

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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LAM RESEARCH CORP.,  
Petitioner,

v.

DANIEL L. FLAMM,  
Patent Owner.

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Case IPR2015-01759  
Patent RE 40,264 E

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Before DONNA M. PRAISS, CHRISTOPHER L. CRUMBLEY, and  
JO-ANNE M. KOKOSKI, *Administrative Patent Judges*.

CRUMBLEY, *Administrative Patent Judge*.

DECISION

Denying Institution of *Inter Partes* Review  
35 U.S.C. § 314(a) and 37 C.F.R. § 42.108

## I. INTRODUCTION

Lam Research Corporation filed a Petition requesting an *inter partes* review of claims 13–26, 64, and 65 of U.S. Patent No. RE 40,264 E (Ex. 1001, “the ’264 patent”). Paper 1 (“Pet.”). Daniel L. Flamm, the named inventor on the ’264 patent and the Patent Owner, filed a Preliminary Response to the Petition. Paper 6 (“Prelim. Resp.”).

Pursuant to 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in the Petition shows “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” Taking into account the arguments presented in Flamm’s Preliminary Response, we conclude that the information presented in the Petition does not establish that there is a reasonable likelihood that Lam will prevail in challenging claims 13–26, 64, and 65 of the ’264 patent as unpatentable. Accordingly, we do not institute trial on those claims.

### A. Related Matters

The ’264 patent is the subject of concurrently filed *inter partes* review proceedings IPR2015-01764, IPR2015-01766, and IPR2015-01768.

We are informed that the ’264 patent is presently at issue in a declaratory judgment action captioned *Lam Research Corp. v. Daniel L. Flamm*, Case 5:15-cv-01277-BLF (N.D. Cal.), and in an infringement action captioned *Daniel L. Flamm v. Samsung Electronics Co., Ltd., et al.*, Case 1:15-cv-613 (W.D. Tex.). Pet. 3; Paper 4, 1.

*B. The '264 Patent*

The '264 patent, titled "Multi-Temperature Processing," reissued April 29, 2008, from U.S. Patent Application No. 10/439,245, filed on May 14, 2003. Ex. 1001, (54), (45), (21), (22). The '264 patent is a reissue of U.S. Patent No. 6,231,776, which issued May 15, 2001 from U.S. Patent Application 09/151,163, filed September 10, 1998. *Id.* at (64). The 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." Ex. 1001, Abstract. The apparatus used in the method is shown in Figure 1 below.

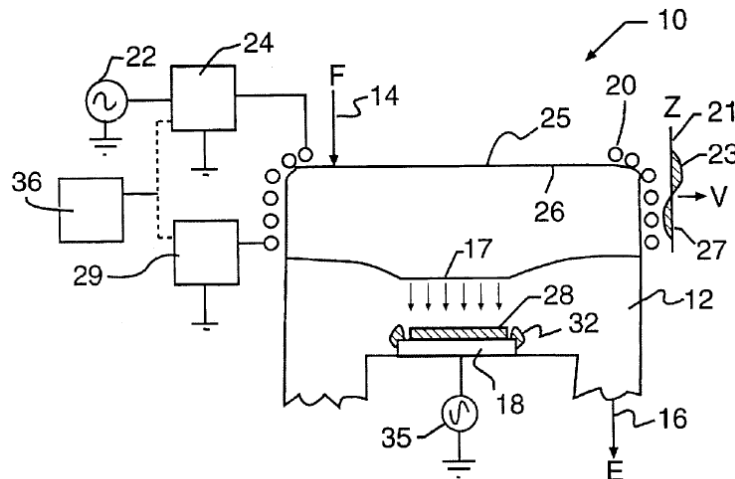
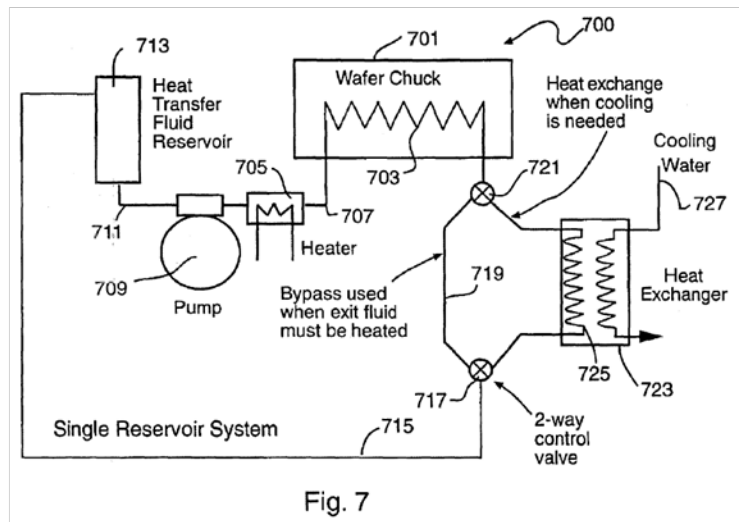
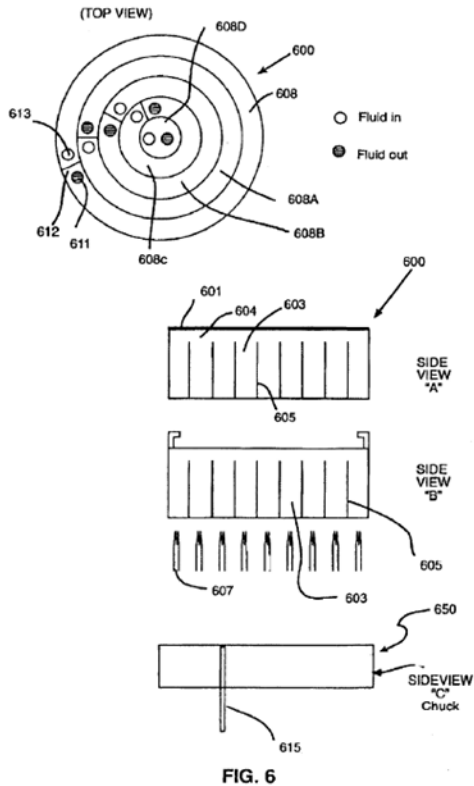


Figure 1 depicts a substrate (product 28, such as a wafer to be etched) on a substrate holder (product support chuck or pedestal 18) in a chamber (chamber 12 of plasma etch apparatus 10). *Id.* at 3:24–25, 3:32–33, 3:40–41.

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



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.” *Id.* at 14:28–63 and 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 and 50–67.

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

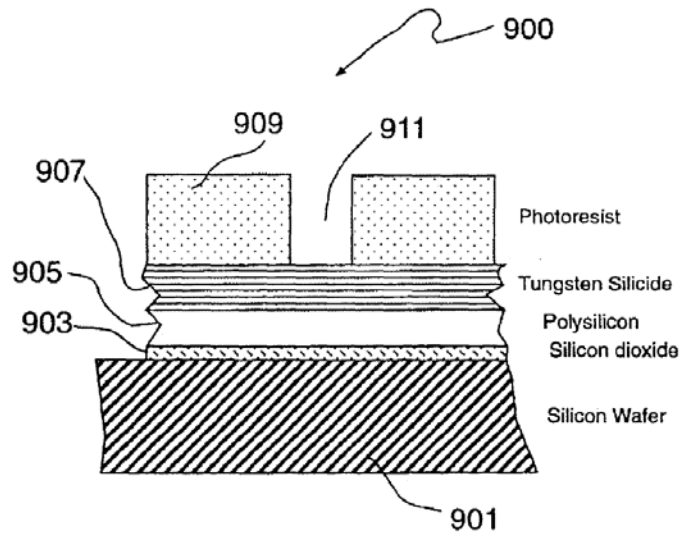


Figure 9 depicts substrate 901 having a stack of layers including oxide layer 903, polysilicon layer 905, tungsten silicide layer 907, and photoresist masking layer 909 with opening 911, from the treatment method shown in Fig. 10, below. *Id.* at 17:58–18:57.

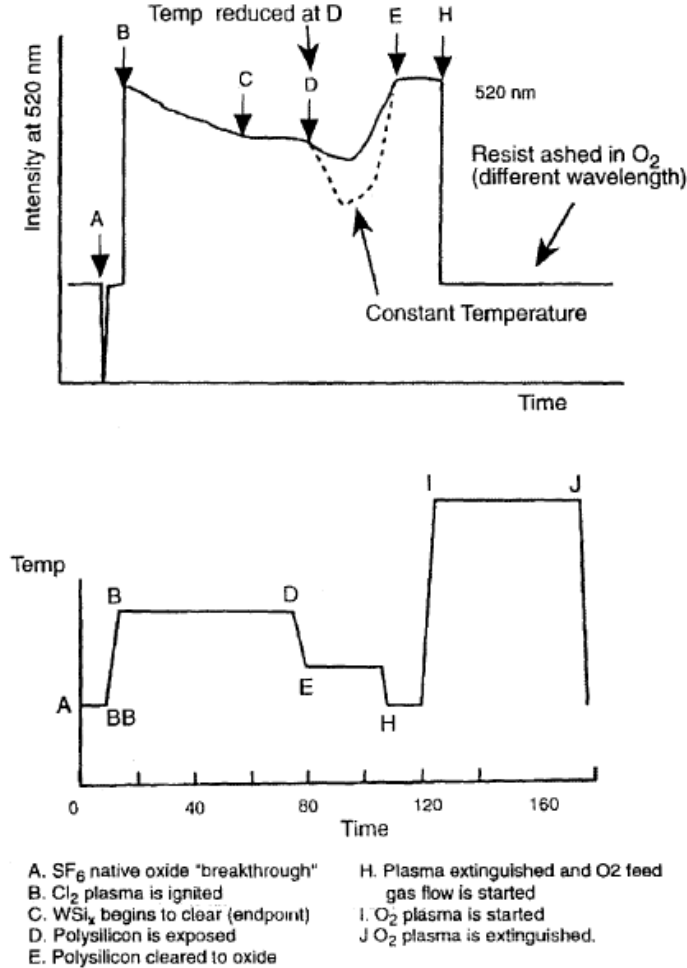


Fig. 10

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. *Id.* at 18:58–19:64. The plasma's optical emission at 530 nm 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 and 45–52.

*C. Illustrative Claim*

Of the challenged claims, only claim 13 is independent, and is reproduced below:

13. A method of etching a substrate in the manufacture of a device, the method comprising:
- placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;
  - setting the substrate holder to a selected first substrate holder temperature with a heat transfer device;
  - etching a first portion of the film while the substrate holder is at the selected first substrate holder temperature;
  - with the heat transfer device, changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and
  - etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;
- wherein the thermal mass of the substrate holder is selected for a predetermined temperature change within a specific interval of time during processing; the predetermined temperature change comprises the change from the selected first substrate holder temperature to the selected second substrate holder temperature, and the specified time interval comprises the time for changing from the selected first substrate holder temperature to the selected second substrate holder temperature.

Ex. 1001, 20:50–21:10.

*D. Asserted Grounds of Unpatentability*

Lam challenges claims 13–26, 64, and 65 of the '264 patent on the asserted grounds of unpatentability set forth in the table below. Pet. 6.

| <b>References</b>                           | <b>Basis<sup>1</sup></b> | <b>Challenged Claim(s)</b> |
|---------------------------------------------|--------------------------|----------------------------|
| Tegal <sup>2</sup> , Matsumura <sup>3</sup> | § 103(a)                 | 13, 15, 16, 18–21, 64, 65  |
| Tegal, Matsumura, Thomas <sup>4</sup>       | § 103(a)                 | 14                         |
| Tegal, Matsumura, Narita <sup>5</sup>       | § 103(a)                 | 17                         |
| Hwang <sup>6</sup> , Tegal, Matsumura       | § 103(a)                 | 22                         |
| Tegal, Matsumura, Collins <sup>7</sup>      | § 103(a)                 | 23, 24                     |
| Tegal, Matsumura, Mahawili <sup>8</sup>     | § 103(a)                 | 25, 26                     |

Lam asserts that all references are prior art to the '264 patent under 35 U.S.C. § 102(b) (Pet. 5); Flamm does not, at this stage of the proceeding, challenge the prior art status of any reference.

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<sup>1</sup> The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, took effect on March 16, 2013. Because the application from which the '264 patent issued was filed before that date, our citations to Title 35 are to its pre-AIA version.

<sup>2</sup> EP 0 399 676 A1 (Nov. 28, 1990) (Ex. 1002).

<sup>3</sup> U.S. Patent 5,151,871 (Sept. 29, 1992) (Ex. 1003).

<sup>4</sup> U.S. Patent 4,680,086 (July 14, 1987) (Ex. 1005).

<sup>5</sup> U.S. Patent 4,913,790 (Apr. 3, 1990) (Ex. 1004).

<sup>6</sup> U.S. Patent 5,174,856 (Dec. 29, 1992) (Ex. 1006).

<sup>7</sup> EP 0 601 788 A2 (June 15, 1994) (Ex. 1007).

<sup>8</sup> U.S. Patent 5,059,770 (Oct. 22, 1991) (Ex. 1008).

## II. ANALYSIS

### A. Claim Construction

#### 1. Claim Construction Standard

Before proceeding with claim construction, we must determine the proper standard of construction to apply. Lam contends that the claims of the '264 patent should be given their broadest reasonable construction. Pet. 9–10. That standard, however, is applicable only to unexpired patents. See 37 C.F.R. § 42.100(b) (“A claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.”).

The term of a patent grant begins on the date on which the patent issues and ends 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) (2002). 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, thus, expired no later than December 4, 2015.

Because, on this record, we conclude that the term of the '264 patent expired subsequent to the filing of the Petition and the Preliminary Response, but prior to the end of the preliminary stage<sup>9</sup> of an *inter partes*

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<sup>9</sup> 37 C.F.R. § 42.2 (“*Preliminary Proceeding* begins with the filing of a

review, for purposes of this Decision we construe the claims of the '264 patent under the standard applicable to expired patents. For claims of an expired patent, the Board's 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*, 415 F.3d at 1312–17). 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).

## 2. *Disputed Claim Terms*

In its Preliminary Response, Flamm points out that the Petition proposes constructions of claim terms based on the broadest reasonable interpretation, and therefore is "unfounded." Prelim. Resp. 3. Flamm does not identify, however, how the construction of any disputed term would be different under the broadest reasonable interpretation standard, as opposed to the standard for expired patents. Nor do we discern the construction of the terms to be different under the two standards. To the extent Flamm is arguing that Lam's Petition should be denied simply for using the incorrect claim construction standard, we decline to do so.

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petition for instituting a trial and ends with a written decision as to whether a trial will be instituted.")

Lam proffers constructions for several claim terms: *selected thermal mass*, *portion of the film*, *specified time interval*, and *etching at least one of the portions of the file comprises radiation*. Pet. 10–15. Of these terms, Flamm only disputes with particularity the construction of *selected thermal mass*. Prelim. Resp. 4–5. For the purposes of this Decision, only this disputed term requires construction.

### 3. *Selected Thermal Mass*

Claim 13 requires that the substrate holder “hav[e] a *selected thermal mass* . . . wherein the *thermal mass* of the substrate holder is *selected* for a predetermined temperature change within a specific interval of time.” As Lam correctly notes, the specification of the ’264 patent does not disclose how the thermal mass of the substrate holder is selected, and makes only passing reference to the thermal mass being “low.” Pet. 10. For instance, the specification states that “[i]n a specific embodiment, the upper surface [of the substrate holder] is made using a low thermal mass, high conductivity material.” Ex. 1001, 15:43–45. The Summary of the Invention also states that the substrate holder has a “low thermal mass” as compared to the thermal capacity of the fluid that circulates through the substrate holder, in order to “permit[] maintaining the workpiece at a substantially uniform temperature.” *Id.* at 2:37–46. The specification does not describe how one of ordinary skill in the art is to select the thermal mass of the substrate holder “for a predetermined temperature change within a specific interval of time,” as required by claim 13.

Given the specification’s relative silence on *selected thermal mass*, Lam asserts that a person of ordinary skill in the art would have understood

that the “thermal mass” of an object is the “measure of the amount of heat required to produce a particular temperature change in that object.” Pet. 11. Relying on the testimony of its declarant, Dr. Joseph L. Cecchi, Lam asserts that the thermal mass of an object is proportional to both the object’s specific heat, and the mass of the object. *Id.* (citing Ex. 1009 ¶¶ 58–59). A person of ordinary skill in the art, according to Lam, would have understood *selected thermal mass* to mean selecting the specific heat of the substrate holder, its mass, or both. *Id.*

Flamm argues that Lam’s proposed construction reads the word “thermal” out of the claim, as it would permit the claim to be satisfied by a substrate holder having a selected mass, independent of its thermal properties. Prelim. Resp. 5. Flamm proposes that the plain and ordinary meaning of *thermal mass* is “the product of the specific heat capacity of the material of the body and the mass of the body,” and recognizes that this is consistent with the definition set forth by Dr. Cecchi. *Id.* Flamm concludes that *selected thermal mass* means “the selected product of the specific heat capacity of the material of the body and the mass of the body.” *Id.*

On the record before us, we cannot discern any material distinction between the parties’ claim construction positions. Flamm recognizes that its definition of thermal mass is consistent with that of Dr. Cecchi. The crux of Flamm’s objection appears to be that Lam’s proposed construction would permit *selected thermal mass* to be met by selecting the mass of an object without regard to the effect of that selection on the thermal mass. Prelim. Resp. 5 (“the selection of the ‘mass’ or ‘material’ of a substrate holder could be made independent of the thermal properties thereof”). We do not

interpret Lam’s construction in this manner, but believe Flamm’s objections are addressed by making explicit the link between thermal mass and the object’s mass and material. To that end, we construe *selected thermal mass* as “thermal mass selected by selecting the mass of the substrate holder, the material of the substrate holder, or both.”

*B. Obviousness Over Tegal and Matsumura*

Lam contends that claims 13, 15, 16, 18–21, 64, and 65 are unpatentable under 35 U.S.C. § 103(a), as they would have been obvious over the combined disclosures of Tegal and Matsumura. Pet. 16–37. Lam explains how the combined references teach the subject matter of each challenged claim and asserts that a person of ordinary skill in the art would have had reason to combine or modify the references. *Id.* Lam also relies upon the Declaration of Dr. Cecchi (Ex. 1009) to support its positions.

Tegal “relates to plasma etch processes for the manufacture of semiconductor wafers . . . .” Ex. 1002, 1:4–5. Figure 1, below, is a schematic of an embodiment for etching a silicon oxide layer at two temperatures in the same chamber.

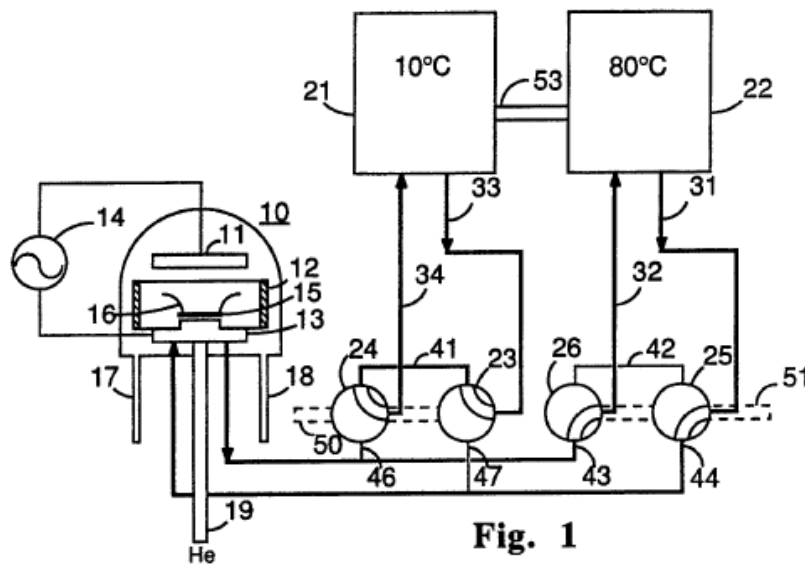


Figure 1 depicts plasma reactor 10 with a chamber having a substrate (wafer 15) on a substrate holder (electrode 13 with plurality of tines 16). *Id.* at 2:52–3:7. The plasma reactor “performs different types of etch, requiring different temperatures, in a single reactor” on the substrate. *Id.* at 1:43–48. For example, “a tapered etch can be performed in oxide through a patterned photoresist” by a first etching at 80°C for an isotropic etch, followed by a second etching at 10°C–40°C for an anisotropic etch. *Id.* at 5:5–45.

Figure 1 also depicts a system for controlling the temperature of the substrate holder, in the form of two reservoirs of water maintained at 10°C and 80°C. The 10°C and 80°C waters are mixed, using taps 47 and 44, and delivered to the substrate holder (electrode 13 with plurality of tines 16) at the desired temperature. The return water from the substrate holder is recirculated back to the reservoirs, remixed with hot or cold water to the desired temperature, and recirculated to the substrate holder. The valves “may be individually actuated electronically.” *Id.* at 3:36–4:32.

Tegal discloses that changing the temperature of the substrate requires more than heating or cooling the substrate; the temperature of the plumbing connecting the substrate holder with the source of fluid must also be raised or lowered. *Id.* at 3:44–49. Tegal addresses this by locating valves 23–26 “as closely as possible to” the substrate holder, so that only conduits 46, 47, 43, and 44 and electrode/substrate holder 13 must change temperature. *Id.* at 3:50–52; 4:44–46. Furthermore, Tegal discloses that “[b]y reducing the mass of these means, the time for the temperature change is reduced.” *Id.* at 46–48.

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.” Ex. 1003, 2:60–65. Matsumura envisions applying the method to plasma etching when Matsumura states that while “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, CVD, etching and ashing processes.” *Id.* at 10:3–7.

### *1. The Parties’ Positions*

Our analysis focuses on the parties’ arguments regarding *selected thermal mass*, as we find them dispositive to Lam’s Petition. Lam argues that Tegal discloses selecting the thermal mass of the substrate holder, in particular selecting the mass of the substrate holder to “reduce the time for temperature change” as described above. Pet. 16–17. According to Lam, this is “for a predetermined temperature change,” as Tegal discloses

changing the temperature from 80°C to 40°C. Pet. 22 (citing Ex. 1002, 5:32–41).

Furthermore, Lam asserts that Matsumura discloses making a temperature change “within a specific interval of time,” because its “predetermined recipe[s]” are for heating or cooling an object over a predetermined period of time. Pet. 22–23 (citing Ex. 1003, 3:1–7). Lam argues that a person of ordinary skill in the art at the time of the invention would have had reason to use the Matsumura control system, including its recipes, in the Tegal substrate holder, to improve the flexibility of the Tegal system. *Id.* at 35–36.

Flamm raises several arguments in response. First, Flamm argues that Lam improperly divides up the claim elements, reducing *wherein the thermal mass of the substrate holder is selected for a predetermined temperature change within a specific interval of time during processing* into three elements: 1) *wherein the thermal mass of the substrate holder is selected*; 2) *for a predetermined temperature change*; and 3) *within a specific interval of time during processing*. Prelim. Resp. 9–10. Second, Flamm contends that Tegal does not disclose *selecting the thermal mass* because the reduction of the mass of the “means” in Tegal has nothing to do with reducing the thermal mass of these means. *Id.* at 11–12. Furthermore, Flamm argues, this portion of Tegal does not disclose selecting the thermal mass *for a predetermined temperature change*, as required by the claims. *Id.* at 13–14.

## 2. Analysis

At the outset, we agree with Flamm that Lam’s analysis improperly breaks the elements of claim 13 into small phrases, and then attempts to match disclosures from the prior art to those phrases taken out of context. In particular, we note that claim 13 requires that the thermal mass of the substrate holder is selected *for* a predetermined temperature change *within* a specific interval of time during processing. The claim language requires that these phrases are interdependent, and cannot be parsed into separate elements met individually. In other words, the thermal mass must be selected in order to undergo a predetermined temperature change within a specific interval of time (for example, a change of 10°C per minute). Lam’s analysis is deficient, to the extent it separates *predetermined temperature change* from *specific interval of time* and analyzes each separately.

Tegal discloses selecting the mass—and, by extension, the thermal mass—of its conduits and substrate holder only in the sense that it advocates *reducing* the mass of these means in order to achieve a reduced time to change their temperature. See Ex. 1002, 4:46–48. This is no more a *specific interval of time* than “faster” is a specific interval of time. Tegal does not, on this record, disclose any selection of the mass<sup>10</sup> of the substrate holder in order to ensure that the substrate holder changes a specific temperature over a discrete period of time. Nor is Matsumura sufficient to meet this element of the claims, as Matsumura does not disclose selecting the thermal mass of the substrate holder at all.

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<sup>10</sup> Lam does not argue that Tegal teaches selecting the material of the substrate holder, only its mass.

We do not find Dr. Cecchi's testimony on these issues (Ex. 1009 ¶¶ 73, 81–83) to be persuasive. Dr. Cecchi's analysis mirrors that set forth in the Petition, and also breaks up the elements of the claims into phrases that are then analyzed out of context. For these reasons, we do not credit his testimony that Tegal and Matsumura teach all of the limitations of claim 13.

As we have found that the combined teachings of Tegal and Matsumura fail to disclose that the *thermal mass of the substrate holder is selected for a predetermined temperature change within a specific interval of time during processing*, we are unpersuaded that the record sufficiently establishes that Lam would prevail in demonstrating the unpatentability of claim 13 over these references. We reach the same conclusion with respect to dependent claims 15, 16, 18–21, 64, and 65, which also contain the same claim limitation. We, therefore, decline to institute trial on this ground of unpatentability.

### *C. Remaining Grounds of Unpatentability*

Lam presents several other grounds of unpatentability under section 103(a), each of which is based on the combined disclosures of Tegal and Matsumura with other references. Pet. 6. None of these asserted obviousness grounds, however, rely on any disclosures other than Tegal and Matsumura to meet the thermal mass limitation of claim 13 discussed in the preceding section. *See, e.g., id.* at 45–46 (claim chart for Hwang, Tegal, and Matsumura ground relies only on Tegal for thermal mass limitations). We, therefore, are not persuaded that any of the additional references remedy the deficiency in the combined disclosures of Tegal and Matsumura identified

above. Accordingly, we deny institution of trial on these grounds, as Lam has not demonstrated a reasonable likelihood of prevailing.

### III. CONCLUSION

For the foregoing reasons, we conclude that the information presented in the Petition and Preliminary Response does not establish that there is a reasonable likelihood that Lam will prevail in challenging claims 13–26, 64, and 65 of the '264 patent as unpatentable under § 103(a).

### IV. ORDER

In consideration of the foregoing, it is hereby ordered that the Petition is *denied*.

IPR2015-01759  
Patent RE 40,264 E

For PETITIONER:

Michael R. Fleming  
Samuel K. Lu  
Irell & Manella LLP  
mfleming@irell.com  
slu@irell.com  
LamFlammIPR@irell.com

For PATENT OWNER:

Christopher Frerking  
chris@ntknet.com

George C. Summerfield  
summerfield@stadheimgear.com