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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/177,352	07/11/2005	Toshihiko Akahori	010777C	8679

38834 7590 02/06/2013
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EXAMINER
GEORGE, PATRICIA ANN

ART UNIT	PAPER NUMBER
1793	

NOTIFICATION DATE	DELIVERY MODE
02/06/2013	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte TOSHIHIKO AKAHORI, TORANOSUKE ASHIZAWA, KEIZO HIRAI, MIHO KURIHARA, MASATO YOSHIDA, and YASUSHI KURATA

Appeal 2011-012973
Application 11/177,352
Technology Center 1700

Before CHUNG K. PAK, CHARLES F.WARREN, and DEBORAH KATZ, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*

DECISION ON APPEAL

The named inventors (hereinafter "Appellants")[1] appeal under 35 U.S.C. § 134(a) from the Examiner's refusal to allow claims 1, 3, and 23 through 83, all of the claims pending in the above identified application.[2]

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[1] Appellants identify the real party in interest as "Hitachi Chemical Co., Ltd., by virtue of an assignment recorded in the U.S. Patent and Trademark Office on August 1, 2012, Frame 0819, in parent U.S. Patent Application Serial No. 09/856,491." (*See* Appeal Brief filed March 30, 2011 ("App. Br.") at 2.)

[2] Although the action appealed from was a non-final rejection, we have jurisdiction pursuant to 35 U.S.C. §§ 6 and 134 since the claims have been twice presented and rejected. *See Ex parte Lemoine,* 46 USPQ2d 1420,

An oral hearing was held on January 25, 2013. We have jurisdiction under 35 U.S.C. § 6(b).

STATEMENT OF THE CASE

The subject matter on appeal is directed to a method of polishing a substrate with a CMP (Chemical Mechanical Polishing) abrasive composition. (*See* Spec. 1, ll. 10-18.) This appealed subject matter is related to the subject matter in Appeal No. 2011-012892 (Application 11/407,195), which is directed to a set of two materials for forming the same CMP abrasive composition used in this case. Details of the appealed subject matter are recited in illustrative claims 1, 40, and 76 reproduced below from the "CLAIMS APPENDIX" in the Appeal Brief:

> 1. A method for polishing a substrate, comprising
>
> holding a substrate having formed thereon a film to be polished against a polishing pad of a polishing platen, wherein the substrate has formed thereon at least a silicon oxide film or a silicon nitride film, followed by
>
> pressing and moving the substrate and the polishing platen while supplying a CMP abrasive in between the film to be polished and the polishing pad to thereby polish the film to be polished;
>
> wherein the CMP abrasive is prepared by

1423 (BPAI 1994).

separately preparing

a cerium oxide slurry containing cerium oxide particles, a dispersant and water; and
a liquid additive for CMP abrasive consisting essentially of a dispersant and water; and

mixing, either at the time of the polishing or immediately before polishing, the cerium oxide slurry and the liquid additive for CMP abrasive;

wherein each dispersant is a polymer dispersant selected from the group consisting of a polymer containing ammonium acrylate as a copolymerized ingredient, a polyammonium-acrylate and a polyamine-acrylate.

40. The method of claim 1, wherein the cerium oxide slurry and the liquid additive are supplied onto the polishing platen separately during polishing, to be mixed on the polishing platen.

76. The method of claim 1, wherein mixing, either at the time of the polishing or immediately before polishing, the cerium oxide slurry and the liquid additive for CMP abrasive provides the CMP abrasive with an increased ratio of a rate of polishing a silicon oxide film to a rate of polishing a silicon nitride film.

(*See* App. Br. 22, 29, and 33 (Claims App'x).)

Appellants seek review of the Examiner's rejection of claims 1, 3, and 23 through 83 under 35 U.S.C. § 103(a) as unpatentable over Yoshida[3] in

[3] JP 10-106986 A published in the name of Yoshida et al. on April 24, 1998. Our reference to this Japanese publication is to the English machine

view of Danielson[4] maintained in the Answer.[5] (*See* Reply Brief filed July 27, 2011 ("Reply Br.") at 3; Examiner's Answer mailed May 27, 2011 ("Ans.") at 3-10; and App. Br. 5-6,)

DISCUSSION

Appellants do not dispute the Examiner's finding that Yoshida teaches a polishing method comprising holding a substrate having formed thereon [at least a silicon oxide film or a silicon nitride] film to be polished against a polishing pad of a polishing platen, . . . [and] pressing and moving the substrate and the polishing platen while supplying a CMP abrasive in between the film to be polished and the polishing pad." (*Compare* Ans. 4 *with* App. Br. 9-20 and Reply Br. 4-19). Nor do Appellants dispute the Examiner's finding that Yoshida teaches a CMP abrasive comprising a cerium oxide slurry containing cerium oxide particles, a dispersant, such as a polymer containing ammonium acrylate as a copolymerized ingredient, a polyammonium-acrylate, and a polyamine-acrylate. (*Compare* Ans. 4 *with* App. Br. 9-20 and Reply Br. 4-19). Rather, Appellants contend that neither Yoshida nor Danielson teaches or would have suggested "separately preparing a cerium oxide slurry containing cerium oxide particles, a dispersant and water; and a liquid additive for CMP abrasive consisting essentially of a dispersant and water; and mixing, either at the time of the

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translation of record.
[4] U.S. Patent 5,407,526 issued to Danielson et al. on April 18, 1995.
[5] Examiner's Answer mailed May 27, 2011 ("Ans.") at 3-10.

polishing or immediately before polishing, the cerium oxide slurry and the liquid additive for CMP abrasive" as required by the claims on appeal. (*See, e.g.*, App. Br. 9-19.)

Thus, the first critical question is:

Has the Examiner shown that one of ordinary skill in the art would have been led to "separately preparing a cerium oxide slurry containing cerium oxide particles, a dispersant and water; and a liquid additive for CMP abrasive consisting essentially of a dispersant and water; and mixing, either at the time of the polishing or immediately before polishing, the cerium oxide slurry and the liquid additive for CMP abrasive" with a reasonable expectation of successfully forming the same CMP abrasive composition taught by Yoshida? On this record, we answer this question in the affirmative.

As is apparent from Yoshida's Example, Yoshida teaches preparing a cerium oxide slurry containing particularly treated and sized cerium oxide particles, a dispersant and water as its CMP abrasive composition used in polishing semiconductor elements like the method recited in the claims on appeal. (Yoshida, ¶¶ 0017-0019.) Specifically, Yoshida teaches forming a cerium oxide slurry that employs particularly treated and sized cerium oxide particles, as well as the dispersant and water present in the cerium oxide slurry and liquid additive recited in the claims on appeal. (*Id.*) Once the CMP abrasive composition is formed, Yoshida teaches using it to polish a Si wafer having a SiO_2 insulator film. (Yoshida, ¶¶ 000019-0022.) Although

Yoshida does not mention the particular mixing sequence[6] recited in the claims on appeal in forming its CMP abrasive composition, we concur with the Examiner that one of ordinary skill in the art would have reasonably expected to form the same CMP abrasive composition taught by Yoshida regardless of the type of mixing sequences employed so long as the same ingredients are ultimately mixed to form a CMP abrasive composition containing the same ingredients in the same concentrations[7] for the same polishing purpose. *In re Longi*, 759 F.2d 887, 897 (Fed. Cir. 1985) ("[A] reasonable expectation of success, not absolute predictability" supports a conclusion of obviousness.); *see also In re Hampel*, 162 F.2d 483, 485 (CCPA 1947) ("There is nothing in the instant record which indicates that the particular order of steps produces results differing in any way from those which would be brought about if another order of steps were followed.");

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[6] The mixing sequence recited in the claims on appeal involves mixing cerium particles, a dispersant and water to form an initial cerium slurry, mixing portions of the same dispersant and water to form a liquid additive and then finally mixing the additional dispersant and water (identified as the liquid additive in the claims) to the initial cerium slurry containing the same dispersant and water to form the final cerium slurry taught by Yoshida for the purpose of polishing a semiconductor substrate.

[7] Claim 1 does not recite the amounts of cerium particles, a dispersant and water present in a cerium oxide slurry and the amount of the same dispersant and water present in the liquid additive that is used to dilute the cerium oxide slurry. In other words, the combined amounts of the dispersant and water present in the resulting cerium oxide slurry, i.e., the amounts of the dispersant and water in the CMP abrasive composition recited in claim 1, include the amounts of the dispersant and water present in the CMP abrasive composition exemplified by Yoshida.

In re Burhans, 154 F.2d 690, 692 (CCPA 1946) ("There is no merit in the point here [regarding Appellants' contention that the references do not teach his characteristic steps which are new in the art] in the absence of any proof in the record that the order of performing the steps produces any new and unexpected results.")

This is especially compelling in this case since the claims on appeal recite a CMP abrasive composition in a product-by-process format. *In re Hirao*, 535 F.2d 67, 69 (CCPA 1976) (When a claim recites a method of making a product in which one of the additives is defined by a process limitation, such additive is treated in the same manner as products in product-by-process claims.) As stated by our reviewing court in *In re Thorpe*, 777 F.2d 695, 697 (Fed. Cir. 1985):

> If the product in a product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.

As indicated *supra*, the CMP abrasive composition recited in the claims on appeal includes the CMP abrasive composition taught by Yoshino.

With respect to claims 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, and 74, Appellants separately argue that neither Yoshida nor Danielson teaches supplying a cerium slurry containing cerium particles, a dispersant, and water and a mixture containing additional dispersant and water onto a polishing platen during polishing for further mixing. (App. Br. 19-20.) This argument is not well taken. From the disclosure of Yoshida

discussed above, one of ordinary skill in the art would have had a reasonable expectation that the same CMP abrasive composition taught by Yoshida would be utilized by a polishing platen during polishing whether it is delivered in the form of a full mixture, i.e., a cerium slurry containing cerium particles, a dispersant and water onto a polishing platen, or it is delivered in the form of a combination of partial mixtures, e.g., a cerium slurry containing cerium particles and partial amounts of a dispersant and water and a mixture containing additional amounts of the same dispersant and water necessary for forming the CMP abrasive composition taught by Yoshida.

In addition, as correctly found by the Examiner at pages 8 and 18 of the Answer, Danielson teaches the importance of mixing CMP abrasive ingredients "at the point of use." (*See, e.g.*, Abstract, col. 2, ll. 2-10.) Danielson also teaches that "[t]he combination of point of use mixing and fluid velocity generated by the polishing device during polishing keeps the slurry from settling up or gelling." (col. 2, ll. 34-37). Thus, the collective teachings of Yoshida and Danielson would have at least led one of ordinary skill in the art to use a mixture containing additional dispersant and water in the point of use, i.e., a polishing platen (polishing device), to further inhibit the cerium particles in the slurry from settling.

Appellants contend that their "[S]pecification includes evidence showing the unexpected improvements in the properties of the presently claimed method of polishing a substrate over" Yoshida or Danielson. (App.

Br. 16.) In support of this contention, Appellants refer to Examples 1 through 10 and Comparative Examples 1 and 2 in Table 1 at pages 19 and 20 of the Specification. (App. Br. 16-18.) Appellants assert that the showing of unexpected results in the Specification is reasonably commensurate in scope with either claim 1 or claims 76 through 83. (App. Br. 19.)

Thus, the second critical question is:

Have Appellants demonstrated that the Specification evidence relied upon shows that the claimed subject matter as a whole imparts unexpected results relative to the closest prior art, Yoshida? On this record, we answer this question in the negative.

It is well settled that Appellants bear the burden of supplying sufficient factual evidence to show that the claimed invention as a whole imparts unexpected results. *In re Geisler,* 116 F.3d 1465, 1470 (Fed. Cir. 1997); *In re Freeman*, 474 F.2d 1318, 1324 (CCPA 1973); *In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972). That burden requires Appellants to show that the Specification evidence of unexpected results is derived from a comparison between the claimed subject matter and the closest prior art, namely Yoshida, and is reasonably commensurate in scope with the claimed subject matter. *See, e.g., In re Harris*, 409 F.3d 1339, 1344 (Fed. Cir. 2005) ("Even assuming that the results were unexpected, Harris needed to show results covering the scope of the claimed range. Alternatively Harris needed to narrow the claims."); *In re Baxter Travenol Labs.,* 952 F.2d 388, 392 (Fed. Cir. 1991) ("[W]hen unexpected results are used as evidence of

nonobviousness, the results must be shown to be unexpected compared with the closest prior art."); *In re Greenfield,* 571 F.2d 1185, 1189 (CCPA 1978) ("Establishing that one (or a small number of) species gives unexpected results is inadequate proof, for 'it is the view of this court that objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.'")

Here, as correctly found by the Examiner in the Answer, Appellants' reliance on the Specification evidence as demonstrating unexpected results over the closest prior art reference, Yoshida, is misplaced. While the Specification evidence may show that the claimed invention represented by Examples 1 through 10 imparts superior results over using aged CMP abrasive compositions in Comparative Examples 1 and 2, Appellants fail to direct us to any meaningful side-by-side comparison in which the inventive experiment is identical to Yoshida's Example, except for the novel mixing feature of the claimed invention. As indicated *supra*, Yoshida, like Appellants, exemplifies using its CMP abrasive composition for polishing a semiconductor substrate soon after it is formed. In other words, the closest prior art is the exemplified embodiment of Yoshida which combines individual ingredients to form its CMP abrasive composition just before it is used for polishing semiconductor elements. On this record, Appellants have not shown that the prolonged storage employed in Comparative Examples 1 and 2 would not materially affect the CMP composition taught by Yoshida in terms of sedimentation (not dispersed) of cerium particles in a slurry,

evaporation of the dispersant and/or water in the slurry, and contamination of the slurry. In other words, Appellants have not demonstrated that Comparative Examples 1 and 2 are comparable to the exemplified embodiment of Yoshida or are closer to the claimed invention than the exemplified embodiment of Yoshida.

Moreover, notwithstanding Appellants' arguments to the contrary at page 19 of the Appeal Brief, the showing in the Specification is not reasonably commensurate in scope with either claim 1 or claims 76 through 83. While the showing is limited to forming a few specifically prepared CMP abrasive compositions containing specific concentrations of specifically treated and sized cerium oxide particles, specific dispersants and water, claim 1 or claims 76 through 83 on appeal are not so limited. In this regard, we note that claims 1 and 76 through 83 do not recite the specific preparation, concentrations of ingredients, and specifically treated and sized cerium particles employed in the Specification to obtain asserted superior properties. The functional limitation "an increased ratio of a rate of polishing" recited in claims 76 through 83 does not limit their CMP abrasive composition to those which are said to provide specific unexpected properties in the Specification. On this record, Appellants have not shown that the properties applicable to the particularly prepared specific CMP abrasive compositions of Examples 1 through 10 in the Specification are applicable to those multifarious CMP abrasive compositions encompassed by the claims 1 and 76 through 83. The need for a showing that is

reasonably commensurate in scope with the claims on appeal is especially important in this case since Yoshida, at paragraphs 0004 to 0011 and 0017-0022, suggests that the concentrations of the ingredients, as well as the particularly treated and sized cerium particles, can affect the performance of a CMP abrasive composition in polishing a semiconductor substrate.

Accordingly, having fully considered and weighed the evidence of record advanced by the Examiner and Appellants, we determine that the weight of the evidence taken as a whole supports the Examiner's conclusion of obviousness within the meaning of 35 U.S.C. § 103(a).

SUMMARY

In view of the foregoing, the decision of the Examiner rejecting the claims on appeal is affirmed. However, since we rely on additional facts and reasoning materially different from those set forth in the Answer, we denominate our affirmance as including a new ground of rejection pursuant to 37 C.F.R. § 41.50(b).

This decision contains a new ground of rejection pursuant to 37 C.F.R. § 41.50(b). 37 C.F.R. § 41.50(b) provides "[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review."

37 C.F.R. § 41.50(b) also provides that the appellants, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new ground of rejection to

avoid termination of the appeal as to the rejected claims:

> (1) *Reopen prosecution*. Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner. . . .
>
> (2) *Request rehearing*. Request that the proceeding be reheard under § 41.52 by the Board upon the same record. . . .

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

AFFIRMED & 37 C.F.R. § 41.50(B)

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