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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte TAKAHIRO MIZUNO, SHUUGO YOKOTA,
YASUYUKI YAMATO, and TOMOHIKO AKATSUKA¹

Appeal 2017-003303
Application 13/818,058²
Technology Center 1700

Before ADRIENE LEPIANE HANLON, JEFFREY T. SMITH,
and MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

SMITH, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

This is an appeal under 35 U.S.C. § 134 from the final rejection of claims 1, 2, and 6–8.³ We have jurisdiction under 35 U.S.C. § 6.

Appellants' invention relates generally to polishing compositions for polishing silicon nitride, comprising colloidal silica on which a sulfonic acid is immobilized to the surface. (Spec. 2). Claim 1 illustrates the subject

¹ These are the names of the identified inventors of the appealed application.

² According to the Appeal Brief, the real party in interest is Fujimi Inc. *See* (App. Br. 3).

³ Claim 5 has been withdrawn from consideration. (Final Act. 2).

matter on appeal and is reproduced from the Claims Appendix to the principal Brief.

1. A polishing composition used in an application to polish silicon nitride, comprising
colloidal silica on which a sulfonic acid is immobilized to the surface, the colloidal silica on which a sulfonic acid is immobilized to the surface is obtained by coupling a silane coupling agent having a thiol group to colloidal silica, followed by oxidizing the thiol group, wherein the polishing composition has a pH of 6 or less, and wherein under a pH of 6 or less, the colloidal silica on which a sulfonic acid is immobilized to the surface has a zeta-potential opposite to that of the silicon nitride.

Appellants (*see generally* App. Br.) request review of the following rejections under 35 U.S.C. § 103(a):

- I. Claims 1, 2 and 6 rejected as unpatentable over the combined teachings of Kamimura (US 2010/0009538 A1, published: Jan. 4, 2010), Sun (US 7,044,836 B2, issued: May 16, 2006), Siddiqui (US 2008/0182485 A1, published: July 31, 2008) and Cano-Serrano et al. (*Sulfonic Acid functionalized silica through quantitative oxidation of thiol groups*, Chem. Comm. Issue 2, 246–247 (2003)).
- II. Claims 7 and 8 rejected as unpatentable over the combined teachings of Kamimura, Sun, Siddiqui, and Cano-Serrano, and Minamihaba (US 2006/0243702 A1, published: Nov. 2, 2006).
- III. Claim 7 rejected as unpatentable over the combined teachings of Kamimura, Sun, Siddiqui, and Cano-Serrano,

and Nakajo (US 2009/0267021 A1, published: Oct. 29, 2009).

- IV. Claims 1, 2 and 6 rejected as unpatentable over the combined teachings of Sun, Siddiqui, and Cano-Serrano.
- V. Claims 7 and 8 rejected as unpatentable over the combined teachings of Sun, Siddiqui, and Cano-Serrano, and Minamihaba.
- VI. Claim 7 rejected as unpatentable over the combined teachings of Sun, Siddiqui, and Cano-Serrano, and Nakajo.

OPINION⁴

After consideration of Appellants' arguments and evidence and the Examiner's position in the Final Office Action and Answer, we AFFIRM the obviousness determinations.

Upon consideration of the evidence in this appeal record in light of the respective positions advanced by the Examiner and Appellants, we determine that Appellants have not identified reversible error in the Examiner's determination that the subject matter recited in claims 1, 2, and

⁴ Appellants present arguments for independent claim 1. (App. Br. 7–17). Appellants do not present substantial arguments addressing dependent claims 2, and 6–8. (See generally App. Br.). We limit our discussion to independent claim 1 which we select as representative of the rejected claims. A discussion of Minamihaba and Nakajo are unnecessary for disposition of the present appeal.

6–8 would have been obvious to one of ordinary skill in the art within the meaning of 35 U.S.C. § 103(a). Accordingly, we sustain rejections I–VI.

The complete statement of the rejections on appeal appear in the Final Office Action. (Final Act. 2–14).

The Examiner found Kamimura describes a colloidal silica polishing composition used to polish silicon nitride that differs from the claimed invention by not describing the colloidal silica in which a sulfonic acid is immobilized. (Final Act. 2–3).

The Examiner found Sun describes a polishing composition that comprises colloidal silica bonded with a sulfonic acid further including an organic acid and coupling a silane compound. (Final Act. 3). Sun discloses the polishing compositions comprising metal oxide particles (silica) are colloidally stable over a wide pH range. (Sun Col. 1 ll. 56–58). Sun discloses the silane compound is preferably adhered to a portion of the metal oxide particle through covalent bonds. (Sun Col. 3 ll. 2–4). Sun further discloses the anionic polymer (sulfonic acid) can be adhered to the silane compound by covalent bonds. (Sun paragraph bridging Cols. 2–3). Sun discloses the polishing abrasive can have any suitable zeta potential. (Sun Col. 4 ll. 16–23).

The Examiner found Siddiqui discloses a polishing composition that comprises colloidal silica, a polymer having an immobilized stabilizer and chelating agent. (Final Act. 3–4). The Examiner also found Siddiqui describes adjusting the zeta potential of the polishing abrasive. (*Id.*; Siddiqui ¶ 10).

The Examiner found Cano-Serrano discloses a method of forming colloidal silica in which a sulfonic acid is immobilized is silica wherein the colloidal silica is obtained by coupling a silane coupling agent having a thiol group to silica followed by oxidizing the thiol group. (Final Act. 4–5).

The Examiner determined the combined teachings of Kamimura, Sun, Siddiqui, and Cano-Serrano would have rendered obvious the subject matter of independent claim 1. (Final Act. 2–14).

Rejections Based on Kamimura, Sun, Siddiqui, and Cano-Serrano

Appellants argue Kamimura does not teach a polishing composition where the polishing composition comprises colloidal silica as presently claimed and the additional references Sun, Siddiqui and Cano-Serrano do not remedy the deficiencies of Kamimura. (App. Br. 7–8, 11–14).

Appellants argue Kamimura does not teach the organic acid is immobilized on the surface of the colloidal silica. (App. Br. 11). This argument is not persuasive because the Examiner acknowledges Kamimura does not teach the organic acid is immobilized on the surface of the colloidal silica and relies on Sun, Siddiqui and Cano-Serrano for this teaching. (Final Act. 2–3).

Appellants argue Sun and Siddiqui disclose polishing compositions having surface-modified silica. However, Sun discloses that the polymers, which may include acid functional groups, are merely adhered to the surface of colloidal silica. Appellants further argue Sun’s polymers shield the charges on the silica particles. (App. Br. 11–12). In further support of the

arguments presented against Sun, Appellants rely on the Declaration of Yasuyuki Yamato. The Declarant states:

[I]t is clear that the polymer is adhered to the silane compound in Sun by a reaction between the functional groups of the polymer and the functional group of the silane compound to form a coating. Thus, the functional groups in Sun's polymers merely serve as anchors to the silane compound and are located within the resulting coating. In fact, Sun specifies that "[p]referably, the polymer is adhered to the silane compound through one or more electrostatic bonds." *Id.*, col. 4, lines 4-6. Sun's particles do not contain a colloidal silica particle on which to sulfonic acid is immobilized." (Yamato Declaration ¶ 7).

Appellants' arguments and statements presented in the Declaration are not persuasive of reversible error. According to the Specification:

The immobilization of an organic acid on the surface of colloidal silica in the polishing composition is carried out by chemically bonding a functional group of the organic acid to the surface of colloidal silica. The immobilization of an organic acid on colloidal silica cannot be achieved by only allowing colloidal silica and an organic acid to merely coexist. (Spec. 3).

The statements of the Declarant are based on portions of the Sun disclosure appearing in columns 2 and 3 which have been identified as optional or preferred embodiments. (Yamato Declaration ¶¶ 5-6). The Declarant has not explained how the reaction of the functional groups of the polymer and silane are different from what has been described in the Specification as the basis of creating immobilization. Sun also discloses the reaction can take place by using covalent bond. (Sun cols. 3-4). Furthermore, the Examiner relied on Siddiqui for describing the immobilization of sulfonic acid to colloidal silica.

Sun's discussion of shielding is directed to a possible theory that hypothesizes that the shielding is a result from the additional adhering of the polymer to a portion of the metal oxide particles—that is additional to adhering the polymer to the silane compound. (Col. 4, ll. 8–15). Sun discloses the shielding of the particles from agglomeration results in colloidal stability. Appellants have not established that the additional shielding properties renders the present invention patently distinct from the disclosure of Sun.

Appellants argue Siddiqui's teachings of adjusting the zeta potential of the abrasive particles and the layer to be polished are not suggestive of the opposite zeta potential, required by the claimed invention. (App. Br. 12–13). Appellants' argument is not persuasive. As set forth above, Sun in addition to Siddiqui discloses the suitability of adjusting the zeta potential. Appellants have failed to show that a person of ordinary skill in the art, based on the teachings of the cited prior art, would not have sufficient skill to adjust the zeta potential.

Appellants argue Cano-Serrano does not indicate that the sulfonic acid modified silica disclosed therein can be used in a polishing composition to achieve an increased rate of silicon nitride polishing. (App. Br. 8, 11).

The Examiner cited Cano-Serrano for disclosing recognized methods of forming colloidal silica in which a sulfonic acid is immobilized is silica wherein the colloidal silica is obtained by coupling a silane coupling agent having a thiol group to silica followed by oxidizing the thiol group. (Final Act. 4–5). Appellants have not directed us to any evidence showing that a person of ordinary skill in the art, based on the teachings of the cited prior art, would not have reasonably expected that colloidal silica in which a

sulfonic acid is immobilized would be suitable in polishing compositions. To the extent that the claimed polishing composition achieves an “increased” rate of silicon nitride polishing, Appellants do not direct our attention to adequate evidence of unexpected results. As explained by the Examiner, the showings from the Specification in the Declaration are insufficient to determine what is necessary to achieve the alleged unexpected results. (Ans. 20). It is not readily discernible from the present Specification the techniques which are utilized in forming the representative colloidal silica or the organic acid utilized in the type “B” composition.

Appellants argue “[e]ach of Sun, Siddiqui, and Cano-Serrano disclose different types of surface-modified silica.” Thus, Appellants conclude there is no motivation to combine the references and there is no reasonable expectation of success for combining the teachings of Kamimura, Sun, Siddiqui, and Cano-Serrano due to their contrary teachings. (App. Br. 14).

We are not persuaded by Appellants’ arguments. The prior art cited by the Examiner establishes it is recognized that colloidal silica in which a sulfonic acid is immobilized is suitable for polishing compositions. The cited prior art also establishes known techniques for forming colloidal silica in which a sulfonic acid is immobilized. As discussed above, Sun discloses that the colloidal silica can be formed by a variety of techniques, and Appellants do not explain, in any detail, how those techniques would have been expected to affect the ability to immobilize sulfonic acid thereon. Consequently, on this record, we find a person of ordinary skill in the art would have reasonably expected the recognized techniques for forming colloidal silica in which a sulfonic acid is immobilized would have been suitable for polishing compositions.

Rejections Based on Sun, Siddiqui, and Cano-Serrano

Appellants rely on substantially the same arguments when addressing the combination of Kamimura, Sun, Siddiqui and Cano-Serrano and the combination of, Sun, Siddiqui and Cano-Serrano. (App. Br. 6–15).

As stated above, the arguments presented against the combination of Kamimura, Sun, Siddiqui and Cano-Serrano were not found persuasive. Accordingly, we sustain the rejection of the claims over Sun, Siddiqui and Cano-Serrano for the reasons presented by the Examiner and given above.

For the reasons stated above, and the reasons presented by the Examiner, we sustain the rejections of claims 1, 2, and 6–8 under 35 U.S.C. § 103(a).

ORDER

The rejections of claims 1, 2, and 6–8 under 35 U.S.C. § 103(a) are affirmed.

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

AFFIRMED