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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* TAKESHI KADONO and KAZUNARI KURITA

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Appeal 2019-000764  
Application 14/442,367  
Technology Center 2800

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Before RAE LYNN P. GUEST, DEBRA L. DENNETT, and  
LILAN REN, *Administrative Patent Judges*.

REN, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>1</sup> appeals from the Examiner's decision to reject claims 7, 8, 10–13, and 16. Final Act. 1. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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<sup>1</sup> We use the word “Appellant” to refer to “[A]pplicant” as defined in 37 C.F.R. § 1.42(a). Appellant identifies the real party in interest as “SUMCO Corporation.” Appeal Br. 1.

### RELATED APPEALS

Appellant provides related appeals for U.S. Patent Application No. 14/442,373 and U.S. Patent Application No. 14/442,355. Appeal Br. 2.

We rendered a decision for U.S. Patent Application No. 14/442,373 affirming the Examiner's decision on October 24, 2019.

We rendered a decision for U.S. Patent Application No. 14/442,355 affirming the Examiner's decision on October 24, 2019.

### CLAIMED SUBJECT MATTER

The claims are directed to “a method of producing a semiconductor epitaxial wafer, which . . . can suppress metal contamination by achieving higher gettering capability[.]” Spec. ¶ 1. Claim 7, reproduced below, is illustrative of the claimed subject matter:

7. A semiconductor epitaxial wafer, comprising:  
a semiconductor wafer; a modifying layer formed from a certain element contained as a solid solution in the semiconductor wafer, the modifying layer being formed in a surface portion of the semiconductor wafer; and an epitaxial layer on the modifying layer,  
*wherein a half width of a concentration profile of the certain element in a depth direction of the modifying layer is 100 nm or less, and a haze level of a surface portion of the epitaxial layer is 0.30 ppm or less.*

Claims Appendix (Appeal Br. 16) (emphasis added).

### REFERENCES

The prior art references relied upon by the Examiner in rejecting the claims on appeal are:

Name	Reference	Date
Glaysia	US 2009/0206270 A1	Aug. 20, 2009
Ishibashi	US 2012/0090536 A1	Apr. 19, 2012
Asayama	JP2010-040864 (as translated)	Feb. 18, 2010

### REJECTIONS

Claims 7–8 and 10–13 are rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph. Final Act. 3. We note that the Examiner rejects claims 8 and 10–13 “because they depend on the rejected claim 7.” *Id.* at 4. Although claim 16 is not explicitly rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, because claim 16 also depends from claim 7, we consider claim 16 similarly rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph. *See id.*

Claims 7, 8, 10–12, and 16 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Asayama in view of Ishibashi. Final Act. 5; Ans. 2.

Claim 13 is rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Asayama and Ishibashi, and further in view of Glaysia. Final Act. 7.

OPINION

*Indefiniteness Rejection of Claim 7<sup>2</sup>*

We review the appealed indefiniteness rejection for error based upon the issues identified by Appellant and in light of the arguments and evidence produced thereon. *Cf. Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (“[I]t has long been the Board’s practice to require an applicant to identify the alleged error in the examiner’s rejections”). After having considered the evidence presented in this Appeal and each of Appellant’s contentions, we are not persuaded that reversible error has been identified, and we affirm the Examiner’s indefiniteness rejection based on the arguments raised and the evidentiary record.

The Examiner rejects claim 7 as indefinite finding that the claim term “the half width of a concentration profile” is ambiguous rendering the scope of claim 7 unclear when read in light of the Specification. Final Act. 2–3, 4.

Appellant argues that the Examiner reversibly erred by giving “no weight” to the evidence in the record. Appeal Br. 5, 6. According to the Appellant, the evidence shows that a skilled artisan would have understood the term “half width of a concentration profile” to only mean “‘Full Width at Half Maximum’ or FWHM” — and not half width at half maximum (HWHM) of the concentration profile.<sup>3</sup> *Id.* at 5. Specifically, Appellant

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<sup>2</sup> Appellant does not present separate arguments for the indefiniteness rejection of claims 8, 10–13, and 16. *See* Appeal Br. 4–9. The indefiniteness rejection of claims 8, 10–13, and 16 therefore stands or falls with that of claim 7. *See* 37 C.F.R. § 41.37(c)(1)(iv) (2017).

<sup>3</sup> According to Appellant’s document titled “What is a Continuous Particle Size Distribution” (“document two” discussed in further detail *infra*),

argues that the Examiner gives no weight to a declaration (by Mr. Takeshi Kadono (“Declaration” or “Decl.”) who is one of the named inventors of the pending application) and three documents accompanying the Declaration.

The Examiner, on the other hand, reasons that, when read in light of the Specification, a skilled artisan would have reasonably understood the claim term to have multiple possible meanings. Ans. 2–3; *see also* Final Act. 4. Upon considering the evidence presented by Appellant (discussed in detail *infra*), the Examiner provides that a skilled artisan would have understood the recited “half width” to mean either FWHM or HWHM — or that the skilled artisan would not have excluded HWHM from the definition of “half width.” Ans. 2–3. The Examiner further states that a skilled artisan could also have reasonably understood “the half width of a concentration profile” to also mean half of the width of a concentration profile — such as half of the overall width of a Gaussian curve for a concentration distribution. Final Act. 4.

From the outset, we note that the Specification does not provide a definition of the term “half width of the concentration profile.” Ans. 2. The Specification also does not use the term “full width at half maximum” or “half width at half maximum.” *Id.* at 4. All that is provided in the Specification is that “‘the half width of the concentration profile of a certain element’ is a half width of the concentration profile of the certain element measured by SIMS, with the epitaxial layer being thinned to 1  $\mu\text{m}$

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FWHM or “the full width at half maximum . . . is obtained by drawing a horizontal line at 50% of the maximum and taking the difference between the two places it intersects the distribution[, e.g., the concentration profile as represented as a distribution].” Document two, p.1. HWHM, or “the half width at half maximum,” is half of the value of FWHM. *Id.*

considering the measurement accuracy if the thickness of the epitaxial layer exceeds 1  $\mu\text{m}$ .” Spec. ¶ 56.

In the Declaration, Mr. Kadono explains that the Specification as well as each of the three accompanying documents shows that “half width” means “full width at half maximum.” Decl. ¶¶ 5, 6.

With regard to the Specification, Mr. Kadono presents FIG. 5A<sup>4</sup> and states that the figure shows “the half width of the Carbon concentration is defined as a width at about  $1.5 \times 10^{19}$  atoms/cm<sup>3</sup>” and the half width is found to be 91 nm which satisfies the claim limitation of “100 nm or less.” Decl. ¶ 6.<sup>5</sup>

We are not persuaded by Appellant that the Examiner gives no weight to Mr. Kadono’s statement based on the Specification. Appeal Br. 6–7. As the Examiner points out, when read in light of the Specification (including FIG. 5A as well as other figures and the disclosure in its entirety), a skilled artisan would not have limited the scope of “the half width of a concentration profile” to full width at half maximum (FWHM) or excluded other alternative meanings such as half width at half maximum (HWHM) or half of the overall width of the concentration profile. Final Act. 2–3. We also note that one of the accompanying documents (document two discussed *supra*) discussed in the Declaration indicates that the half width at half

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<sup>4</sup> Also included on page 5 of in the Declaration is a separate figure titled “FIG 5.A” which is a figure similar to FIG. 5A but without the texts “Example 1 Cluster ion (C<sub>5</sub>H<sub>5</sub>)” and “Modifying Layer.” “FIG 5.A” additionally includes a call-out box for the peak showing a width of 91 nm. The Declaration does not explain the source of “FIG 5.A” which does not appear in the Specification.

<sup>5</sup> Mr. Kadono does not rely on “FIG 5.A” and does not provide how the value of 91 nm is reached. *See* Decl. ¶ 6.

maximum is half of the value of full width at half maximum, and, to the extent the skilled artisan would find, as Mr. Kadono did, a full width at half maximum of 91 nm, FIG. 5A would likewise support the claim limitation of “100 nm or less” at half width at half maximum, because half of 91 nm (or 45.5 nm) is also “100 nm or less.”

Moreover, the data in Table 1 includes the “half width” of various examples but does not unequivocally define the term to mean FWHM over any other meaning, namely HWHM or half of the overall width of the concentration profile. *See* Spec. 24, Table 1. Appellant’s statement that FIG. 5A shows the concentration profile of example 1 does not support Appellant’s position because FIG. 5A does not illustrate how the 91 nm value of Table 1 was calculated from FIG. 5A or inform us of the meaning of the “half width” value in the Table. Appellant has not shown that a skilled artisan would have understood FIG. 5A to mean that the recited “half width” necessarily means FWHM over any other meaning. Appellant’s attorney argument, not based on the evidentiary record, does not persuade us of reversible error.

With regard to document one, which is an excerpt from the International Union of Pure and Applied Chemistry (or IUPAC) Compendium of Chemical Terminology, 2nd Edition (1997), Mr. Kadono states that it “contains a definition of ‘half-width (of a band)’ as the ‘full width of a spectral band at a height equal to half of the height at the band maximum. Also known as full width at half maximum (FWHM).” Decl. ¶ 5. An image of the entirety of document one is reproduced below as Figure 1:

**half-width (of a band)**

The full width of a spectral band at a height equal to half of the height at the band maximum. Also known as full width at half maximum (FWHM). The dimension of band width should be either inverse length (wavenumbers) or inverse time (frequencies) so that the values give an indication of the energies. Note the hyphen in half-width. Half bandwidth has the meaning of half-width at half maximum.

1996, 68, 2245; see also O.B. 226

Figure 1. An image of the excerpt from the IUPAC Compendium of Chemical Terminology. Decl. ¶ 5.

The Examiner points out that document one does not support Appellant’s argument because the definition is for the “half-width (of a band)” — distinct from the phrase at issue which is “half width of the concentration profile.” Final Act. 2 (emphasis omitted). Although Mr. Kadono states that “[t]he ‘full width at half maximum’ value is a common term used to describe a distribution, such as in mass spectrometry, for example” (Decl. ¶ 5), Mr. Kadono does not explain how the recited limitation “half width of the concentration profile” relates to the “half-width (of a band)” in document one. Mr. Kadono also does not explain why the phrase “half width of the concentration profile” would have necessarily been understood by the skilled artisan to mean only “full width at half maximum.” In other words, Mr. Kadono’s statement that “[t]he ‘full width at half maximum’ value is a common term used to describe a distribution, such as in mass spectrometry” does not explain what the phrase “half width of a concentration profile” means to a skilled artisan when read in light of the Specification. Mr. Kadono’s opinion with regard to document one does not support Appellant’s argument that the recited “half width of a concentration

profile” means full width at half maximum and excludes all other meanings such as the half width at half maximum or half of the overall width. *See* Decl. ¶ 5 (stating only that “one of ordinary skill in the art would understand that ‘half width of the concentration profile’ refers to the ‘full width at half maximum’ of the concentration profile” without explaining how this opinion is evidenced by a different term, “half-width (of a band),” in document one).

Moreover, we note that document one in fact further provides “[h]alf bandwidth has the meaning of half-width at half maximum” (document one) contrasted with the “full width of a spectral band at a height equal to half of the height at the band maximum” which is “[a]lso known as full width at half maximum (FWHM).” Decl. ¶ 5 (citing document one). Rather than clarifying the meaning of “half width of the concentration profile,” document one provides further ambiguity by raising the similar sounding term “half bandwidth” with yet another possible meaning. We are therefore not persuaded that the Examiner reversibly erred in weighing the evidentiary value of document one or Mr. Kadono’s statement with regard to document one and finding that document one does not provide a clear and unequivocal definition of the recited limitation “half width of the concentration profile.”

Mr. Kadono states that document two, which is a “Brookhaven Instruments Corporation White Paper, . . . graphically shows the location of FWHM of a distribution.” Decl. ¶ 5. As the Examiner points out, although Mr. Kadono’s statement with regard to document two is correct, it does not support the argument that the skilled artisan would have understood the recited limitation of “half width of a concentration profile” to mean “full width at half maximum of the concentration profile.” Final Act. 2. The Examiner further points out that document two does not use the term “half

width” at all and in fact provides “HWHM, the half width at half maximum, is another measure of width.” Document two, p. 1; *see also* Final Act. 2; Ans. 3. We are therefore not persuaded that the Examiner reversibly erred in properly weighing the evidentiary value of document two or Mr. Kadono’s statement with regard to document two.

Mr. Kadono states that document three, which is a translation from a Japanese dictionary, provides that “‘half width’ means FWHM (Full width at half-maximum) in general.” Decl. ¶ 5. The Examiner points out, however, that the text of document three (provided in the Declaration) allegedly uses the terms “full width at half maxim” and “half width” in Japanese which is then translated into English. Final Act. 2. The Examiner notes that the record before us, to the extent it is an accurate translation, does not show that “half width” in Japanese is necessarily the same as “half width” in the English language in which claim 7 is written. Ans. 3.

Even if we were to take, as an established fact, that “‘half width’ means FWHM (Full width at half-maximum) in general,” at least in the Japanese language (Decl. ¶ 5), we are nonetheless unpersuaded that this supports Appellant’s argument that the recited “half width of the concentration profile” excludes other meanings such as the one given by the Examiner in light of the Specification (Final Act. 4) or a half width at half maximum of the concentration profile.

Appellant also presents a prior art reference, namely Patent No. 5,929,462 (“the ’462 Patent”), which uses “FWHM” to refer to “the half-width of the photoluminescence spectrum.” Appeal Br. 8–9 (citing ’462 Patent at 4:33). We note, however, that the ’462 Patent also uses the acronym “FWHM” to refer to “the half-width at half maximum.” ’462 Patent at 5:26–

29 (“Both the half-width at half maximum of the photoluminescence spectrum (FWHM) and the current density threshold were measured to evaluate the laser characteristics of the Semiconductor optical device **10**.”). Appellant does not explain why this statement in the ’462 Patent supports the argument that the recited “half width” is “known in the art as ‘Full Width at Half Maximum’ or FWHM[.]” Appeal Br. 8–9. The ’462 Patent is therefore not entirely consistent with the dictionary meaning provided by Appellant — further underscoring the Examiner’s finding that there are multiple reasonable meanings of the disputed term.

As the court states in *In re Morris*, 127 F.3d 1048, 1056 (Fed. Cir. 1997):

The appellants urge us to consult the specification and some of the cited prior art . . . and interpret the disputed language more narrowly in view thereof. When read in light of this material, according to applicants, the ‘true’ meaning of the phrase emerges. We decline to attempt to harmonize the applicants’ interpretation with the application and prior art. Such an approach puts the burden in the wrong place. It is the applicants’ burden to precisely define the invention, not the PTO’s. *See* 35 U.S.C. § 112, ¶ 2. . . . [T]his section puts the burden of precise claim drafting squarely on the applicant.

In this case, neither the Specification nor the evidence in the record before us supports Appellant’s argument to restrict the disputed term to only one reasonable definition. In analyzing this case, we are mindful of the “essential purpose of patent examination [which] is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative

process.” *In re Zletz*, 893 F.2d 319, 321–22 (Fed. Cir. 1989) (“During patent examination the pending claims must be interpreted as broadly as their terms reasonably allow. . . . The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed.”). “[I]f a claim is amenable to two or more plausible claim constructions, the USPTO is justified in requiring the applicant to more precisely define the metes and bounds of the claimed invention by holding the claim unpatentable under 35 U.S.C. § 112, second paragraph, as indefinite.” *Ex parte Miyazaki*, 89 USPQ2d 1207, 1211 (BPAI 2008) (precedential).

Based on the record before us including the Declaration and the accompanying documents — none of which shows that other possible definitions should be excluded or are unreasonable, we are not persuaded by Appellant that the Examiner reversibly erred by giving “no weight” (Appeal Br. 5, 6) to the Declaration and the accompanying documents. “[I]f a claim is amenable to two or more plausible claim constructions, the USPTO is justified in requiring the applicant to more precisely define the metes and bounds of the claimed invention by holding the claim unpatentable under 35 U.S.C. § 112, second paragraph, as indefinite.” *Ex parte Miyazaki*, 89 USPQ2d 1207, 1211 (BPAI 2008) (precedential). We accordingly sustain the Examiner’s indefiniteness rejection.

#### *Obviousness Rejections*

Review of the rejections under 35 U.S.C. § 103(a) would require considerable speculation as to the scope of the claims. Such speculation would not be appropriate. *In re Steele*, 305 F.2d 859, 862 (CCPA 1962) (“[W]e do not think a rejection under 35 U.S.C. § 103 should be based on

such speculations and assumptions.”). We, therefore, decline to reach the 35 U.S.C. § 103(a) rejections as a result of our affirmance of the indefiniteness rejection, and the ambiguous meaning of the phrase “half width of the concentration profile.”

### CONCLUSION

The Examiner’s indefiniteness rejection is affirmed.

In summary,

### DECISION SUMMARY

<b>Claims Rejected</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
7, 8, 10–13, 16	112(b) or 112 (pre-AIA), second paragraph	Indefiniteness	7, 8, 10–13, 16	
7, 8, 10–12, 16	103(a)	Asayama and Ishibashi	Not reached <sup>6</sup>	Not reached
13	103(a)	Asayama, Ishibashi, and Glayish	Not reached <sup>7</sup>	Not reached
<b>Overall Outcome</b>			7, 8, 10–13, 16	

### TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

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<sup>6,7</sup> As explained above, we do not reach this rejection. *Steele*, 305 F.2d at 862 (“[W]e do not think a rejection under 35 U.S.C. § 103 should be based on such speculations and assumptions.”).

Appeal 2019-000764  
Application 14/442,367

AFFIRMED