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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ADAM JAMES ELLISON, SINUE GOMEZ,
SHANDON DEE HART, GUANGLI HU,
JOHN CHRISTOPHER MAURO, and JAMES JOSEPH PRICE

Appeal 2019-001941
Application 14/838,482
Technology Center 1700

Before BRADLEY R. GARRIS, JEFFREY T. SMITH, and CHRISTOPHER L. OGDEN, *Administrative Patent Judges*.

OGDEN, *Administrative Patent Judge*.

DECISION ON APPEAL[1]

Appellant[2] appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 11–13, 15, 16, 18, 20, and 21. We affirm.

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[1] The appeal record includes the following: Specification, Aug. 28, 2015 ("Spec."); Final Office Action, Jan. 5, 2018 ("Final Action"); Appeal Brief, July 5, 2018 ("Appeal Br."); Examiner's Answer, Nov. 8, 2018 ("Answer"); and Reply Brief, Jan. 4, 2019 ("Reply Br.").

[2] Appellant is Corning Incorporated, which is the applicant as defined in 37 C.F.R. § 1.42. Appellant also identifies this entity as the real party in interest. *See* Appeal Br. 2.

BACKGROUND

According to Appellant, the invention at issue "is directed to new manners of achieving high hardness coatings on glass substrates so that through proper consideration of characteristics of the substrate and coating, mitigation in the reduction in flexural strength and/or strain to failure is achieved." Appeal Br. 6. Independent claim 11, which we reproduce below, is representative:

> 11. An apparatus, comprising:
>
> a glass substrate having a first strain to failure characteristic, a first elastic modulus characteristic, and a flexural strength; and
>
> a coating applied over the glass substrate to produce a composite structure, where the coating has a second strain to failure characteristic and a second elastic modulus characteristic, wherein the first strain to failure characteristic is higher than the second strain to failure characteristic, the coating comprises one or more of silicon nitrides, silicon oxynitrides, silicon carbides, silicon oxy-carbides, aluminum nitrides, aluminum oxy-nitrides (AlON), aluminum carbides, aluminum oxy-carbides, aluminum oxides, nanocrystalline diamond, indium tin oxide (ITO), $MgAl_2O_4$, $CaAl_2O_4$, $MgAl_2O_{4–x}$, $MgAl_2O_{4–x}$, $Mg_{(1–y)}Al_{(2+y)}O_{4–x}$, and/or $Ca_{(1–y)}Al_{(2+y)}O_{4–x}$, SiO_xC_y, $SiO_xC_yN_z$, Al, AlN, AlN_xO_y, Al_2O_3, Al_2O_3/SiO_2, BC, BN, Graphene, $SiCN_x$, SiN_x, SiO_2, SiC, SnO_2, SnO_2/SiO_2, Ta_3N_5, TiC, TiN, TiO_2, and/or ZrO_2, and wherein:
>
> *the first elastic modulus characteristic is selected such that one of:*
>
> *(i) the first elastic modulus characteristic is above a minimum predetermined threshold such that any reduction of the flexural strength of the glass substrate resulting from application of the coating is mitigated; and*
>
> *(ii) the first elastic modulus characteristic is below a maximum predetermined threshold such that any reduction of the strain to failure of the glass substrate resulting from application of the coating is mitigated.*

Appeal Br. Claims App'x 3 (emphasis of key portion added). Claim 21 is also independent. *See id.* at 5. Claims 12, 13, 15, 16, 18, 20 depend from claim 11. *Id.* at 3–5.

The Examiner rejects claims 11–13, 15, 16, 18, 20, and 21 under 35 U.S.C. § 103 as being unpatentable over Amin[3] in view of Patel.[4] Final Action 3–5.

DISCUSSION

Appellant argues the claims together. *See* Appeal Br. 9–13. Therefore, we focus our decision on independent claim 11. The remaining claims fall with claim 11. *See* 37 C.F.R. § 41.37(c)(1)(iv).

The Examiner finds that Amin discloses an ion-exchanged glass[5] substrate for use as a housing, enclosure, or protective cover of an electric device, which has an elastic modulus of about 50–100 GPa. Final Action 3 (citing Amin, Abstract). This elastic modulus range overlaps the ranges recited in the claims at issue in this appeal. *See id.*; *see also* Appeal Br. Claims App'x 4 (a "minimum predetermined threshold" that is "at least about" 70, 75, 80, or 85 GPa), 5 ("higher than one of: about 75GPa, about 80GPa, and about 85GPa").

The Examiner notes that "Amin does not disclose a coating on the glass and does not teach the [recited] effect on flexural strength or strain to failure characteristics." *Id.* at 4. However, the Examiner finds that Patel

[3] Amin et al., US 2010/0047521 A1 (published Feb. 25, 2010) ("Amin").
[4] Patel et al., US 2008/0138631 A1 (published June 12, 2008) ("Patel").
[5] Ion exchange is a method of adding compressive stress to a glass surface by exchanging cations on the surface with larger cations. *See* Spec. ¶ 51; Amin ¶ 35.

teaches a protective coating for a substrate material such as glass ceramic, "that minimizes mechanical wear of the substrate material component. *Id.* (citing Patel, Abstract, ¶¶ 26, 30). The Examiner also finds that Patel teaches that the coating may comprise some of the materials recited in claim 11. *Id.* (citing Patel ¶¶ 27, 40).

The Examiner determines that a person of ordinary skill in the art would have had reason to apply Patel's coating to Amin's glass substrate, "to provide a thin[,] hard[,] protective coating for the glass that minimizes mechanical wear of the glass to protect it during use while maintaining clarity of the glass for use as a protective cover glass with a reasonable expectation of success." Final Action 4. The Examiner also finds that because Amin's substrate and Patel's coating "are substantially identical to the instant application glass and coating," including the elastic modulus of the substrate and the coating, "the combination would inherently possess the instant claimed strain to failure and flexural strength characteristics." *Id.* at 4–5.

In response, Appellant makes the following arguments: (1) Appellant's coating achieves unexpected results, (2) the Examiner improperly combined Amin with Patel, and (3) Patel is non-analogous art. We address these arguments in turn, below.

A. Whether Appellant's coating achieves unexpected results

Appellant argues that the claimed invention achieves an unexpected result by balancing parameters "to allow a coating to be rigidly fused to the underlying substrate, yet that minimize the reduction in flexural strength and strain to failure of the coated article." Appeal Br. 10.

According to Appellant, at the time of invention, a person of ordinary skill in the art would have expected that adding a coating, such as Patel's, to a substrate, such as Amin's, would reduce the strength of the glass. *Id.* at 9. As evidence, Appellant points to Figure 5 of the Specification, which we reproduce below:

FIG. 5

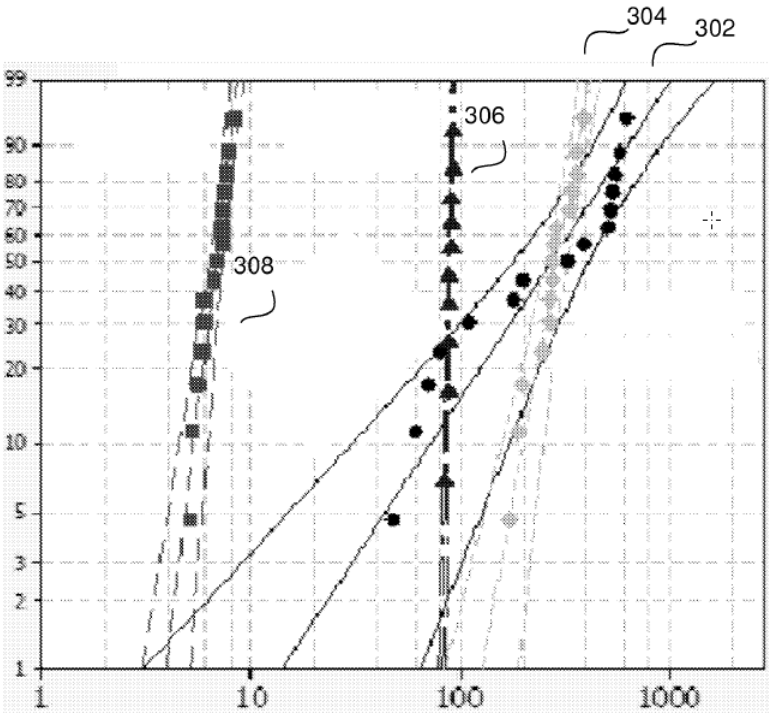

Figure 5 plots the probability of failure (*y* axis) against stress to failure (*x* axis) for both non-coated (304, 302) and coated (308, 306) substrates. *Id.*; Fig. 5; Spec. ¶¶ 31–32. According to Appellant, this chart shows that "the strengths of the coated substrates were lower than those of the un-coated substrates." Appeal Br. 9. Appellant also points to Emonts et al., US 4,618,538 (issued Oct. 21, 1986), 1:33–59, which "discusses how some pigmented coatings reduce glass bending strength," and Roemer-Scheuermann et al., US 2005/0129959 A1 (published June 16, 2005) ¶ 41,

indicating that "coatings that are rigidly fused to the glass (as is the case in Patel) . . . impair the strength of the glass." Appeal Br. 9.

However, Appellant argues that the inventors "unexpectedly found that careful consideration of various characteristics of the glass substrate and coating yield improvements in the resulting flexural strength and/or strain to failure in the resulting coated substrate." Appeal Br. 10. As evidence, Appellant points to Figures 6 and 7 of the Specification. *Id.* We reproduce Figure 6 below:

FIG. 6

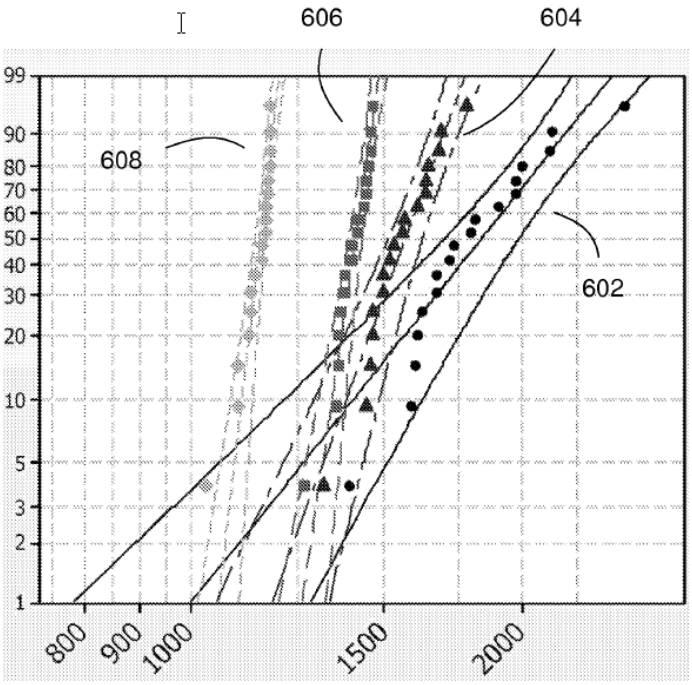

Figure 6 is a theoretical, calculated plot of failure probability (*y* axis) versus flexural strength (*x* axis) for coated ion-exchange substrates having elastic moduli of 37, 72, and 120 GPa (608, 606, and 604, respectively) as compared to a non-coated ion-exchange substrate (602). Appeal Br. 10; Spec. ¶¶ 36.

We reproduce Figure 7 below:

FIG.7

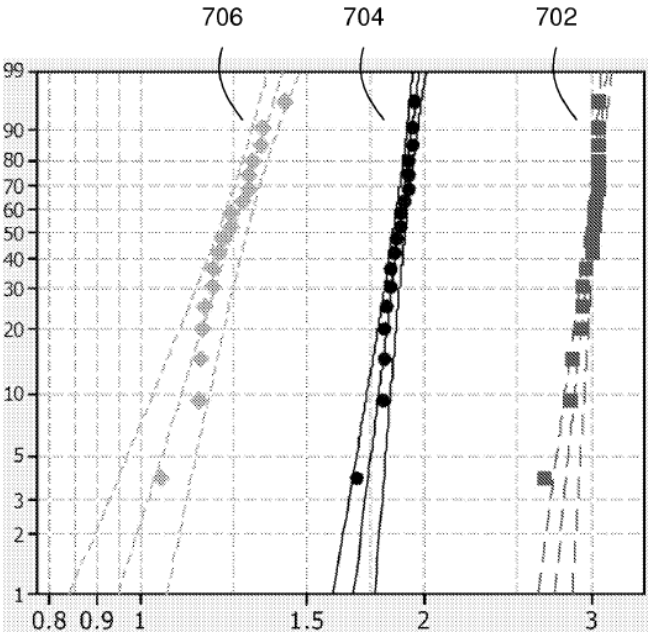

Figure 7 is a theoretical, calculated plot of failure probability (*y* axis) versus strain to failure (*x* axis) for coated ion-exchange substrates having elastic moduli of 120, 72, and 37 GPa (706, 704, and 702, respectively). Appeal Br. 10; Spec. ¶ 38.

According to Appellant, Figure 6 shows "that as the elastic modulus of the glass is increased, the flexural strength increases," and Figure 7 "shows that as the elastic modulus increases, the strain to failure decreases." Appeal Br. 10. In other words, Appellant argues that increasing the elastic modulus of the glass substrate improves flexural strength, but worsens strain to failure. According to Appellant, the inventors unexpectedly found a range for the elastic modulus that "minimize[s] the reduction in flexural strength and strain to failure of the coated article." *Id.*

In response, the Examiner states that Figures 6 and 7 contain data only for an indium tin oxide (ITO) coating with a thickness of 30 nm and an

elastic modulus of 140 GPa, whereas claim 11 includes a broad range of other coatings, and contains no limit for the elastic modulus of the coating (i.e., the "second elastic modulus characteristic"). *See* Answer 6. Thus, according to the Examiner, "the data relied upon to show unexpected results is narrower than the scope of the instant claims." *Id.*

Appellant has the burden of showing unexpected results. *In re Geisler*, 116 F.3d 1465, 1469–70 (Fed. Cir. 1997). In particular, where the difference between the claimed invention and the prior art is some range, "the applicant must show that the particular range is *critical*, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990). Furthermore, an "applicant's showing of unexpected results must be commensurate in scope with the claimed range." *In re Peterson*, 315 F.3d 1325, 1330 (Fed. Cir. 2003).

We agree with the Examiner that the scope of claim 11 is significantly broader than the simulated data presented in Figures 6 and 7. In addition, while Appellant's Figure 6 shows a relationship between the elastic modulus of the substrate and the flexural strength, Appellant has not sufficiently explained how Figure 6 identifies a critical range for the elastic modulus corresponding to the "minimum predetermined threshold" recited in claim 11. Similarly, Appellant has not sufficiently explained how Figure 7 identifies a critical range for the elastic modulus corresponding to the "maximum predetermined threshold" recited in claim 11. Nor has Appellant explained how any synthesis of Figures 6 and 7 lead to a particular critical range for the elastic modulus corresponding to any of the claims on appeal.

Furthermore, it does not appear that claim 11 effectively limits the range of the substrate's elastic modulus. Claim 11 recites an apparatus in which one selects the elastic modulus of the substrate (i.e., the "first elastic modulus characteristic") based on *either* a minimum threshold or a maximum threshold. *See* Appeal Br. Claims App'x. 3. Claim 11 does not specify these thresholds exactly, but claims 13 and 14 (withdrawn) recite nearly overlapping ranges for the minimum and maximum thresholds, respectively. *See* Appeal Br. Claims App'x 4; *see also id.* at 5–6 (claims 21 and 22 (withdrawn)). Because any, or at least nearly any, choice of elastic modulus would be either greater than the contemplated minimum thresholds, or less than the contemplated maximum thresholds, the evidence does not support Appellant's contention that claim 11 reflects an unexpected critical range.

Finally, Appellant has not pointed to evidence sufficient to show that the simulated data in Figures 6 and 7 would have been unexpected at the time of invention. To show unexpected results, applicant must not only show that the invention reflects different results than those of the prior art, but also "that the difference actually obtained would not have been expected by one skilled in the art at the time of invention." *In re Freeman*, 474 F.2d 1318, 1324 (CCPA 1973) (citations omitted). Appellant presents evidence suggesting that at the time of invention, a person of ordinary skill in the art would have expected that adding a coating would reduce the stress to failure and strength of the substrate. *See* Appeal Br. 9; Spec., Fig. 5. However, Appellant has not shown that the claimed invention is inconsistent with that expectation. For example, the simulated data in Figure 6 shows that non-

coated substrate 602 exhibits higher flexural strength than all three coated substrates 604, 606, and 608.

For the above reasons, Appellant has not presented evidence sufficient to show unexpected results.

B. Whether the Examiner properly combined Amin with Patel

Next, Appellant argues that a person of ordinary skill in the art "would not have looked to the field of immersion lithography to improve Amin's electronic-device-housing substrate." Appeal Br. 10. According to Appellant, Patel's solution is "for reducing debris (due to wear) in a clean manufacturing environment," and this is not a relevant concern to Amin's glass substrate, which "is in . . . ordinary, everyday, surrounding conditions where dirt, debris, and particles (of a much larger size, and in much larger quantities) are readily present." *Id.*; *see also id.* at 11. Because Patel's concern for wear resistance is "so that the particles generated by that wear do not contaminate a clean room environment," Appellant argues that "one of ordinary skill in the art would not have looked to Patel's teaching on wear resistance as such a coating would be superfluous." Appeal Br. 11.

The Examiner responds that Amin teaches "the need to balance the desirability of making a [glass enclosure] smaller and lighter with making it *stronger* and more rigid." Answer 6–7 (citing Amin ¶ 4). According to the Examiner, Patel provides a solution for applying a protective coating that improves durability and wear resistance to a substrate, without compromising its transparency. *Id.* (citing Patel ¶ 40).

The Examiner's rationale for combining Amin with Patel is persuasive, and Appellant has not identified reversible error. Amin teaches that glass enclosures should be durable. *See* Amin ¶ 20 (glass enclosure is

"sufficiently strong and durable so as to withstand typical consumer use/applications"). The Examiner is correct that Patel presents a solution for improving the durability and wear resistance of a glass substrate that does not impede its transparency. Thus, we agree with the Examiner that a person of ordinary skill in the art would have had reason to modify Amin's glass enclosure by adding Patel's coating.

Appellant also argues that the Examiner's combination of Amin and Patel relies on impermissible hindsight reconstruction. Appeal Br. 11–12. According to Appellant, the Examiner's rejection "take[s] into account knowledge gleaned only from Appellant's disclosure, i.e., that a particular coating on a particular substrate would lead to beneficial results in mitigating reduction in flexural strength and/or in strain to failure." *Id.* at 12.

We disagree with Appellant's characterization of the Examiner's rejection. The Examiner relies on the teachings of Amin and Patel as to improving durability and wear resistance, not on mitigating reductions in flexural strength or strain to failure. *See* Answer 8–9. Therefore, we do not find this argument persuasive of reversible error.

C. Whether Patel is non-analogous art

Finally, Appellant argues that Patel is non-analogous art. Appeal Br. 12–13. According to Appellant, the field of endeavor of the claimed invention is "cover glass for electronic devices, whereas Patel's is the field of immersion lithography." Appeal Br. 13. Appellant also argues that for the claimed invention, the inventors were faced with the problem of "resist[ing] sharp contact, single event damage in order to reduce the likelihood of scratching the cover glass of an electronic device." *Id.* By contrast, according to Appellant, "Patel is concerned with reducing wear (as by

repeated sliding contact) that would produce unwanted dust in a clean room environment." *Id.*

In response, the Examiner finds that, like Appellant's disclosure, the relevant field of endeavor of Amin and Patel is "the field of glass that experiences wear," and particularly to "glass articles experiencing wear and benefited by strength and durability in the generic field of electronics." Answer 7. However, according to the Examiner, the claims on appeal "are not narrowed to any particular field of art and instead recite only an 'apparatus' in the preamble with no limitation placed on the use of the apparatus." *Id.* at 8.

We agree with the Examiner that Patel is within the same field of endeavor as the claimed invention. "The field of endeavor of a patent is not limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field." *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1001 (Fed. Cir. 2016). The field of endeavor is also informed by "explanations of the invention's subject matter in the patent application, including the embodiments, function, and structure of the claimed invention." *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004) (citing *In re Wood*, 599 F.2d 1032, 1036 (CCPA 1979)). According to Appellant's Specification, the invention "relates to methods and apparatus for retaining high strength and/or strain in a coated glass substrate structure." Spec. ¶ 2. Thus, in its most general description of the invention, the Specification does not limit the field solely to cover glass for electronic devices. Furthermore, as the Examiner correctly notes, the claims themselves are not directed to a particular application for the coated glass. *See* Answer 7–8. Like the claimed

invention, Patel relates to a coating that improves the mechanical properties of a glass substrate, and it is within the same field of endeavor.

Also unpersuasive of reversible error is Appellant's argument that Patel is not reasonably pertinent to the problem faced by the inventors. The Specification recognizes the problem that there "are needs in the art for new methods and apparatus for achieving high hardness coatings on glass substrates." Spec. ¶ 7; *see also id.* ¶ 8 ("[A] coating may be applied to a glass substrate to address the surface hardness issue."); ¶ 12 (noting that increasing hardness by adding a hard coating to a glass substrate "may degrade the strength and/or strain to failure of the glass substrate"). Patel is reasonably pertinent to the problem of providing a suitable hard coating on a glass substrate. *See, e.g.*, Patel 34 ("Coatings with high hardness tend to also be wear-resistant which is beneficial to minimize mechanical wear.").

For the above reasons, and based on the Examiner's findings and conclusions as a whole, which we find persuasive, the preponderance of the evidence supports the Examiner's rejection, and Appellant has not shown reversible error. Therefore, we affirm the Examiner's decision as to all claims.

CONCLUSION

In summary,

Claims Rejected	Basis	Affirmed	Reversed
11–13, 15, 16, 18, 20, 21	§ 103 Amin, Patel	11–13, 15, 16, 18, 20, 21	

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended. *See* 37 C.F.R. §§ 1.136(a)(1)(iv), 41.50(f) (2018).

AFFIRMED