-step etching processes, but rather that it is only a factor in the sense that the time period to change the substrate temperature is equal to or less than the time period to change the gas. Tr. 12:20–14:4. Moreover, Flamm's argument that the time required for heating and cooling in Kadomura "*does not constitute a factor*" is limited to the effect that heating or cooling has on delaying the time required to complete the two-step etching processes. *See* PO Resp. 9 ("[T]he time required for the rapid cooling *does not constitute a factor of delaying the time required for the etching treatment of the specimen W.*" (second emphasis added) (quoting Ex. 1006, 6:55–62)); *accord id.* at 9–10 (citing Ex. 1006, 10:13–16). Flamm does not address the other benefits of providing better temperature control, particularly with respect to accurately controlling the thermal history curve. Nor does Flamm address how modifying Kadomura to include Matsumura's control recipes comports with Matsumura's stated objective of "controll[ing the] devices-heating and -cooling times so as to accurately control their thermal history curve." Ex. 1007, 2:60–65.

We also do not agree with Flamm's argument that modifying Kadomura's dry etching apparatus and method to include Matsumura's control recipes would have no meaningful effect. *See* PO Resp. 15–18. Flamm relies almost exclusively on his own testimony to highlight disparate

teachings in Kadomura and Matsumura. *See id.* (citing Ex. 2001 ¶¶ 18, 19, 25–29). Flamm, however, fails to explain how these disparate teachings have any effect upon the obviousness ground formulated by Samsung that serves as the focal point of this trial. Stated differently, we fail to see how the differences between Kadomura and Matsumura highlighted by Dr. Flamm would prohibit or preclude the manner in which Samsung proposes to combine the teachings of Kadomura and Matsumura to account for all the limitations of independent claims 27 and 37.

Lastly, we do not agree completely with Flamm’s argument that Samsung relies upon conclusory assertions and fails to articulate a reason why a person of ordinary skill in the art would combine the teachings of Kadomura with those of Matsumura to arrive at the claimed invention. *See* PO Resp. 18–21. According to Flamm, Samsung’s rationale for using Matsumura’s control recipes to improve Kadomura’s dry etching apparatus and method is based on the following two purported benefits: (1) “allowing the specimen W to be set to several different temperatures in a controlled manner”; and (2) “allowing it to process several different types of materials and substrates.” *Id.* at 18–19 (quoting Pet. 32) (citing Ex. 1002 ¶ 61). We agree with Flamm that Samsung’s purported benefit of processing several different types of materials and substrates was not developed adequately during trial (i.e., Samsung merely acknowledged that Kadomura’s system already possesses the ability to process different types of materials (*see* Pet. Reply 9–10)). Flamm, however, either overlooks or ignores the benefit of providing better temperature control as it relates to accurately controlling the thermal history curve, which was advanced by Samsung throughout its Petition and Reply. *See* Pet. 13, 21, 28–29, 32–33; Pet. Reply 8–9. Flamm

also fails to appreciate how this benefit comports with Matsumura's stated objective. Ex. 1007, 2:60–65, 10:21–29.

c. Flamm's Argument as to Changing Kadomura's Principle of Operation or Otherwise Rendering it Inoperable for its Intended Purpose is Misplaced

Flamm contends that modifying Kadomura's dry etching apparatus and method to include Matsumura's control recipes in a manner that would eliminate Kadomura's gas exchange procedure between etching steps would change Kadomura's principle of operation or otherwise render it inoperable for its intended purpose. PO Resp. 10–13. In particular, Flamm argues that the gas exchange procedure between the first and second etch is critical to each of the embodiments disclosed in Kadomura and, therefore, qualifies as a principle of operation. *Id.* at 13–14 (citing Ex. 2001 ¶¶ 19–21).

As Samsung notes, however, Flamm's change in principle of operation argument is misplaced. Pet. Reply 11–12. Samsung asserts, and we agree, that it never suggested eliminating Kadomura's gas exchange procedure between the first and second etch in each of its embodiments when formulating its asserted ground based on the combined teachings of Kadomura and Matsumura. *Id.* at 12. Instead, as we explain above, Samsung argues that one of ordinary skill in the art would have recognized that modifying Kadomura's dry etching apparatus and method to include Matsumura's control recipes would yield the benefit of providing better temperature control, without eliminating Kadomura's gas exchange procedure between the first and second etch in each of its embodiments. Pet. 32–33. As Samsung reinforced throughout its Petition and Reply, as well as consistent with Matsumura's stated objective, modifying Kadomura in this manner would enhance the reliability of—and prevent irregularities

in—semiconductor devices of the same kind that are subject to Kadomura’s two-step etching processes because Matsumura’s control recipes would allow accurate control of their thermal history curves. *See* Pet. 13, 21, 28–29; Pet. Reply 8–9; Ex. 1007, 2:60–65, 10:21–29. Flamm does not explain why incorporating Matsumura’s control recipes would require elimination of Kadomura’s gas exchange procedure.

*d. Neither Kadomura nor Matsumura Teach Away
From the Claimed Invention*

Flamm presents two teaching away arguments. First, Flamm argues that Kadomura teaches away from the concept of a preselected time period because its technique of exhausting and replacing the gas between etches, and employing very cold temperatures, results in relatively long intervals between etches of “about 30 sec[onds].” PO Resp. 5 (citing Ex. 1006, 6:54, 8:42; Ex. 2001 ¶ 11). In contrast, Flamm argues that the ’264 patent teaches a time interval of “several seconds,” which, according to Flamm, is at least an order of magnitude shorter than anything taught by Kadomura. *Id.* Second, Flamm contends that Matsumura teaches away from the claimed invention of the ’264 patent because Matsumura is not directed to etching. *Id.* at 6–7 (citing Ex. 1007, 1:15–20, 4:56–59, Figs. 1, 4; Ex. 2001 ¶ 13); *see also id.* at 15 (arguing that “Matsumura’s various specific temperature changing recipes have no utility at all for plasma etching” (citing Ex. 2001 ¶ 25)).

In response to Flamm’s first teaching away argument, Samsung contends that none of the challenged claims recite an explicit time duration between the first and second etch, and it would be improper to read such a duration from the specification of the ’264 patent into these claims. Pet.

Reply 11 (citing *In re Van Geuns*, 988 F.2d 1181 (Fed Cir. 1993)).

According to Samsung, Flamm’s first teaching away argument is merely an unsubstantiated individual attack on Kadomura that lacks any legal basis.

Id. Indeed, Samsung asserts that Flamm fails to meet his burden of demonstrating that Kadomura criticizes, discredits, or otherwise disparages the claimed invention. *Id.* (citing *Meiresonne v. Google, Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017)).

In response to Flamm’s second teaching away argument, Samsung contends that Matsumura explicitly discloses that its processes may be applied to “any of the ion implantation, CVD, etching and ashing processes.” Pet Reply. 12 (quoting Ex. 1007, 10:3–7) (emphasis omitted). According to Samsung, the named inventor of the ’264 patent, Dr. Flamm, conceded during cross-examination that an “ashing process” is a plasma etching process for removing photoresist. *Id.* (citing Ex. 1011, 62:25–63:3).

It is well-settled that a reference teaches away from a claimed invention if it “criticize[s], discredit[s], or otherwise discourage[s]” modifying the reference to arrive at the claimed invention. *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). We will not, however, “read into a reference a teaching away from a process where no such language exists.” *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1364 (Fed. Cir. 2006).

We do not agree with Flamm’s teaching away arguments. Beginning with Flamm’s first teaching away argument, we agree with Samsung that neither independent claim 27 nor independent claim 37 recite an explicit time duration between the first and second etch. *See* Pet. Reply 11. Flamm’s arguments to the contrary are not commensurate in scope with

these claims because they do not require a time interval of “several seconds” between etches. *See In re Self*, 671 F.2d 1344, 1348 (CCPA 1982) (explaining that limitations not appearing in the claims cannot be relied upon for patentability). In any event, we are unable to ascertain a substantial difference between “about 30 seconds” and “several seconds” that is significant enough to warrant a teaching away. In essence, Flamm attempts to read into Kadomura a teaching away where no such language exists. *See DyStar*, 464 F.3d at 1364.

Turning to Flamm’s second teaching away argument, we agree with Samsung that Matsumura explicitly discloses that its processes may be applied to “etching and ashing processes.” *See* Pet Reply. 12 (quoting Ex. 1007, 10:3–7). In other words, contrary to Flamm’s assertions, one of ordinary skill in the art would have understood that Matsumura’s control recipes have utility in plasma etching because Matsumura specifically contemplates that its processes may be applied in etching and ashing processes. Ex. 1007, 10:3–7. As it did with Kadomura, Flamm attempts to read into Matsumura a teaching away where no such language exists. *See DyStar*, 464 F.3d at 1364.

e. Summary

In summary, based on the record developed during trial, Samsung has demonstrated by a preponderance of the evidence that the subject matter of independent claims 27 and 37 would have been obvious over the combined teachings of Kadomura and Matsumura.

6. *Claims 32 and 40*

Flamm does not address separately Samsung's explanations and supporting evidence as to how the combined teachings of Kadomura and Matsumura account for all the limitations recited in dependent claims 32 and 40. *See generally* PO Resp. 9–30. We have reviewed Samsung's explanations and supporting evidence as to how the combined teachings of Kadomura and Matsumura account for all the limitations recited in these dependent claims, as well as its reasons as to why one of ordinary skill in the art would have been prompted to combine or modify the respective teachings, and we agree with and adopt Samsung's analysis. Pet. 33–35, 46–47; Ex. 1002 ¶¶ 63, 64, 83. Based on the record developed during trial, we conclude that Samsung has demonstrated by a preponderance of the evidence that the subject matter of dependent claims 32 and 40 would have been obvious over the combined teachings of Kadomura and Matsumura.

D. Obviousness Based on the Combined Teachings of Kadomura, Matsumura, and Narita

Samsung contends that claims 31 and 50 are unpatentable under § 103(a) over the combination of Kadomura, Matsumura, and Narita. Pet. 47–50. Samsung explains how this proffered combination purportedly teaches the subject matter of each challenged claim, and asserts that a person of ordinary skill in the art would have had a sufficient reason to combine or modify the teachings of the references. *Id.* Samsung also relies upon the Declaration of Dr. Shanfield to support its positions. Ex. 1002 ¶¶ 84–89. In its Patent Owner Response, Flamm presents three arguments directed to dependent claims 31 and 50. PO Resp. 23–25. Flamm relies upon the Declaration of Dr. Flamm to support his positions. Ex. 2001 ¶¶ 33–35.

We begin our analysis with a brief overview of Narita, and then we address the parties' contentions with respect to dependent claims 31 and 50.

1. Narita Overview

Narita discloses a method for treating “a surface of a workpiece while accurately controlling the temperature of the workpiece.” Ex. 1008, 2:7–10. In particular, Narita discloses that the workpiece may be heated using the radiation of an infrared ray (“IR”) lamp, a halogen lamp, or a normal heater. *Id.* at 2:63–65. According to Narita, its disclosed method also may apply to plasma etching and thermal CVD, among other treatment methods. *Id.* at 3:3–5.

2. Claims 31 and 50

Claims 31 and 50 depend from independent claims 27 and 37, respectively, and each recite “wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.” Ex. 1001, 22:38–40, 24:1–3.

Samsung contends that Kadomura's dry etching apparatus and method involves changing the temperature of specimen W from -30°C to 50°C by providing heat via the heater attached to stage 12. Pet. 47–48 (citing Ex. 1006, 10:7–18, 7:40). Samsung argues, however, that Kadomura does not disclose explicitly that the heat provided by the heater is in the form of “radiation.” *Id.* at 48. Samsung turns to Narita's radiant heater (e.g., IR lamp, halogen lamp, or normal heater) to teach this particular feature. *Id.* (citing Ex. 1008, 2:63–65).

Relying on the testimony of Dr. Shanfield, Samsung asserts that it would have been obvious to one of ordinary skill in the art to modify Kadomura's dry etching apparatus to include Narita's radiant heater

(e.g., IR lamp, halogen lamp, or normal heater) in order to heat stage 12 because Narita discloses that its teachings are applicable to plasma etching. Pet. 48–49 (citing Ex. 1002 ¶¶ 85, 88). According to Samsung, one of ordinary skill in the art would have recognized that such a modification would add flexibility to Kadomura’s dry etching apparatus by providing alternative heat source options for the process designer. *Id.* at 49. Samsung also asserts that using radiation for heating, as taught by Narita, in Kadomura’s dry etching apparatus would have been an obvious matter of design choice. *Id.*

Flamm presents three arguments directed to dependent claims 31 and 50. First, Flamm contends that Narita’s radiant heat source would defeat Matsumura’s basis for control because Matsumura’s control system depends on the heater temperature being determinate of wafer temperature. PO Resp. 23 (citing Ex. 2001 ¶ 33). Second, Flamm argues that a person of ordinary skill in the art would not have included Narita’s radiant heater in Kadomura’s dry etching apparatus to effectuate a temperature change because heating through intimate contact with Kadomura’s electrostatic chuck was operable to provide better uniformity and control than Narita’s IR lamp or halogen lamp. *Id.* at 24. According to Flamm, one of ordinary skill in the art would have recognized that these different techniques teach away from each other. *Id.* (citing Ex. 2001 ¶ 34). Third, Flamm argues that Narita’s rapid heating control depends on detecting radiation emitted from a wafer. *Id.* (citing Ex. 1008, 3:68–4:4). Consequently, Flamm asserts that it would have been known to one of ordinary skill in the art that the intensity and uniformity of radiation emanating from Kadomura’s plasma discharge

could not be controlled using Narita's ability to control heating. *Id.* at 24–25.

Samsung disagrees with Flamm's first argument that Narita's radiant heat source would defeat Matsumura's basis for control because Flamm does not provide any evidence or explanation to support this argument.

Pet. Reply 18 (citing 37 C.F.R. § 42.65(a)). Moreover, Samsung argues that its proffered combination of Kadomura, Matsumura, and Narita relies upon incorporating Narita's radiant heater into Kadomura's dry etching apparatus, as modified by Matsumura's control recipes, not on modifying Matsumura's control system with Narita's radiant heat source, as asserted by Flamm. *Id.* at 18–19. Samsung also disagrees with Flamm's second argument that combining Narita's IR lamp or halogen lamp with Kadomura's dry etching apparatus would degrade its uniformity and control because, once again, Flamm provides no evidence or explanation to support this argument. *Id.* at 20 (citing 37 C.F.R. § 42.65(a)). For instance, Samsung argues that Dr. Flamm offers no explanation as to what he means by uniformity and control, how Kadomura achieves uniformity and control, and why such uniformity and control would be degraded by Narita's radiant heat source. *Id.* Lastly, Samsung disagrees with Flamm's third argument that Kadomura's plasma discharge would interfere with Narita's ability to control heating, because Narita explicitly discloses that its radiation heating method may be applied to various plasma etching processes. *Id.* at 20–21 (citing Ex. 1008, 3:3–5, 8:32–36).

As an initial matter, we agree with Samsung that using Narita's radiation heater in Kadomura's dry etching apparatus, as modified by Matsumura's control recipes, would have been obvious to one of ordinary

skill in the art because Narita discloses that its teachings are applicable to plasma etching. Pet. 48–49; Ex. 1002 ¶¶ 85, 88; Ex. 1008, 3:3–5, 8:32–36. We have considered Flamm’s arguments to the contrary, but do not agree with them for the following reasons. Flamm’s first argument that Narita’s radiant heat source would defeat Matsumura’s basis for control is misplaced. As Samsung correctly points out in its Reply, the proffered combination of Kadomura, Matsumura, and Narita at issue relies upon incorporating Narita’s radiant heater into Kadomura’s dry etching apparatus, as modified by Matsumura’s control recipes, not on modifying Matsumura’s control system with Narita’s radiant heater. See Pet. Reply 18–19. Stated differently, Samsung does not advocate including Narita’s radiant heater in Matsumura’s control system, but rather seeks to include Narita’s radiant heater in Kadomura’s dry etching apparatus, which, in turn, also includes Matsumura’s control recipes to yield the benefit of providing better temperature control.

Next, we do not agree with Flamm that combining Narita’s IR lamp or halogen lamp with Kadomura’s dry etching apparatus would degrade uniformity and control. In particular, we do not credit Dr. Flamm’s supporting testimony on this particular issue because it is conclusory in nature. Ex. 2001 ¶ 34. According to 37 C.F.R. § 42.65(a), “[e]xpert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.” See *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 294 (Fed. Cir. 1985) (stating a lack of objective support for expert opinion “may render the testimony of little probative value in [a patentability] determination”). For instance, Dr. Flamm testifies that:

A [person of ordinary skill in the art] would not have combined Narita with Kadomura to effectuate a temperature change because a [person of ordinary of skill in the art] would know that heating through intimate contact with Kadomura's electrostatic chuck was operable to provide better uniformity and control than an [IR] lamp or halogen lamp taught by Narita. Such [IR] lamp or halogen lamp is primarily for rapid heating, commonly called "RTP," which would not be combined with Kadomura's technique that emphasizes better uniformity and control for cryogenic processing. A [person of ordinary skill in the art] would recognize that these different techniques teach away from each other.

Ex. 2001 ¶ 34. Dr. Flamm, however, provides little, if any, support for these statements. Absent underlying facts or data to support his opinion, we are not convinced that heating with an IR lamp or halogen lamp, as taught by Narita, would degrade uniformity and control. *See* Pet. Reply 19–20 (referencing teachings in Narita that provide for control and uniformity).

Lastly, we do not agree with Flamm that Kadomura's plasma discharge would interfere with Narita's ability to control heating because, as Samsung correctly points out, Narita explicitly discloses that its radiation heating method is applicable to plasma etching. *See* Pet. Reply 20–21 (citing Ex. 1008, 3:3–5, 8:32–36). Indeed, Narita discloses that it "applie[s] to various [treatment] methods," including, among other things, "plasma etching." Ex. 1008, 3:3–5. This also is reflected in dependent claim 7 of Narita, which depends from independent claim 1, and recites, in relevant part, "wherein said method comprises a method selected from the group consisting of . . . plasma etching." *Id.* at 8:32–36. Given that both Kadomura and Narita are applicable to plasma etching, we find that one of ordinary skill in the art would have looked to certain aspects in Narita, such as its radiant heater, in an effort to improve the temperature change

procedure in Kadomura's two-step etching processes by providing alternative heat source options for the process designer.

Based on the record developed during trial, Samsung has demonstrated by a preponderance of the evidence that the subject matter of dependent claims 31 and 50 would have been obvious over the combined teachings of Kadomura, Matsumura, and Narita.

E. Obviousness Based on the Combined Teachings of Kadomura, Matsumura, and Wang I

Samsung contends that claims 27, 34, 37, 41, and 44 are unpatentable under § 103(a) over the combination of Kadomura, Matsumura, and Wang I. Pet. 50–66. Samsung explains how this proffered combination purportedly teaches the subject matter of each challenged claim, and asserts that a person of ordinary skill in the art would have had a sufficient reason to combine or modify the teachings of the references. *Id.* Samsung also relies upon the Declaration of Dr. Shanfield to support its positions. Ex. 1002 ¶¶ 90–119. Flamm contends that Kadomura does not teach the limitations of dependent claims 34 and 41. PO Resp. 26–30. Flamm relies upon the Declaration of Dr. Flamm to support his positions. Ex. 2001 ¶¶ 41–47.

We begin our analysis with a brief overview of Wang I, and then we address independent claims 27 and 37 before turning to the parties' contentions with respect to dependent claims 34 and 41.

1. Wang I Overview

Wang I generally relates to a process for etching conductive layers used in semiconductor integrated circuits and, in particular, to a method for etching metal silicides, polycrystalline silicon, and composite silicide-polysilicon structures, as well as reactive plasma gas chemistry for use in

such methods. Ex. 1009, 1:13–19. Figures 20 and 21, reproduced below, illustrate the effect of hexode temperature on polysilicon etch rate and on molybdenum silicide etch rate for etching gases that are devoid of and contain a small volume percentage of additive gas, respectively. *Id.* at 6:1–5.

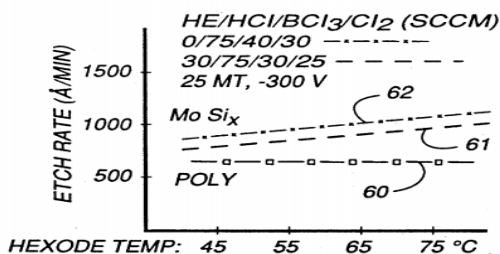


Figure 20

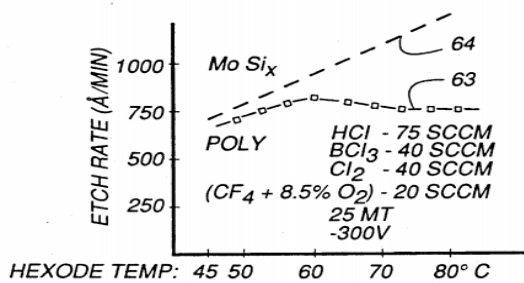


Figure 21

Figures 20 and 21 shown above each illustrate an increase of silicide etch rates over a substrate holder temperature range from 45°C to 75°C. *Id.* at 10:13–30.

2. Claims 27 and 37

To support its assertion that independent claim 27 would have been obvious over the combined teachings of Kadomura, Matsumura, and Wang I, Samsung relies upon essentially the same analysis discussed above in the context of the asserted ground based on the combined teachings of Kadomura and Matsumura, except Samsung’s analysis is predicated on Kadomura’s first embodiment, not its third embodiment. *Compare* Pet. 19–33, *with id.* at 51–58. Samsung then turns to Wang I’s disclosure that a higher substrate temperature increases the etch rate of silicide, such as WSi_x, to teach that one or both of the first and second substrate temperatures is above “room temperature.” *Id.* at 56–57.

Relying on the testimony of Dr. Shanfield, Samsung asserts that it would have been obvious to one of ordinary skill in the art to modify Kadomura's dry etching method and apparatus to increase the substrate temperature above 20°C (i.e., room temperature) during the first etching step (i.e., the step in which WSi_x layer 33 is etched) because Wang I discloses that a higher substrate temperature increases the etch rate of the silicide. Pet. 57 (citing Ex. 1002 ¶¶ 91, 104). According to Samsung, a high etch rate would provide an increased throughput, which Samsung alleges was a desirable feature for the processing of semiconductor devices at the time of the invention embodied in the challenged claims of the '264 patent. *Id.*

Turning to independent claim 37, Samsung contends that Kadomura teaches all the limitations recited in this claim except “a substrate holder temperature sensor,” heating the substrate holder above “room temperature” during at least one of the two film treatments, and changing from a first substrate temperature to a second substrate temperature “within a preselected time period to process the film.” Pet. 59–65. For the most part, Samsung relies upon essentially the same analysis with respect to independent claim 27 discussed above to support its assertion that independent claim 37 would have been obvious over the combination of Kadomura, Matsumura, and Wang I. *Compare id.* at 51–56, *with id.* at 59–65. That is, Samsung turns to Matsumura's sensor 25 and control recipes to teach “a substrate holder temperature sensor,” and “a preselected time period.” *Id.* at 60, 64–65. Samsung turns to Wang I's disclosure that a higher substrate temperature increases the etch rate of silicide, such as WSi_x, to teach heating the substrate holder above “room temperature” during at least one of the two film treatments. *Id.* at 63–64.

Flamm does not address separately Samsung's explanations and supporting evidence as to how the combined teachings of Kadomura, Matsumura, and Wang I account for all the limitations recited in independent claims 27 and 37, nor does Flamm address Samsung's reasons as to why one of ordinary skill in the art would have been prompted to combine or modify the respective teachings. *See generally* PO Resp. 9–23, 26–30. We have reviewed Samsung's explanations and supporting evidence, and we agree with and adopt Samsung's analysis. *See* Pet. 51–65; Ex. 1002 ¶¶ 90–104, 106–117. Based on the record developed during trial, we conclude that Samsung has demonstrated by a preponderance of the evidence that the subject matter of independent claims 27 and 37 would have been obvious over the combined teachings of Kadomura, Matsumura, and Wang I.

3. *Claims 34 and 41*

Claims 34 and 41 depend from independent claims 27 and 37, respectively, and each recites “the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film.” Ex. 1001, 22:49–51, 23:31–33.

Samsung contends that Kadomura teaches the limitation of dependent claim 34 because it discloses that the first portion of the film includes WSi_x and polysilicon, whereas the second portion of the film includes just polysilicon. Pet. 58–59 (citing Ex. 1006, Figs. 1A–1C; Ex. 1002 ¶ 105). Samsung relies upon essentially the same analysis discussed above with respect to dependent claim 34 to account for the same limitation recited in

dependent claim 41. *Compare* Pet. 58–59 (citing Ex. 1006, Figs. 1A–1C; Ex. 1002 ¶ 105), *with id.* at 65 (citing Ex. 1002 ¶ 118).

Flamm argues that Kadomura’s first embodiment teaches “to avoid etching the different material composition (31) of silicon oxide underneath polysilicon.” PO Resp. 27 (citing Ex. 1006, Fig. 1C). Flamm also argues that one of ordinary skill in the art would have recognized that Kadomura’s first embodiment teaches using a second etching temperature to etch the same material composition without etching a different material composition. *Id.* at 29. Consequently, Flamm asserts that Kadomura teaches away from etching a first film portion comprising one material composition at one temperature immediately before etching a second film portion having a different material composition using another temperature. *Id.* (citing Ex. 2001 ¶ 46). According to Flamm, “Wang [I] does not add anything to Kadomura.” *Id.* at 30 (citing Ex. 2001 ¶ 47).

In its Reply, Samsung reiterates its position that Kadomura teaches the limitations recited in dependent claims 34 and 41 because it discloses “the first portion of the film” includes WSi_x 33 and polysilicon 32, whereas “the second portion” includes just polysilicon 32. Pet. Reply 25–26 (citing Pet. 58–59, Ex. 1002 ¶ 105). Samsung argues that the combination of “ WSi_x 33 and polysilicon 32” is a different material composition than just “polysilicon 32.” *Id.*

We agree with Samsung that Kadomura teaches the limitations recited in dependent claims 34 and 41. As Samsung correctly notes in its Petition and Reply (Pet. 58–59, 65; Pet. Reply 25–26), Kadomura’s first embodiment discloses a two-step etching processes that begins with placing specimen W in silicon substrate 30 having a W polycide on stage 12 in diffusion chamber

2. Ex. 1006, 6:5–16, Fig. 1A. Specimen W has “a W polycide comprising a polysilicon layer 32 and a WSi_x layer 33 . . . formed on a SiO₂ film 31 on a silicon substrate 30.” *Id.* at 6:7–12. A first portion of polysilicon layer 32 and WSi_x layer 33—the combination of which amounts to the claimed “first portion of the film”—is etched with specimen W at 20°C. *Id.* at 6:17–29, Figs. 1A, 1B. A remaining portion of polysilicon layer 32—otherwise considered the claimed “second portion of the film”—is etched with specimen W at -30°C. *Id.* at 6:36–7:7, Figs. 1B, 1C. Based on these disclosures, we find that the combination of WSi_x 33 and polysilicon 32 (“the first portion of the film”) is a different material composition that is etched at one temperature (20°C) prior to just polysilicon 32 (“the second portion of the film”) being etched at another temperature (-30°C).

Flamm’s argument to the contrary is misplaced in that Flamm relies on Kadomura’s first embodiment for a teaching “to avoid etching the different material composition (31) of silicon oxide underneath polysilicon.” PO Resp. 27 (citing Ex. 1006, Fig. 1C). Samsung, however, is not asserting that layer 31 corresponds to either of the first or second portions of the film required by dependent claims 34 and 41. *See* Pet. 59 (annotating Figure 1 of Kadomura (the first embodiment) to show that the “first portion of the film” corresponds to a combination of layers 32 and 33, while the “second portion of the film” corresponds to a portion of layer 32 alone).

We also do not agree with Flamm’s assertion that Kadomura teaches away from etching a first portion of the film comprising one material composition at one temperature, immediately before etching a second portion of the film having a different material composition using another temperature. *See* PO Resp. 29. As we explain above, Kadomura’s first

embodiment teaches a two-step etching process in which the combination of WSi_x 33 and polysilicon 32 is etched at one temperature prior to polysilicon 32 being etched using another temperature. Once again, Flamm attempts to read into Kadomura a teaching away where no such language exists. *See DyStar*, 464 F.3d at 1364.

Based on the record developed during trial, we conclude that Samsung has demonstrated by a preponderance of the evidence that the subject matter of dependent claims 34 and 41 would have been obvious over the combined teachings of Kadomura, Matsumura, and Wang I.

4. *Claim 44*

Flamm does not address separately Samsung's explanations and supporting evidence as to how the combined teachings of Kadomura, Matsumura, and Wang I account for all the limitations recited in dependent claim 44. *See generally* PO Resp. 9–30. We have reviewed Samsung's explanations and supporting evidence as to how the combined teachings of Kadomura, Matsumura, and Wang I account for the limitation recited in this dependent claim, as well as its reasons as to why one of ordinary skill in the art would have been prompted to combine or modify the respective teachings, and we agree with and adopt Samsung's analysis. Pet. 65–66; Ex. 1002 ¶ 119. Based on the record developed during trial, we conclude that Samsung has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 44 would have been obvious over the combined teachings of Kadomura, Matsumura, and Wang I.

*F. Obviousness Based on the Combined Teachings of
Kadomura, Matsumura, Wang I, and Wang II*

Samsung contends that claims 47 and 48 are unpatentable under § 103(a) over the combination of Kadomura, Matsumura, Wang I, and Wang II. Pet. 67–69. Samsung explains how this proffered combination purportedly teaches the subject matter of each challenged claim, and asserts that a person of ordinary skill in the art would have had a sufficient reason to combine or modify the teachings of the references. *Id.* Samsung also relies upon the Declaration of Dr. Shanfield to support its positions. Ex. 1002 ¶¶ 120–126. Flamm contends that Kadomura does not teach the limitations recited in dependent claims 47 and 48. PO Resp. 25–26. Flamm relies upon the Declaration of Dr. Flamm to support his positions. Ex. 2001 ¶¶ 36–40.

We begin our analysis with a brief overview of Wang II, and then we address the parties’ contentions with respect to dependent claims 47 and 48.

1. Wang II Overview

Wang II discloses depositing an SiO₂ film on a substrate using CVD. Ex. 1010, Abstract, 6:33–43. According to Wang II, its disclosed CVD technique forms “improved highly conformal (~100%) silicon dioxide coatings . . . using lamp radiant heating to provide a wafer temperature of about 200°C–500°C.” *Id.* at 26:41–48.

2. Claim 47

Claim 47 depends from independent claim 37, and recites “wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises chemical vapor deposition.” Ex. 1001, 23:58–60.

Samsung contends that Kadomura discloses depositing SiO₂ film 31 on substrate 30, but does not explain explicitly how this film is deposited thereon. Pet. 67 (citing Ex. 1006, 6:7–11, Fig. 1A). Samsung turns to Wang II’s disclosure of depositing an SiO₂ film on a substrate using CVD to teach the limitation recited in dependent claim 47. *Id.* (citing Ex. 1010, 26:41–48).⁴ Relying on the testimony of Dr. Shanfield, Samsung asserts that it would have been obvious to one of ordinary skill in the art to modify Kadomura’s first film treatment to include depositing an SiO₂ film before etching on a substrate using CVD at a wafer temperature of about 200°C–500°C, as taught by Wang II. *Id.* at 68 (citing Ex. 1002 ¶¶ 121, 124, 125). According to Samsung, one of ordinary skill in the art would have recognized that such a modification would improve the teachings of Kadomura because it makes problems such as “overhang, cusps and voids much less severe, thereby minimizing or even eliminating the amount of follow-up processing which must be done to remedy such problems.” *Id.* (quoting Ex. 1010, 29:2–6). Samsung also asserts that it would have been obvious to one of ordinary skill in the art to use Wang II’s CVD technique to deposit film on Kadomura’s substrate 30 because CVD was among the most well-known types of deposition techniques for depositing an SiO₂ film. *Id.* at 68–69.

Flamm contends that the combined teachings of Kadomura, Matsumura, Wang I, and Wang II do not account for the limitation recited in

⁴ On page 67 of the Petition, Samsung quotes text from Wang II and then cites to Exhibit 1010 at column 27, lines 41–48. This quoted text, however, appears in Exhibit 1010 at column 26, lines 41–48.

dependent claim 47. PO Resp. 25. In particular, Flamm argues that one of ordinary skill in the art would have understood that Wang II's high temperature radiant heating is incompatible with Kadomura's cryogenic etching process and, therefore, would not have combined the teachings of Wang II with those of Kadomura. *Id.* at 25–26 (citing Ex. 2001 ¶ 38).

Samsung counters that Flamm's argument in this regard is misplaced for three reasons. Pet. Reply. 22–25. First, Samsung contends that Flamm's position is predicated on the notion that Wang II's radiant heat source (e.g., IR lamp) would be incorporated into the combination of Kadomura, Matsumura, Wang I, and Wang II. *Id.* Samsung, however, argues that this proffered combination merely involves the deposition of the SiO₂ film using CVD at a wafer temperature of 200°C–500°C without any limitation on the heat source used for heating the wafer to this temperature. *Id.* (citing Pet. 68; Ex. 1002 ¶ 124). Second, Samsung argues that Flamm provides no explanation to support his contention that Wang II's high temperature process would be incompatible with Kadomura's purported teaching of cryogenic etching. *Id.* at 23. In any event, Samsung argues that one of ordinary skill in the art would not have understood Kadomura to teach a cryogenic etching process because the temperatures used in its two-step etching processes are much higher than those typically used for cryogenic etching. *Id.* To support this argument, Samsung directs us to Shih, which discloses low temperature etching (e.g., etching at -133°C) typically understood to correspond to cryogenic etching. *Id.* at 23–24 (citing Ex. 1012, 43; Ex. 1013 ¶ 15). Third, Samsung argues that, even if it were to assume that Kadomura teaches a cryogenic etching process, Flamm's argument that cryogenic etching process would be incompatible with Wang

II's high temperature process is contradicted by Shih's disclosure of a cryoetching system that preheats a sample to 210°C. *Id.* at 24–25 (Ex. 1012, 43–45, Fig. 2; Ex. 1013 ¶ 17).

We agree with Samsung that Wang II's disclosure of depositing a SiO₂ film on a substrate using CVD teaches the limitation recited in dependent claim 47. *See* Pet. 67 (citing Ex. 1010, 26:41–48). We also agree with Samsung that it would have been obvious to one of ordinary skill in the art to modify Kadomura's first film treatment to include Wang II's depositing an SiO₂ film on a substrate using CVD because it makes problems such as “overhang, cusps and voids much less severe, thereby minimizing or even eliminating the amount of follow-up processing which must be done to remedy such problems.” *See id.* at 68 (quoting Ex. 1010, 29:2–6). Flamm's argument that the teachings of Kadomura and Wang II are incompatible and, therefore, not combinable is predicated on the notion that Kadomura teaches a cryogenic etching process. *See* PO Resp. 25–26. Apart from cryogenic valves 22 and 24 identified in Kadomura's plasma etching apparatus illustrated in Figures 4 and 5, Flamm does not direct us to, nor do we discern, a specific disclosure in Kadomura that would support Flamm's position that Kadomura teaches a cryogenic etching process.

Samsung's position that one of ordinary skill in the art would have understood that Kadomura does not disclose a cryogenic etching process is reinforced by Shih. We view Samsung's reliance upon Shih in its Reply as evidence of the knowledge that one of skill in the art “would bring to bear in reading the prior art identified as producing obviousness.” *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015). That is, we view Shih as falling within the purview of permissible evidence

we may consider in determining whether Kadomura teaches a cryogenic etching process. Upon considering this evidence, we agree with Samsung that Shih supports its assertion that one of ordinary skill in the art would not have understood Kadomura to disclose a cryogenic etching process because the temperatures used in Kadomura's two-step etching processes (e.g., -50°C) are much higher than those that typically correspond to cryogenic etching (e.g., 140K, which equates to -133°C). *Compare* Ex. 1006, 8:40–64, *with* Ex. 1012, 43.

We also do not credit Dr. Flamm's supporting testimony on this particular issue because it is conclusory in nature. In his Declaration, Dr. Flamm testifies that "a [person of ordinary skill in the art] would not combine high temperature radiant heating with Kadomura, which teaches a cryogenic etching process, each of which is incompatible with each other. Accordingly, a [person of ordinary skill in the art] would not combine Wang II with Kadomura." Ex. 2001 ¶ 38. Dr. Flamm, however, provides little, if any, support for these statements, and no explanation as to why a cryogenic etching process is incompatible with a separate step of high temperature radiant heating. Absent underlying facts or data to support Dr. Flamm's opinion, we are not convinced that Wang II's high temperature radiant heating is incompatible with Kadomura, even if we were to assume Kadomura teaches a cryogenic etching process. *See* 37 C.F.R. § 42.65(a); *Ashland Oil*, 776 F.2d at 294. Samsung, on the other hand, directs us to sufficient evidence that it was known to use a preheating step at 210°C in a cryogenic etching system. Pet. Reply 24–25 (citing Ex. 1012, 43–45, Fig. 2).

Based on the record developed during trial, we conclude that Samsung has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 47 would have been obvious over the combined teachings of Kadomura, Matsumura, Wang I, and Wang II.

3. *Claim 48*

Claim 48 depends from independent claim 37, and recites “wherein at least one film treatment comprises maintaining the substrate temperature at a selected value from about 300 to 500 degrees centigrade.” Ex. 1001, 23:61–64. Samsung contends that Wang II’s disclosure of using CVD to deposit Kadomura’s SiO₂ film 31 on substrate 30 at a wafer temperature of about 200°–500°C teaches the limitation recited in dependent claim 48. Pet. 69 (citing Ex. 1002 ¶ 126). Samsung asserts that it would have been obvious to one of ordinary skill in the art to modify Kadomura’s dry etch apparatus and method to include the aforementioned disclosure in Wang II for essentially the same reasons discussed above with respect to dependent claim 47. *Id.*

Flamm relies upon the same argument discussed above in the context of dependent claim 47 to rebut Samsung’s explanation and supporting evidence as to how the combined teachings of Kadomura, Matsumura, Wang I, and Wang II account for the limitation recited in dependent claim 48. *Compare* PO Resp. 26, *with id.* at 25. For the same reasons identified above, we do not agree with Flamm’s argument. Based on the record developed during trial, we conclude that Samsung has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 48 would have been obvious over the combined teachings of Kadomura, Matsumura, Wang I, and Wang II.

III. CONCLUSION

Samsung has demonstrated by a preponderance of the evidence that (1) claims 27, 32, 37, and 40 are unpatentable under § 103(a) over the combination of Kadomura and Matsumura; (2) claims 31 and 50 are unpatentable under § 103(a) over the combination of Kadomura, Matsumura, and Narita; (3) claims 27, 34, 37, 41, and 44 are unpatentable under § 103(a) over the combination of Kadomura, Matsumura, and Wang I; and (4) claims 47 and 48 are unpatentable under § 103(a) over the combination of Kadomura, Matsumura, Wang I, and Wang II.

IV. ORDER

In consideration of the foregoing, it is

ORDERED that claims 27, 31, 32, 34, 37, 40, 41, 44, 47, 48, and 50 of the '264 patent are held to be unpatentable; and

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

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Patent RE40,264 E

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