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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/612,926	02/03/2015	Hongqi Li	2269-11659.1(2012-0361.01	4911
63162	7590	03/12/2020	EXAMINER	
TRASK BRITT, P.C./ MICRON TECHNOLOGY			CULBERT, CHRISTOPHER A	
P.O. BOX 2550			ART UNIT	PAPER NUMBER
SALT LAKE CITY, UT 84110			2815	
			NOTIFICATION DATE	DELIVERY MODE
			03/12/2020	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte HONGQI LI, ANURAG JINDAL, and IRINA VASILYEVA

Appeal 2019-001024
Application 14/612,926
Technology Center 2800

Before JULIA HEANEY, DEBRA L. DENNETT, and
SHELDON M. McGEE, *Administrative Patent Judges*.

HEANEY, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE¹

Pursuant to 35 U.S.C. § 134(a), Appellant² appeals from the Examiner’s decision to reject claims 13–19 and 22, which constitute all the claims pending in this application. *See* Final Act. 1. Claims 1–12 have been

¹ In this Decision, we refer to the Specification dated February 3, 2015 (“Spec.”), the Final Office Action dated February 2, 2018 (“Final Act.”), the Appeal Brief dated May 2, 2018 (“Appeal Br.”), the Examiner’s Answer dated September 25, 2018 (“Ans.”), and the Reply Brief dated November 16, 2018 (“Reply Br.”).

² We use the word Appellant to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Micron Technology, Inc. Appeal Br. 1.

withdrawn. Claims 20 and 21 have been cancelled. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM-IN-PART.

CLAIMED SUBJECT MATTER

The subject matter on appeal relates to a semiconductor device having exposed conductive vias. Spec. ¶ 3. Claim 13, reproduced below, is the sole independent claim on appeal and illustrative of the claimed subject matter:

13. A semiconductor device, comprising: conductive vias extending through a thickness of a substrate, each of the conductive vias comprising an exposed surface proximate a backside surface of the substrate;

a barrier material laterally adjacent to portions of the conductive vias extending from the backside surface of the substrate, *wherein the barrier material forms recesses and extends over the backside surface of the substrate*, each recess being defined between adjacent conductive vias, and *wherein each recess has a different depth than a depth of an adjacent recess; and*

a self-planarizing isolation material disposed within each recess of the barrier material and on a side of at least a portion of the barrier material opposing the substrate, wherein at least one laterally extending portion of the barrier material proximate the substrate is exposed adjacent an associated conductive via of the conductive vias.

Appeal Br. 22 (Claims Appendix) (emphases added).

REFERENCES

The prior art relied upon by the Examiner is:

Name	Reference	Date
Henninger	US 2004/0031987 A1	Feb. 19, 2004
Lin	US 2010/0246152 A1	Sept. 30, 2010
LAI	US 2011/0175512 A1	July 21, 2011
Yang	US 2012/0083116 A1	Apr. 5, 2012

REJECTIONS

The Examiner maintains the following rejections on appeal:

1. Claims 13–19 and 22 are rejected under 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Final Act. 2.
2. Claims 13–16 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Applicant Admitted Prior Art (APA)³ in view of Yang. Final Act. 3.
3. Claims 17 and 18 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over APA in view of Yang and further in view of Lin. Final Act. 6.
4. Claim 19 is rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over APA in view of Yang and further in view of Henninger. Final Act. 6.

³ Spec. Figure 1E, ¶ 4. The Examiner refers to the publication of the Specification, US 2015/0145146 A1, dated May 28, 2015.

5. Claim 22 is rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over APA in view of Yang and further in view of Lai. Final Act. 7.

OPINION

Rejection 1: § 112, second paragraph

The Examiner determines that the rejected claims are indefinite because a person of ordinary skill in the art would not know how to determine whether a material can be characterized as a “self-planarizing isolation material.” Final Act. 2. The Examiner determines that “self-planarizing isolation material” is unclear because “[t]here is no explicit definition provided in the disclosure, applicant gives examples but there are no limits per se. At best the claim requires at formation the material to have ‘low viscosity’ a relative term without limit in the specification, but does not limit the end product (product by process).” *Id.* at 2–3. The Examiner explains that the term “self-planarizing isolation material” in a device claim is indefinite because a device in final form is already cured and therefore its material is no longer self-planarizing. Ans. 4.

Appellant argues that the Specification defines and explains the term “self-planarizing isolation material” such that a person of ordinary skill would readily understand what is claimed. Appeal Br. 7. Appellant relies on examples in the Specification of a “self-planarizing isolation material” and its properties. *Id.* at 8 (citing Spec. ¶¶ 25, 37). Appellant further argues that non-patent literature shows that “self-planarizing” when used in reference to materials is a term of art, and would readily be understood by one of

ordinary skill in the art. *Id.* at 9–10 (citing Lee,⁴ Matsuura⁵). Appellant further argues the fact that a self-planarizing material has been cured does not change a material from being capable of “self-planarizing.” Reply Br. 3.

In determining whether a claim is unpatentable under § 112, second paragraph, we look to whether a person of ordinary skill in the art would understand what is claimed when the claim is read in light of the Specification. *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576 (Fed. Cir. 1986); *In re Moore*, 439 F.2d 1232, 1235 (CCPA 1971) (“[T]he definiteness of the language employed must be analyzed—not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art.”).

Here, the Examiner’s reasoning that “self-planarizing isolation material” is indefinite because “there is no explicit definition provided in the disclosure” (Final Act. 2–3), and the final form of the device would have already been planarized by curing (Ans. 4.), demonstrates harmful error. An explicit definition is not required for a person of ordinary skill to understand the claim language in light of the Specification. Further, the fact that the Specification’s examples use the word “may” is not dispositive of how a person of ordinary skill in the art would understand what is claimed. In the context of the Specification, a person of ordinary skill would have

⁴ Sang-Joon John Lee et al., *Microfabrication for Microfluidics*, Integrated Microsystems Series, pp. 173–75 (2010). (“Lee”)

⁵ M. Matsuura et al., *A Highly Reliable Self-planarizing Low-k Intermetal Dielectric for Sub-quarter Micron Interconnects*, Tech. Digest of IEDM; pp. 785–88 (1997). (“Matsuura”)

understood that a “self-planarizing isolation material” is a material that is capable of “self-planarizing.” Accordingly, we reverse the rejection.

Rejections 2–5: § 103

The Examiner finds that APA teaches a semiconductor device comprising conductive vias, a barrier material forming recesses with each recess having a different depth than a depth of an adjacent recess, and an isolation material within each recess, as recited in claim 13. Final Act. 4–5. The Examiner finds that APA does not specifically teach that the isolation material is a self-planarizing isolation material, but finds that Yang teaches polyimide which is a self planarizing isolation material. *Id.* The Examiner determines that it would have been obvious to a person of ordinary skill in the art to have selected a self-planarizing material such as Yang’s polyimide, on the basis of its suitability for the intended use. *Id.* at 5.

Recesses

Appellant argues that while variations of substrate thickness in APA’s device may result in a recess having a different depth than an adjacent recess, APA does not teach that each of the recesses has a different depth than an adjacent recess. Appeal Br. 12. The Examiner responds that the term “recesses” as recited in claim 13 does not require every recess to have a different depth than an adjacent recess, but only that a subset of recesses have different depths. Ans. 5–6. Appellant’s argument does not persuasively identify error because the claim term “recesses” only requires two recesses even if there are additional recesses in the device. Therefore, “each recess” having “a different depth than a depth of an adjacent recess” refers to at least two adjacent recesses having different depths.

Self-Planarizing Isolation Material

Appellant argues that while Yang discloses that the dielectric layer can include polyimide, there is no disclosure that the dielectric layer is self-planarizing material. Appeal Br. 13. The Examiner responds by arguing paragraph 25 of the Specification identifies polyimide as an exemplary self-planarizing isolation material. Ans. 6. Appellant does not dispute that Yang discloses polyimide, and Appellant's argument does not persuasively identify error.

Accordingly, we affirm the rejection of claim 13.

Appellant does not separately argue any of the dependent claims, beyond repeating arguments discussed above for independent claim 13, except for claim 19. Claim 19 depends from claim 13 and additionally recites "an at least substantially conformal isolation material comprising silicon oxide interposed between the barrier material and the self-planarizing isolation material." Appeal Br. 23 (Claims Appendix).

The Examiner finds that APA does not specifically teach a conformal silicon oxide isolation material interposed between the barrier material and the self-planarizing material, but finds that Henninger teaches it was well known in the art to form a multilayer barrier material of silicon nitride and silicon oxide. Final Act. 6–7 (citing Henninger ¶ 115). The Examiner determines it would have been obvious to use Henninger's multilayer barrier material in the device of APA, on the basis of the multilayer barrier material's suitability for the intended use. *Id.* at 7. Appellant argues that while Henninger teaches a diffusion barrier that may be multilayered it does not teach a silicon oxide material disposed between the diffusion barrier layer and the self-planarizing isolation material. Appeal Br. 15–16. The

Examiner responds by arguing that Appellant does not provide any evidence refuting the combination of references presented in the Final Rejection. Ans. 8–9.

Appellant’s argument persuasively identifies harmful error because the Examiner’s proposed combination of APA, Yang, and Henninger does not teach or suggest a silicon oxide layer interposed between the barrier material and the self-planarizing isolation material. The Examiner’s proposed change is focused on modifying the barrier material of APA from a layer of silicon nitride to a multilayer. Final Act. 6–7. The end result of this modification would be a multilayer barrier material adjacent to the self-planarizing isolation material, but there would not be silicon oxide interposed between the multilayer barrier material and the self-planarizing isolation material, as required by claim 19. Accordingly, we reverse the rejection of claim 19.

CONCLUSION

The Examiner’s rejections are affirmed in part.

DECISION SUMMARY

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
13–19 and 22	112, second paragraph	Indefiniteness		13–19 and 22
13–16	103(a)	APA, Yang	13–16	
17–18	103(a)	APA, Yang, Lin	17–18	
19	103(a)	APA, Yang, Henninger		19
22	103(a)	APA, Yang, Lai	22	
Overall Outcome:			13–18 and 22	19

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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). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART