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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte TAKAHIRO SHIRAHATA, HIROYUKI ORITA,
and TAKAHIRO HIRAMATSU

Appeal 2018-008381
Application 14/382,827
Technology Center 1700

Before KAREN M. HASTINGS, MONTÉ T. SQUIRE, and
JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants¹ request our review under 35 U.S.C. § 134(a) of the Examiner's decision to finally reject claims 1, 3, and 5–8². We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

¹ Appellants identify Toshiba Mitsubishi-Electric Industrial Systems Corporation as the real party in interest. Appeal Brief filed March 26, 2018 (“App. Br.”), 2.

² Claim 9 has been withdrawn from consideration. Final Office Action entered November 13, 2017 (“Final Act.”), 1.

CLAIMED SUBJECT MATTER

Appellants claim an electrode for electrochemical reduction of carbon dioxide and water to form carbon monoxide and hydrogen. App. Br. 2–3. Claim 1 illustrates the subject matter on appeal, and is reproduced below with contested language italicized:

1. A method for producing metal oxide film, comprising:
 - (A) spraying a misted solution comprising an alkyl metal onto a substrate placed under non-vacuum; and
 - (B) spraying a *misted dopant solution comprising-boric acid* as the only dopant-onto the substrate in the spraying (A), wherein *the misted solution and the misted dopant solution are supplied and sprayed on the substrate through different paths*, andwherein the substrate in the spraying (A) is at a temperature of not higher than 200°C.

Claims Appendix filed April 16, 2018 (emphasis added).

REJECTION

The Examiner maintains the rejection of claims 1, 3, and 5–8 under 35 U.S.C. § 103(a) as unpatentable over Inaba, et al. (WO 2010/123030 A1, published October 28, 2010)³ in view of JP 2526632 B2, issued August 21, 1996 (“JP”)⁴ and Orita et al. (WO 2010/035313 A1, published April 1, 2010)⁵ in the Examiner’s Answer entered June 29, 2018 (“Ans.”).

³ Appellants do not dispute the Examiner’s reliance on Inaba, et al., U.S. 9,096,441, issued August 4, 2015, as an English equivalent of Inaba, et al., WO 2010/123030, published October 28, 2010. Citations to “Inaba” in this decision, therefore, refer to the U.S. patent.

⁴ Appellants cited JP 2526632 B2 in an information disclosure statement filed November 17, 2015, and the Examiner relies on the English translation of this document provided with the information disclosure statement.

⁵ Appellants do not dispute the Examiner’s reliance on Orita et al., US 2011/0151619 A1, published June 23, 2011, as an English equivalent of

FACTUAL FINDINGS AND ANALYSIS

Upon consideration of the evidence relied upon in this appeal and each of Appellants' contentions, we affirm the Examiner's rejection of claims 1, 3, and 5–8 under 35 U.S.C. § 103(a), for the reasons set forth in the Final Action, the Answer, and below.

We review appealed rejections for reversible error based on the arguments and evidence the appellants provide for each issue the appellants identify. 37 C.F.R. § 41.37(c)(1)(iv); *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) (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.”)).

Claims 1 and 5–8

Appellants argue claims 1 and 5–8 as a group. App. Br. 4–7. We accordingly select claim 1 as representative, and decide the appeal as to claims 1 and 5–8 based on claim 1 alone. 37 C.F.R. § 41.37(c)(1)(iv).

Claim 1 recites a method for producing a metal oxide film that comprises, in part, spraying a misted solution comprising an alkyl metal, and spraying a misted solution comprising a boric acid dopant, onto a substrate, through different paths.

Inaba discloses a composition for manufacturing a zinc oxide film, which is prepared by adding water to an organic solution of an alkyl zinc compound (alkyl metal), and adding a group IIIB element compound

Orita et al., WO 2010/035313 A1, published April 1, 2010. Citations to “Orita” in this decision, therefore, refer to the U.S. patent application.

(dopant) to the solution in an amount yielding a molar ratio of the group IIIB element compound (dopant) to the alkyl zinc compound of 0.005 to 0.3 (0.5% to 30%). Col. 3, l. 44–col. 4, l. 13; col. 5, l. 65–col. 6, l. 6. Inaba also discloses a composition for manufacturing a zinc oxide film that does not include a group IIIB (dopant), and is prepared by adding water to an organic solution of an alkyl zinc compound (alkyl metal). Col. 3, ll. 44–49; col. 4, ll. 16–18.

Inaba discloses forming a zinc oxide thin film on a substrate by heating the substrate to a temperature of 50°C to 250°C, and simultaneously feeding a compressed inert gas and a composition as discussed above through a spray nozzle positioned above the substrate, to atomize and spray (mist) the composition onto the substrate. Col. 13, ll. 31–33; col. 26, l. 58–col. 27, l. 4.

The Examiner finds that although boron is a group IIIB element, Inaba does not explicitly disclose using boric acid as a dopant, and the Examiner relies on JP for suggesting use of a boric acid dopant. Final Act. 3–4.

JP discloses that including a compound containing boron, such as boric acid, in a transparent zinc oxide film improves the conductivity of the film. Pg. 2. In view of this disclosure in JP, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellants' invention to use a boric acid dopant as the group IIIB element compound dopant in Inaba's method of producing a zinc oxide film, to improve the conductivity of the film. Final Act. 4. The Examiner finds, however, that Inaba as so modified by JP does not disclose supplying and spraying separate solutions of an alkyl zinc compound (alkyl metal) and boric acid onto a substrate through different paths, and the Examiner relies on Orita for suggesting use of separate supply paths for forming a zinc oxide

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film. Final Act. 4.

Orita discloses a method of forming a zinc oxide film on a substrate that comprises converting a solution containing a zinc source, such as zinc acetate, into a mist, converting a second, separate solution, into a mist, and simultaneously supplying the two mists and ozone to the surface of a substrate. ¶¶ 1, 42, 54, 83, 84, 87. Orita discloses an apparatus for performing such a method that includes containers 5, 9 having misting devices 6, 10 for solutions 4, 8 supplied through lines L1, L4 to substrate 2. ¶¶ 85, 87; Fig. 6.

In view of these disclosures in Orita, and Inaba's disclosure of manufacturing a zinc oxide film from compositions that may include a dopant, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of Appellants' invention to modify the method of forming a zinc oxide film disclosed in Inaba, as modified by JP, by using separate supply paths, as disclosed in Orita, for atomized solutions of a boric acid dopant and an alkyl zinc compound (alkyl metal), to allow the same apparatus to be readily used to produce zinc oxide films that do and do not include a boric acid dopant. Final Act. 4; Ans. 5–6.

Appellants argue that the combination of Orita, JP, and Inaba “does not teach the claimed method of spraying misted solutions where the dopant solution comprises only boric acid as the dopant, and the two sprayings are independently performed from each other,” and one of ordinary skill in the art would not have modified Inaba “with the methods of Orita” to arrive at the claimed method. App. Br. 5, 6. Appellants argue that although Orita discloses that metal solution 4 and solution 8 may be supplied through different paths L1 and L4 after being converted to a mist, “Orita does not teach that solution 8 is a dopant.” App. Br. 6.

As the Examiner finds, however, JP's disclosure that including a compound containing boron, such as boric acid, in a transparent zinc oxide film improves the conductivity of the film, would have led one of ordinary skill in the art at the time of Appellants' invention to use boric acid as the group III element compound dopant in Inaba's zinc oxide film to improve the film's conductivity. Final Act. 3–4.

In addition, as discussed above, Inaba discloses manufacturing a zinc oxide film by first preparing an alkyl zinc compound (alkyl metal) solution by dissolving an alkyl zinc compound (alkyl metal) in an organic solvent and adding water, adding a group IIIB element (dopant) to the solution, and then simultaneously feeding a compressed inert gas and the solution through a spray nozzle positioned above a substrate, to atomize and spray (mist) the composition onto the substrate. As also discussed above, Inaba discloses an alternative method for manufacturing a zinc oxide film that involves omitting the group IIIB compound (dopant) from the alkyl zinc compound (alkyl metal) solution.

As the Examiner finds, modifying these methods disclosed in Inaba by supplying the alkyl zinc compound (alkyl metal) solution separately from a solution of the group IIIB compound (dopant), and adding the group IIIB compound (dopant) to the alkyl zinc compound (alkyl metal) solution by simultaneously spraying the separate solutions onto a substrate following atomization of the solutions, as disclosed in Orita, would allow a single apparatus to be used to continuously produce zinc oxide films that include, or do not include, a dopant. Ans. 5–6. In this approach, continuously supplying and spraying an atomized alkyl zinc compound (alkyl metal) solution, while intermittently supplying and spraying an atomized dopant solution simultaneously with the atomized alkyl zinc compound (alkyl

metal) solution, would allow both types of zinc oxide films to be produced using a single, continuously operating device.

Further supporting the Examiner's findings and analysis, and contrary to Appellants' arguments, Orita explicitly discloses that the method described in the reference allows a dopant to be supplied to a substrate separately from a zinc source, which Orita explains is particularly advantageous when a single solvent suitable for both the dopant and zinc source cannot be used due to differing solubilities of the materials. *See* Orita ¶ 89. Orita explains that supplying the dopant and zinc source as separate solutions allows different solvents to be used for each material, permitting solutions to be prepared that include the dopant and zinc source at concentrations not otherwise possible if a single solvent were used. *Id.* One of ordinary skill in the art would have understood that an organic alkyl zinc compound (alkyl metal) as disclosed in Inaba would be highly soluble in organic solvents, while an inorganic boric acid dopant as suggested by JP would be highly soluble inorganic solvents, and would have reduced solubility organic solvents.

Consequently, in view of the combined disclosures of Inaba, Orita, and JP, one of ordinary skill in the art reasonably would have been led to modify Inaba's method by supplying separate atomized solutions of an organic alkyl zinc compound (alkyl metal) as disclosed in Inaba, and an inorganic boric acid dopant as suggested by JP, to allow different solvents to be used to prepare each solution, as disclosed in Orita, permitting solutions having desired concentrations of both materials to be prepared.

Appellants argue that "Inaba **requires** a single composition that is not intended to be split nor would it have been split into different paths." App. Br. 4; Reply Br. 2. Appellants argue that "Inaba clearly teaches that the crux

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of Inaba's invention is the provision of a unique and single composition that includes the zinc compound and dopant to solve the problems that are present in Inaba's disclosure." App. Br. 6–7 (citing Inaba col. 3); Reply Br. 2.

Appellants, however, do not identify any disclosure in Inaba, indicating that including an alkyl zinc compound and a group IIIB element compound dopant in a single solution is a requirement for performing the method of Inaba's invention, or is the aspect of Inaba's invention that solves the problems discussed in column 3 of the reference, and we find no such disclosures. App. Br. 6–7; Reply Br. 2. Nor do Appellants identify any disclosure in Inaba, or provide any other evidence, indicating that supplying and spraying an alkyl zinc compound and a group IIIB element compound dopant as separate atomized solutions as suggested by Orita would not solve the problems discussed in column 3 of Inaba, while supplying and spraying the compounds in a single solution would solve those problems. *Id.* It is well-established that unsupported attorney arguments do not constitute evidence necessary to resolve a disputed question of fact. *In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997) (“An assertion of what seems to follow from common experience is just attorney argument and not the kind of factual evidence that is required to rebut a prima facie case of obviousness.”); *Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (“Attorney argument is not evidence” and cannot rebut other admitted evidence.); *In re Pearson*, 494 F.2d 1399, 1405 (CCPA 1974) (“Attorney's argument in a brief cannot take the place of evidence.”); *In re Schulze*, 346 F.2d 600, 602 (CCPA 1965) (“Argument in the brief does not take the place of evidence in the record.”).

Appellants argue that “Inaba clearly teaches the application of a

mixed solution that is not applied by a misting method yet Orita's teachings are inapposite to that teaching." App. Br. 6.

As discussed above, however, Inaba discloses simultaneously feeding a compressed inert gas and a composition as described in the reference through a spray nozzle to atomize and spray (mist) the composition onto the substrate, and Orita discloses converting a zinc acetate solution into a mist, and converting a second solution, such as a dopant solution, into a mist, and simultaneously supplying the two solution mists to the surface of a substrate. Contrary to Appellants' arguments, Inaba and Orita thus both disclose supplying solutions to a substrate that have been atomized, or converted to a mist.

Appellants' arguments, therefore, do not identify reversible error in the Examiner's rejection of claim 1, which we accordingly sustain, along with the Examiner's rejection of claims 5–8, under 35 U.S.C. § 103(a).

Claim 3

Claim 3 depends from claim 1 and recites that in the spraying (A) and spraying (B), a molar concentration of the boric acid supplied to the substrate with respect to a molar concentration of the alkyl metal supplied to the substrate is less than 1.8%.

Appellants argue that the Examiner does not explain or establish that Inaba's "general guidance" of a molar ratio of a group III element compound dopant to an alkyl zinc compound of 0.005 to 0.3, as modified by JP's suggestion of using a boric acid dopant, corresponds to molar concentration of boric acid with respect to a molar concentration of alkyl metal of less than 1.8% as recited in claim 3. App. Br. 7–8.

As discussed above, however, Inaba discloses utilizing a group IIIB

element compound dopant, such as boric acid as suggested by JP, in an amount yielding a molar ratio of the dopant to an alkyl zinc compound of 0.005 to 0.3 (0.5% to 30%), which overlaps the range of molar concentration of boric acid with respect to a molar concentration of alkyl metal of less than 1.8% recited in claim 3, rendering the recited range prima facie obvious. *In re Peterson*, 315 F.3d 1325, 1329–330 (Fed. Cir. 2003) (“In cases involving overlapping ranges, we and our predecessor court have consistently held that even a slight overlap in range establishes a prima facie case of obviousness . . .”). In such circumstances, the burden shifts to the appellants to establish the criticality of the claimed range, 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) (indicating that in cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims, 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.).

As discussed below, on the record before us, Appellants do not meet this burden because Appellants do not establish the criticality of the range recited in claim 3.

Appellants argue that data presented in Figure 5 of their application and discussed in paragraphs 54 and 55 of their Specification “shows that the molar ratio of less than 1.8 was important” because, as illustrated in Figure 5, the resistivities of zinc oxide films having a boron to zinc molar concentration ratio of less than 1.8% were lower than that of an undoped zinc oxide film, while the resistivity of a zinc oxide film having a boron to zinc molar concentration ratio of 1.8% was equal to that of an undoped zinc oxide film. App. Br. 8. Appellants argue that because “there are no relevant

teachings in the cited art for this result, it cannot be reasonably concluded that such would have been expected from the cited art.” App. Br. 9.

It is well-established, however, that “when unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art.” *In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991). Appellants do not identify any averment in the Specification, or provide any other evidence, establishing that the asserted reduction in resistivity resulting from a boric acid to alkyl metal molar concentration ratio of less than 1.8% actually would have been unexpected by one ordinary skill in the art at the time of their invention, particularly in view of Inaba’s disclosure of utilizing a group IIIB element compound to alkyl zinc compound molar concentration ratio range that includes 0.5% to less than 1.8%. App. Br. 7–9. Lack of any teaching in the applied prior art references that a molar ratio of less than 1.8% reduces resistivity does not constitute evidence necessary to establish that such a result would have been unexpected to one of ordinary skill in the art at the time of Appellants’ invention. *In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972) (“[I]t is not enough to show that results are obtained which differ from those obtained in the prior art: that difference must be shown to be an unexpected difference.”); *In re Geisler*, 116 F.3d 1465, 1471 (Fed. Cir. 1997) (“Geisler made no such assertion [that results were unexpected] in his application. Nor did Geisler submit any such statement through other evidentiary submissions, such as an affidavit or declaration under Rule 132 . . . Instead, the only reference to unexpected results was a statement by Geisler’s counsel . . . that Geisler’s results were ‘surprising.’”); *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984) (“[i]t is well settled that unexpected results must be established by factual evidence. Mere argument

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or conclusory statements in the specification does not suffice.”).

Considering the totality of the evidence relied upon in this appeal, a preponderance of the evidence weighs in favor of the Examiner’s conclusion of obviousness. We, accordingly, sustain the Examiner’s rejection of claim 3 under 35 U.S.C. § 103(a).

DECISION

We affirm the Examiner’s rejection of claims 1, 3, and 5–8 under 35 U.S.C. § 103(a).

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