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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte SANG UK RYU, DONG RYUL KIM, SEUNG LAC MA, JANG YEON HWANG, and JONG MIN MOON

Appeal 2019-006307
Application 14/554,984
Technology Center 1700

Before CATHERINE Q. TIMM, CHRISTOPHER C. KENNEDY, and JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant[1] requests our review under 35 U.S.C. § 134(a) of the Examiner's final rejection of claims 1, 2, 4–12, and 15–18.[2] We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We REVERSE.

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[1] We use the word "Appellant" to refer to the "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies LG CHEM, LTD. as the real party in interest. Appeal Brief filed January 28, 2019 ("Appeal Br.") at 2.

[2] Final Office Action entered April 27, 2018 ("Final Act.").

CLAIMED SUBJECT MATTER

Appellant claims a gas barrier film. Appeal Br. 6–8. Claim 1, the sole pending independent claim, illustrates the subject matter on appeal, and reads as follows:

> 1. A gas barrier film, comprising:
>
> an organic-inorganic hybrid coating layer comprising a cured product of a sol-type hydrolyzed composition containing tetraethoxy orthosilicate and 3-glycidoxypropyl-trimethoxysilane;
>
> an inorganic layer; and
>
> a protective coating layer including inorganic nanoparticles surface-modified with an organic silane, the layers being sequentially stacked on one surface or both surfaces of a base, wherein:
>
> the inorganic nanoparticles are at least one selected from the group consisting of alumina nanoparticles, zinc oxide nanoparticles, antimony oxide nanoparticles, titanium oxide nanoparticles, and zirconium oxide nanoparticles;
>
> the inorganic nanoparticles are spherical and have a diameter of 20 to 100 nm; and
>
> the organic silane is 3-glycidoxypropyltrimethoxysilane or a compound of Formula 1:
>
> [Formula l]
>
> $R^1{}_mSiX_{4-m}$
>
> wherein:
>
> X is the same as or different from each other, and each independently is hydrogen, halogen, an alkoxy group having 1 to 12 carbon atoms, an acyloxy group, an alkylcarbonyl group, an alkoxycarbonyl group, or $N(R^2)_2$ wherein R^2 is hydrogen or an alkyl group having 1 to 12 carbon atoms;
>
> R^1 is the same as or different from each other, and each independently represents an alkenyl group, an alkynyl group, an arylalkynyl group, an alkynylaryl group, or an alkylcarbonyl

> group, and has as a substituent an amino group, an amide group, an aldehyde group, a keto group, a carboxyl group, a mercapto group, a cyano group, a hydroxyl group, an alkoxy group having 1 to 12 carbon atoms, an alkoxycarbonyl group having 1 to 12 carbon atoms, a sulfonic acid, a phosphoric acid, an acryl group, a methacryl group, an epoxy group or a vinyl group; and
>
> m is an integer from 1 to 3.

Appeal Br. 27 (Claims App.).

REJECTION

The Examiner maintains the rejection of claims 1, 2, 4–12, and 15–18 under 35 U.S.C. § 103(a) as unpatentable over Lee[3] in view of Kim,[4] Kwon,[5] and Suzuki[6] in the Examiner's Answer entered June 24, 2019 ("Ans.").

FACTUAL FINDINGS AND ANALYSIS

Upon consideration of the evidence relied upon in this appeal and each of Appellant's contentions, we reverse the Examiner's rejection of claims 1, 2, 4–12, and 15–18 under 35 U.S.C. § 103(a), for the reasons set forth in the Appeal and Reply Briefs, and below.

We review appealed rejections for reversible error based on the arguments and evidence the Appellant provides for each issue the Appellant identifies. 37 C.F.R. § 41.37(c)(1)(iv); *Ex parte Frye*, 94 USPQ2d 1072,

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[3] Lee et al., KR 10-2009-0074998 A, published July 8, 2009. Appellant does not contest the Examiner's reliance in a machine translation of this reference, which the Examiner entered into the record on April 11, 2017, and also cited on a PTO-892 form entered April 11, 2017.
[4] Kim et al., US 2007/0267135 A1; published Nov. 22, 2007.
[5] Kwon et al., US 2012/0135216 A1; published May 31, 2012.
[6] Suzuki et al., US 2007/0207298 A1; published Sept. 6, 2007.

1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (explaining that even if the Examiner had failed to make a prima facie case, "it has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections")).

We need address only claim 1, the sole pending independent claim. Claim 1 requires the recited gas barrier film to comprise the following layers sequentially stacked on one surface or both surfaces of a base: an organic-inorganic hybrid coating layer, and inorganic layer, and a protective coating layer including inorganic nanoparticles surface-modified with 3-glycidoxypropyltrimethoxysilane or a compound of Formula I.

Lee discloses "a multi-layered plastic substrate in which an organic-inorganic hybrid buffer layer, a gas barrier layer and an inorganic hard coat layer on which inorganic particles are added are sequentially laminated on a plastic film." Lee 2, first full paragraph. Lee discloses that the inorganic hard coat layer "may be prepared by adding an inorganic particle to a sol-gel or an organic coating solution," and then thermally curing the solution. Lee 4, second and third paragraphs.

The Examiner finds that Lee does not disclose that the inorganic particles included in the hard coating layer are surface modified with an organic silane, and the Examiner relies on Kwon to address this feature missing from Lee's disclosures. Final Act. 4.

Kwon discloses a composition for forming a hard coating film that includes a polymeric binder resin and organic-inorganic silica particles. Kwon ¶¶ 1, 14, 17. Kwon discloses forming the organic-inorganic silica particles by chemically binding an initiator to hydroxyl groups present on

the surface of silica particles by first reacting an alkoxy silane compound with the hydroxyl groups to introduce an epoxy group into the hydroxyl groups, and then reacting a photo or thermal initiator with the epoxy group. Kwon ¶¶ 18, 19, 32. Kwon discloses that suitable alkoxy silane compounds include glycidoxypropyltrimethoxysilane, and suitable initiators include azo compounds. Kwon ¶¶ 26, 33.

Kwon discloses that when the surface-modified organic-inorganic silica particles are UV or heat cured, the azo groups decompose into radicals that function as photo or thermal initiators, and chemically bond to reactive groups on polymers used as the binder resin, grafting the polymers onto the silica particles. Kwon ¶¶ 17, 28. Kwon discloses that the cured coating composition forms a hard coating film having superior scratch and abrasion resistance. Kwon ¶¶ 1, 14.

In view of these disclosures in Kwon, the Examiner concludes that it would have been obvious to one of ordinary skill in the art to use Kwon's surface-modified organic-inorganic silica particles as the inorganic particles in Lee's hard coating composition to obtain a hard coating having improved abrasion and scratch resistance. Final Act. 4.

Appellant argues that the inorganic nanoparticles surface-modified with an organic silane that is 3-glycidoxypropyltrimethoxysilane recited in claim 1 include a terminal epoxide moiety. Appeal Br. 16. Appellant argues that the azo-silica particles disclosed in Kwon do not include a terminal epoxide group, but instead include a terminal azo group. *Id.* Appellant argues that Kwon discloses chemically reacting an epoxide bonded via an alkoxy silane linker to hydroxyl groups on the surface of silica particles with an azo compound "to form a bond and link the azo initiator to the silica

particle." *Id.* Appellant argues that one of ordinary skill in the art would not have removed the azo initiator from Kwon's azo-silica particles because Kwon teaches that improved abrasion and scratch resistance of Kwon's exhibited by Kwon's hard coating layer results from chemical bonding of the azo-silica particles to a binder resin via the azo initiator. Appeal Br. 17.

Appellant's arguments identify reversible error in the Examiner's rejection.

Claim 1 recites a gas barrier film comprising, in part, "a protective coating layer including inorganic nanoparticles surface-modified with an organic silane." Claim 1 further recites that "the organic silane is 3-glycidoxypropyltrimethoxysilane or a compound of Formula I." The plain language of claim 1 thus requires the inorganic nanoparticles included in the protective coating layer of the claimed gas barrier film to be surface-modified with 3-glycidoxypropyltrimethoxysilane or a compound of Formula I.

As discussed above, Kwon discloses forming the organic-inorganic silica particles described in the reference by reacting an alkoxy silane compound, such as glycidoxypropyltrimethoxysilane, with hydroxyl groups present on the surface of silica particles to introduce an epoxy group into the hydroxyl groups, and then reacting a photo or thermal initiator, such as an azo compound, with the epoxy groups, to bond the initiator to the silica particles. Kwon ¶¶ 18, 19, 26, 32, 33. Upon completion of this process, the resulting organic-inorganic silica particles are not surface-modified with 3-glycidoxypropyltrimethoxysilane, because the epoxy moiety of the 3-glycidoxypropyltrimethoxysilane is not present in the molecules attached to the surface of the silica particles, due to reaction of the epoxy group with an

initiator. Consequently, using Kwon's surface-modified organic-inorganic silica particles as the inorganic particles in Lee's hard coating composition for forming an inorganic hard coat layer would not result in a protective coating layer that includes inorganic nanoparticles surface-modified with 3-glycidoxypropyltrimethoxysilane. Rather, Lee's particles would be surface-modified with a molecule including a silane linker and a terminal initiator moiety, and would not include an epoxy group, as Appellant argues.

The Examiner, however, asserts in the Answer that "surface-modified" as recited in claim 1 is "much broader in scope than Appellant's arguments that the nanoparticles must contain 3-glycidoxypropyl trimethoxysilane and would encompass embodiments wherein the compound is further reacted or modified, as disclosed in Kwon." Ans. 8. According to the Examiner, "[t]he nanoparticles of Kwon et al. are initially modified with the silane compound and the silane compound containing nanoparticle is subsequently reacted with an azo containing compound. The nanoparticles are therefore effectively 'surface-modified' with the claimed silane." *Id.* (citations omitted).

The Examiner, however, does not provide any basis for interpreting "surface modified with . . . 3-glycidoxypropyl trimethoxysilane" as encompassing surface modifications in which 3-glycidoxypropyl trimethoxysilane is not actually present. As Appellant points out in the Reply Brief (Reply Br. 7), Appellant's Specification describes preparing the surface-modified inorganic nanoparticles of Appellant's invention by "reacting the organic silane on the surface of the inorganic particle while hydrolyzed with water and a catalyst." Spec. ¶ 44; *see also* Spec. ¶¶ 60–62. The Specification does not describe subsequently subjecting the resulting

silane-modified inorganic particles to any further reaction or modification. Thus, consistent with the disclosures in Appellant's Specification and the plain language of claim 1, one of ordinary skill in the art would understand that the surface-modified inorganic nanoparticles included in the protective coating layer of the gas barrier film recited in claim 1 contain 3-glycidoxypropyltrimethoxysilane on their surface.

The Examiner's interpretation of "surface modified" as "encompass[ing] embodiments wherein the compound is further reacted or modified, as disclosed in Kwon" is, therefore, inconsistent with the plain language of claim 1, and with the disclosures in Appellant's Specification, and, consequently, is unduly broad. *In re Morris*, 127 F.3d 1048, 1054–55 (Fed. Cir. 1997) ("While the Board must give the terms their broadest reasonable construction, the construction cannot be divorced from the specification and the record evidence."); *In re Smith Int'l, Inc*., 871 F.3d 1375, 1382–83 (Fed. Cir. 2017) ("The correct inquiry in giving a claim term its broadest reasonable interpretation in light of the specification is not whether the specification proscribes or precludes some broad reading of the claim term adopted by the examiner. And it is not simply an interpretation that is not inconsistent with the specification. It is an interpretation that corresponds with what and how the inventor describes his invention in the specification, i.e., an interpretation that is 'consistent with the specification.'" (quoting *Morris*, 127 F.3d at 1054)).

The Examiner also does not set forth a reason for why one of ordinary skill in the art would have used the intermediate particles produced during Kwon's process that include an epoxy group that has not yet reacted with an initiator as the inorganic particles in Lee's hard coating composition,

particularly in view of Kwon's disclosure that the improved abrasion and scratch resistance exhibited by Kwon's hard coating layer occurs as a result of bonding the surface modified-silica particles to a binder resin via the initiator.

Thus, on the record before us, the Examiner does not identify any disclosure in Lee or Kwon, when considered individually or in combination, which discloses or would have suggested a gas barrier film comprising a protective coating layer including inorganic nanoparticles surface-modified with an organic silane that is 3-glycidoxypropyltrimethoxysilane, as required by claim 1 as we have interpreted it.

We, therefore, do not sustain the Examiner's rejection of claim 1, and claims 2, 4–12, and 15–18, which each depend from claim 1, under 35 U.S.C. § 103(a).

CONCLUSION

Claims	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2, 4–12, 15–18	103(a)	Lee, Kim, Kwon, Suzuki		1, 2, 4–12, 15–18

REVERSED