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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte AN-REN ZI and CHING-YU CHANG

Appeal 2019-000108
Application 15/019,836
Technology Center 1700

Before KAREN M. HASTINGS, RAE LYNN P. GUEST, DONNA M. PRAISS, *Administrative Patent Judges*.

PRAISS, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Pursuant to 35 U.S.C. § 134(a), Appellant[2] appeals from the Examiner's decision to reject claims 1–17 and 24–26. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

[1] In this Decision, we refer to the Specification filed Feb. 9, 2016 ("Spec."), the Final Office Action dated Sept. 27, 2017 ("Final Act."), the Appeal Brief filed Feb. 23, 2018 ("Appeal Br."), the Examiner's Answer dated Aug. 3, 2018 ("Ans."), and the Reply Brief filed Oct. 2, 2018 ("Reply Br.").

[2] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Taiwan Semiconductor Manufacturing Co., Ltd., is identified as the real party in interest. Appeal Br. 3.

STATEMENT OF THE CASE

The invention relates to a lithography method for manufacturing a semiconductor device. Spec. ¶ 11. Claims 1 and 9, reproduced below, are illustrative of the subject matter on appeal (disputed limitations italicized).

1. A method comprising:

forming a photoresist over a substrate, wherein the photoresist includes *an acid-labile group (ALG) bonded to a polymer backbone and to a polar unit such that the polar unit is acid-cleavable from the polymer backbone*;

exposing the photoresist to a radiation beam;

baking the photoresist, wherein at least one of the exposing and the baking cleaves the polar unit and the ALG from the polymer backbone within an exposed portion of the photoresist; and

performing a developing process to the photoresist.

9. A method comprising:

forming a photoresist over a substrate, wherein the photoresist includes *an acid-labile group (ALG) bonded to a photoresist backbone and bonded to a polarity switch unit*;

exposing the photoresist to a radiation beam to thereby increase the polarity of the polarity switch unit;

baking the photoresist, *whereby at least one of the exposing and the baking separates the ALG and the polarity switch unit from the photoresist backbone*; and

performing a developing process to the photoresist.

Appeal Br. 13, 14 (Claims Appendix).

ANALYSIS

We review the appealed rejections for error based upon the issues Appellant identifies, and in light of the arguments and evidence produced thereon. *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 considering the argued claims and each of Appellant's arguments, we are not persuaded of reversible error in the appealed rejections.

The Examiner rejects claims 1–17 and 24–26 under 35 U.S.C. § 103 as unpatentable over Nishi.[3] Final Act. 2–6.

Appellant separately argues the rejection of independent claims 1 and 9, and relies on arguments presented with respect to claim 1 for the rejection of independent claim 24. Appeal Br. 9–11. Therefore, in view of the lack of arguments directed to dependent claims 2–8, 10–17, and 24–26, claims 2–8 and 24–26 stand or fall with independent claim 1 and claims 10–17 stand or fall with independent claim 9. 37 C.F.R. § 41.37(c)(1)(iv). We separately address claims 1 and 9 below.

Claim 1

Appellant contends the Examiner erred in rejecting claim 1 over Nishi because the Examiner fails to explain how the prior art is being applied to the claim. Appeal Br. 8. Regarding the Examiner's finding that, when R^2 is, for example, an isopropyl group in Nishi's general formula (1) it forms an acid labile portion bonded to a polar lactone group (Final Act. 4–5), Appellant asserts that "Nishi does not disclose that the R^2 group **can** function as an ALG in the resin polymer." Appeal Br. 9. Appellant argues that even if Nishi's R^2 group could function as an ALG, Nishi "does not teach or suggest that the polar lactone group is acid-cleavable from a

[3] US 2003/0054289 A1, published Mar. 20, 2003.

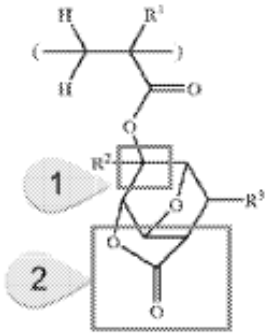
polymer backbone in any regard, much less that the photoresist includes an acid-labile group (ALG) bonded to a polymer backbone and to a polar unit such that the polar unit is acid-cleavable from the polymer backbone as recited in independent claim 1." *Id.* at 10.

The Examiner responds that the claim terms "acid-labile" and "acid-cleavable" have essentially identical meanings and are synonymous with "acid-dissociable," "acid sensitive," and "acid-decomposable." Ans. 3. The Examiner finds "acid-labile" and "acid-cleavable" mean these groups can be cleaved or removed where the tertiary carbon bond attaches to the carboxylic acid oxygen in the presence of an acid. *Id*. The Examiner finds that Nishi discloses in formula (1) a group which may be acid-cleavable depending on the definition of R^2. *Id.* at 6. Specifically, the Examiner finds that one skilled in the art would understand that when R^2 is a straight, branched, or cyclic alkyl group having 1 to 8 carbon atoms, as taught by Nishi as an option for formula (1), the polar unit is acid-cleavable from the polymer backbone at the tertiary carbon shown in formula (1). *Id.* at 4–5. The Examiner annotates Nishi's formula (1) as reproduced below in context with Nishi's paragraphs 7–9.

[0007] In a first aspect, the invention provides a polymer comprising recurring units of the following general formula

[0008] (1) and recurring units having a carboxylic acid protected with an acid-decomposable protecting group containing an adamantane structure or tetracyclo [4.4.0.1^{2,5}.1^{7,10}]dodecane structure, the polymer having a weight average molecular weight of 1,000 to 500,000.

(1)



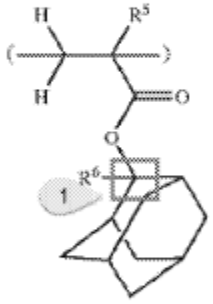
[0009] Herein R^1 is hydrogen or methyl, R^2 is hydrogen or a straight, branched or cyclic alkyl group having 1 to 8 carbon atoms, R^3 is hydrogen or CO_2R^4, and R^4 is a straight, branched or cyclic alkyl group having 1 to 15 carbon atoms.

Nishi's formula (1) above is annotated with bubble 1 pointing to an acid-labile tertiary carbon group and bubble 2 pointing to a polar unit attached through the acid-labile carbon tertiary group to the polymer backbone. *Id.* at 4–5.

The Examiner also directs us to Nishi's paragraphs 18 and 19 annotated below. *Id.* at 5–6.

[0018] In the inventive polymers, the recurring units having a carboxylic acid protected with an acid-decomposable protecting group containing an adamantane structure or tetracyclo[4.4.0.$1^{2,5}$.$1^{7,10}$]dodecane structure are preferably units of at least one of the following general formulae (2) to (4):

(2)

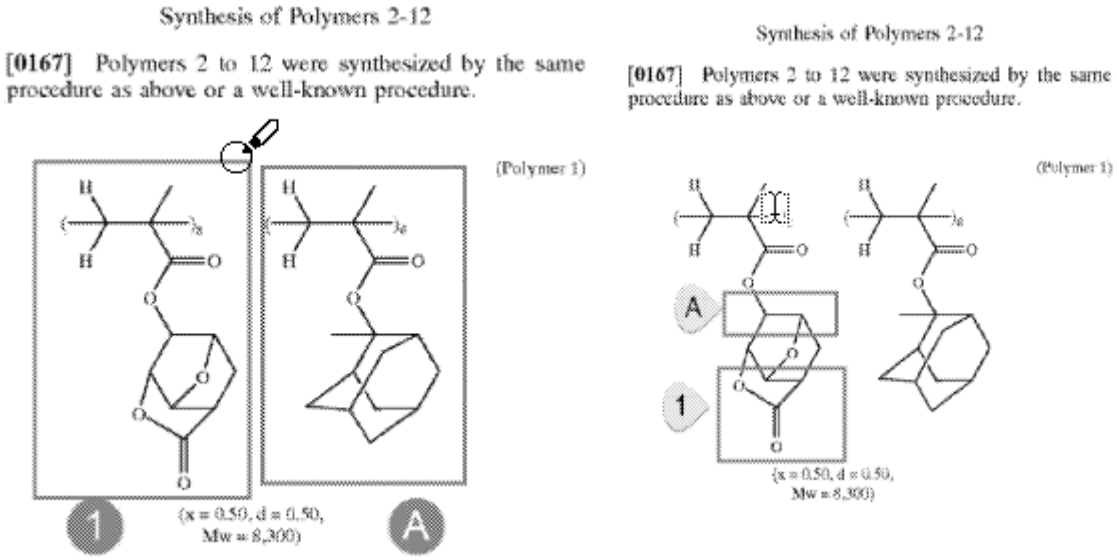


[0019] Herein R^5, R^7 and R^{10} each are hydrogen or methyl. R^6, R^9, $R^{9'}$ and $R^{10'}$ each are a straight, branched or cyclic alkyl group having 1 to 15 carbon atoms, examples of which are as enumerated for R^4.

Annotated paragraphs 18 and 19 depict general formula (2) highlighting the location and definition of variable R^6, also as optionally being "a straight, branched or cyclic alkyl group," that would render the attached carbon a tertiary carbon. Thus, the Examiner finds the definition of R^6 is similar to that of R^2 and in the same position as R^2 in formula (1). *Id.* at 5. The Examiner finds that Nishi discloses in paragraphs 18 and 19 an "acid-decomposable protecting group containing an adamantine structure," therefore, this demonstrates that the tertiary carbon group (bubble 1) attached to the carboxyl's oxygen is known to be acid-labile and/or acid-decomposible. *Id.* at 6.

Regarding claim 1's requirement that the "acid-labile group (ALG) [is] bonded to a polymer backbone and to a polar unit such that the polar unit is acid cleavable from the polymer backbone," the Examiner finds that Nishi discloses the claimed structure regardless of whether the claim requires that

the polar unit is on the same or a separate repeating unit on the polymer backbone. *Id.* at 6–8. The Examiner annotates Nishi's example polymer (1) in two ways as shown below.



In each of the annotated polymer (1) structures, the Examiner identifies the acid-labile group (ALG) with an "A" and the polar unit as "1." *Id.* at 7–8.

In the Reply Brief, Appellant contends that the Examiner takes Official Notice without documentary evidence as to whether a tertiary carbon group is known to be acid-cleavable, acid-labile, acid-dissociable and/or acid-decomposable. Reply Br. 7. Appellant asserts that this is not common knowledge in the art. *Id.* Appellant argues that the assertion the tertiary carbon bonded to R^2 in Nishi's general formula (1) itself being an acid-cleavable group is not supported by the definition of R^6 because "Nishi appears to suggest that the portion of each of general formulae (2)–(4) that is bonded to the carboxylic acid and that contains an adamantine structure—rather than a particular carbon atom alone—functions as an acid-decomposable protecting group." *Id.* at 8. Because Nishi's formula (1) does

not disclose any adamantine group, Appellant asserts that "Nishi does not explicitly disclose that general formula (1) includes any acid-decomposable group." *Id.* at 7.

Regarding the polar unit required by claim 1, Appellant does not dispute the Examiner's factual findings of a tertiary carbon and a polar group taught by Nishi, but, rather, argues that, absent evidence to support a tertiary carbon (when R^2 is an alkyl group) is known to be acid-cleavable, Nishi fails to teach or suggest a photoresist including an acid-labile group (ALG) bonded to a polymer backbone and to a polar unit as required by claim 1. *Id.* at 8–9.

Appellant's arguments do not persuade us that the Examiner reversibly erred in rejecting claim 1 as obvious over the teachings of Nishi. Specifically, we are not persuaded that the Examiner erred in finding that Nishi's disclosure in paragraphs 18 and 19 teaches or suggests that the structure of formula (2) is acid-decomposable due to the tertiary carbon component of the structure, which is also present in general formula (1) when R^2 is a straight, branched, or cyclic alkyl group. Appellant's assertion (Reply Br. 7) that the rejection is in error because Nishi does not "explicitly disclose that general formula (1) includes any acid-decomposable group" is not persuasive of error because an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim." *KSR Int'l Co. v. Teleflex, Inc.*, 440 U.S. 418 (2007). Moreover, Nishi discloses that there are a variety of acid labile groups including tertiary alkyl groups of 4 to 20 carbons. Nishi ¶ 35.[4]

[4] Indeed, Appellant's Specification identifies that an exemplary ALG "may include a bulky unit with a tertiary carbon as a good leaving group."

Appellant's argument (Reply Br. 8) that Nishi's disclosure of an acid-decomposable protecting group is limited to those containing an adamantine structure as depicted in general formulae (2)–(4) is not persuasive of error because Appellant does not adequately explain why one skilled in the art would understand the adamantine structure rather than the tertiary carbon itself being responsible for the acid-decomposable characteristic of general formula (2). In a determination of obviousness, a reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art. *Merck & Co. v. Biocraft Labs.*, 874 F.2d 804, 807 (Fed. Cir. 1989) ("That the [prior art] patent discloses a multitude of effective combinations does not render any particular formulation less obvious."). Moreover, "a reference is not limited to the disclosure of specific working examples." *In re Mills*, 470 F.2d 649, 651 (CCPA 1972) (citation omitted).

The preponderance of the evidence in this appeal record therefore supports the Examiner's conclusion that the claimed subject matter would have been obvious in view of Nishi. Accordingly, we affirm the Examiner's rejection of claim 1 under 35 U.S.C. § 103(a) over Nishi for the above reasons and those provided by the Examiner.

Because we find Appellant's arguments unpersuasive of error in the Examiner's rejection of claim 1 for the reasons discussed above, we likewise affirm the Examiner's rejection of claims 2–8 and 24–26 for the same reasons.

Spec. ¶ 15. This is consistent with the teachings of Nishi and the Examiner's finding that a tertiary carbon in formula (1) would fall within the scope of the clamed ALG.

Claim 9

Appellant contends that the Examiner erred in rejecting claim 9 because Nishi does not disclose any of the components of general formula (1) as a polarity switch unit. Appeal Br. 10–11.

The Examiner responds that Nishi discloses that the carbon bonded to the carboxyl oxygen becomes a tertiary carbon when R^2 is an alkyl group from formula (1) and an acid-labile group. Ans. 9. Referring to Nishi's polymer (1), the Examiner finds that when the acid-labile group is cleaved upon contact with an acid it leaves a carboxylic acid group and the polarity has switched from a hydrophobic group to a polar group. *Id.* at 9–10.

In the Reply Brief, Appellant asserts that the Examiner's finding is not supported that when R^2 is an alkyl group from formula (1), the carbon bonded to the carboxyl oxygen becomes a tertiary carbon and an acid-labile group (ALG). Reply Br. 10. Appellant also argues that the Examiner's annotated polymer (1) of Nishi identifying unit A as both the acid-labile group (ALG) and the polarity switch group fails to disclose the recited "the photoresist includes an acid-labile group (ALG) bonded to a photoresist backbone and bonded to a polarity switch unit" that "separates the ALG and the polarity switch unit from the polymer backbone." *Id.*

Appellant's arguments do not persuade us that the Examiner reversibly erred in rejecting claim 9 over the cited prior art references. Appellant does not dispute the Examiner's interpretation (Ans. 3) of acid-labile group. Nor does Appellant dispute the Examiner's interpretation of "acid-labile group (ALG) [being] bonded to [the] polymer backbone and to a polar unit such that the polar unit is acid cleavable from the polymer backbone." Appeal Br. 9. As discussed above in connection with claim 1, we

are not persuaded that Nishi fails to teach or suggest that when R^2 is an alkyl group from formula (1), the carbon bonded to the carboxyl oxygen becomes a tertiary carbon and an acid-labile group (ALG). Appellant's assertion that the acid-labile group (ALG) and the polarity switch group cannot both be located on unit A of Nishi's annotated polymer (1) does not adequately rebut the Examiner's finding (Ans. 9–10) that when the acid-labile group is cleaved upon contact with an acid it leaves a carboxylic acid group and the polarity has switched from a hydrophobic group to a polar group.

Accordingly, we affirm the Examiner's rejection of claim 9 under 35 U.S.C. § 103(a). Because we find Appellant's arguments unpersuasive of error in the Examiner's rejection of claim 9 for the reasons discussed above, we likewise affirm the Examiner's rejection of claims 10–17 for the same reasons.

CONCLUSION

For these reasons and those the Examiner provides, we uphold the Examiner's rejection of claims 1–17 and 24–26 under 35 U.S.C. § 103 as obvious over the cited prior art.

DECISION SUMMARY

In summary:

Claim(s) Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1–17, 24–26	103	Nishi	1–17, 24–26	

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).

AFFIRMED