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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ELISABETH BUEHLER, MATHIAS WIDMAIER, PALLAVI VERMA, SEVERIN HAHN, and THOMAS ECKL

Appeal 2018-008181
Application 15/367,658
Technology Center 1700

Before GRACE KARAFFA OBERMANN, LILAN REN, 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 decision to finally reject claims 1–7[2]. We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

CLAIMED SUBJECT MATTER

Appellant claims a hybridized electrode (independent claim 1) and a hybrid supercapacitor (independent claim 7). Claim 1 illustrates the subject

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies Robert Bosch GmbH as the real party in interest. Appeal Brief filed January 30, 2018 ("App. Br."), 2.
[2] Final Office Action entered September 20, 2017 ("Final Act."), 1.

matter on appeal, and is reproduced below with contested language italicized:

> 1. A hybridized electrode, comprising:
> *a binder that constitutes from 5% by weight to 10% by weight of the electrode, and that has a capacitance of at least 100 F/g*.

App. Br. 12 (Claims Appendix) (emphasis added).

REJECTION

The Examiner maintains the rejection of claims 1–7 under 35 U.S.C. § 103 as unpatentable over Yu et al. (US 2011/0183180 Al, published July 28, 2011) in view of Taguchi et al. (US 2010/0027195 Al, published February 4, 2010) in the Examiner's Answer entered June 12, 2018 ("Ans.").

FACTUAL FINDINGS AND ANALYSIS

Upon consideration of the evidence relied upon in this appeal and each of Appellant's timely contentions,[3] we affirm the Examiner's rejection of claims 1–7 under 35 U.S.C. § 103, 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 appellant provides for each issue the appellant identifies. 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

[3] We do not consider any argument that Appellant presents for the first time in the Reply Brief that Appellant could have raised in the Appeal Brief. 37 C.F.R. § 41.37(c)(1)(iv); 37 C.F.R. § 41.41(b)(2) (arguments raised for the first time in the Reply Brief that could have been raised in the Appeal Brief will not be considered by the Board unless good cause is shown).

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.")).

Appellant argues claims 1–7 as a group on the basis of independent claims 1 and 7, which Appellant argues together. App. Br. 5–10. We accordingly select claim 1 as representative, and decide the appeal as to claims 1–7 based on claim 1 alone. 37 C.F.R. § 41.37(c)(1)(iv).

Yu discloses an electrode for a supercapacitor comprised of stacks of nano-scale graphene sheets, which Yu refers to as "nanographene platelets," in which individual sheets are either bonded by a conductive polymer binder, or are coated with a thin layer of the binder, to introduce functional groups onto the surface of the graphene sheets (or to "surface functionalize" the sheets). Yu ¶¶ 2, 10, 34, 58, 82; Figs. 6A and 6B. Yu discloses that using an intrinsically conductive polymer, such as polyaniline, as a binder or coating material increases the electrode's capacitance through pseudo-capacitance effects, such as redox reactions. Yu ¶¶ 71, 72, 85, 89, 116. Example 1 of Yu discloses that applying a thin coating of polyaniline to the outer surface of two nanographene platelet electrodes included in a symmetric supercapacitor increased the supercapacitor's specific capacitance by 110 F/g, relative to the specific capacitance of a supercapacitor having two electrodes formed of single-layer nanographene sheets "with no further treatment" (referred to as the "NGP mat"). Yu ¶¶ 117, 118.

The Examiner finds that capacitance is an intrinsic physical property of a particular polymer, and determines that the capacitance of the polyaniline binder disclosed in Yu, therefore, would be expected to be within the capacitance range recited in claim 1, in view of the recitation in claim 3, which depends from claim 1, that the binder can be polyaniline. Ans. 7–9 (citing *In re Spada*, 911 F.2d 705, 709 (Fed. Cir. 1990) and *In re Papesch*, 315 F.2d 381, 391 (CCPA 1963) ("[A] compound and all of its properties are inseparable").).

The Examiner further finds that Yu does not explicitly disclose the weight percentage of the binder material included in the nanographene platelet electrode described in the reference, and the Examiner relies on Taguchi's disclosure of an amount of binder material suitable for use in the positive and negative electrodes of a capacitor. Final Act. 5–6 (citing Taguchi claims 1 and 5, ¶¶ 9, 10, 62); Ans. 8 (citing Taguchi ¶¶ 62, 76). Appellant does not dispute the Examiner's finding that Taguchi discloses a binder amount that encompasses the range recited in claim 1 of from 5% by weight to 10% by weight of the electrode. *Compare* Final Act. 5–6 (citing Taguchi claims 1 and 5, ¶¶ 9, 10, 62) and Ans. 8 (citing Taguchi ¶¶ 62, 76), *with* Reply Br.[4]

Appellant argues that the 110 F/g increase in capacitance exhibited by the polyaniline-coated nanographene platelets disclosed in Yu "cannot be attributed to a particular capacitance of the binder or NGP [nanographene platelet] surface coating itself." App. Br. 5. Appellant argues that Yu attributes the capacitance increase to pseudo-capacitance via a fast redox

[4] Although Appellant argues in the Appeal Brief that Taguchi does not disclose a binder amount as recited in claim 1 (App. Br. 6–8), Appellant concedes in the Reply Brief that, in view of the Examiner's response to Appellant's arguments in the Answer (Ans. 8) "it appears that Taguchi does contemplate a binder (powder + pyrrolidone) that can fall within the 5-10% by weight range set forth in Applicant's claims." Reply Br. 4–6.

reaction at the interface between the nanoparticles and the electrolyte, and, Appellant argues, Yu explains that a conducting polymer and other surface functional groups can promote the pseudo-capacitance effect. *Id*. Appellant argues that Yu discloses an increase in capacitance of “the base electrode of at least 100 F/g,” but the claims require the binder, rather than the electrode, to have a particular capacitance, and Yu does not disclose the capacitance of the polyaniline. *Id*.

As discussed above, however, Yu discloses that using an intrinsically conductive polymer, such as polyaniline, as a binder or coating material for nanographene platelets used to form an electrode increases the electrode’s capacitance through pseudo-capacitance effects, such as redox reactions. Although Yu discloses that such redox reactions occur in a capacitor at the interface between the graphene nanoparticles and an electrolyte (¶ 71), Yu nonetheless discloses—as Appellant acknowledges—that the conducting polymer, or polyaniline, promotes the pseudo-capacitance effect that increases the electrode’s capacitance. Yu ¶¶ 71, 85, 89, 116. Furthermore, as discussed above, Example 1 of Yu discloses that applying a thin polyaniline coating to nanographene platelet electrodes in a supercapacitor resulted in a 110 F/g increase in the supercapacitor’s specific capacitance relative to that of a supercapacitor having uncoated nanographene platelet electrodes. One of ordinary skill in the art reasonably would have understood from Yu’s disclosures as a whole that the increase in specific capacitance was due to the polyaniline coating.

In view of the magnitude of the specific capacitance increase imparted by a polyaniline coating disclosed in Yu, and in view of the disclosure in Appellant’s Specification that polyaniline has a capacitance of 190 F/g, the

Examiner has a reasonable basis for finding that the polyaniline disclosed in Yu has a capacitance of at least 100 F/g. *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977) ("Where . . . the claimed and prior art products are identical or substantially identical, or are produced by identical or substantially identical processes, the PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his claimed product. Whether the rejection is based on 'inherency' under 35 U.S.C. § 102, on 'prima facie obviousness' under 35 U.S.C. § 103, jointly or alternatively, the burden of proof is the same, and its fairness is evidenced by the PTO's inability to manufacture products or to obtain and compare prior art products.").

The burden, therefore, shifts to Appellant to show that the polyaniline disclosed in Yu does not have a capacitance of at least 100 F/g as recited in claim 1, and on the record before us, Appellant's arguments do not meet this burden. *Best*, 562 F.2d at 1255. Specifically, Appellant argues in the Reply Brief that the capacitance properties of polyaniline are not the same for all polyaniline compositions, as demonstrated by the disclosure in Appellant's Specification of polyaniline having a capacitance of 190 F/g, which, Appellant argues, "is greater than the capacitance of the PANI/NGP composite (188 F/g) and greater than the incremental increase in capacitance due to the polyaniline coating (110 F/g)." Reply Br. 4.

Appellant, however, confuses the "PANI/NGP composite" disclosed in Yu, which is the electrode material to which the polyaniline coating was applied, with the "NGP mat," or single-layer nanographene sheets "with no further treatment," whose capacitance was compared to the polyaniline-coated PANI/NGP composite. Yu ¶¶ 117–18. Yu discloses that "[t]he NGP mat herein used is prepared from mostly single-layer graphene sheets," and Yu does not disclose including polyaniline, or any other conductive polymer, in the NGP mat. Yu ¶¶ 116–117. Contrary to Appellant's argument, Yu discloses that the NGP mat had a specific capacitance of 188 F/g (¶ 117), and Yu does not disclose that the PANI/NGP composite had a specific capacitance of 188 F/g.

Furthermore, the relevant inquiry is not whether the capacitance properties of polyaniline are the same for all polyaniline compositions as Appellant asserts. Rather, the issue is whether the polyaniline binder disclosed in Yu has a capacitance value as recited in claim 1. Appellant's comparison between the 190 F/g polyaniline capacitance disclosed in Appellant's Specification, and the 110 F/g capacitance increase imparted by the polyaniline coating disclosed in Yu, does not demonstrate that the polyaniline utilized for the coating disclosed in Yu does not have a capacitance of at least 100 F/g as recited in claim 1.

Appellant argues in the Reply Brief that the specific capacitance increase of 110 F/g disclosed in Yu was imparted by a polyaniline coating, rather than a binder as recited in claim 1. Reply Br. 3. Claim 1, however, recites only that the claimed hybridized electrode comprises a binder, and does not place any limitation on the particular location or placement of the binder. Claim 1, accordingly, does not exclude a binder applied to an electrode as a coating as disclosed in Yu.

Appellant argues that "[t]here is no rational basis to modify Yu with Taguchi" so as to arrive at an amount of binder recited in claim 1. App. Br. 8–10 (emphasis omitted). Appellant argues that the portions of Taguchi cited by the Examiner "fail[] to provide any rationale for its use in modifying Yu" because the cited portions "do[] not refer to the effect of the binder." *Id*.

Regardless of whether Taguchi discloses the effect of the binder described in the reference, however, as discussed above, Yu discloses that an intrinsically conductive polymer, such as polyaniline, used as a binder or coating material in a nanographene platelet electrode, increases the electrode's capacitance. This disclosure teaches or would have suggested that the amount of conductive polymer binder added to an electrode would affect the extent of the capacitance increase imparted by the binder. *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297 (Fed. Cir. 2012) ("A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective."). It follows, therefore, that one of ordinary skill in the art would have been led by Yu's disclosures to determine an amount of polyaniline binder to utilize in an electrode that would impart a desired capacitance increase, such as an amount as recited in claim 1, through nothing more than routine experimentation. *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980) ("[D]iscovery of an optimum value of a result effective variable . . . is ordinarily within the skill of the art.").

Appellant does not provide evidence demonstrating the criticality of the binder weight percentage range recited in claim 1 (App. Br. 8–10), and Appellant's arguments are, therefore, unpersuasive of reversible error in the Examiner's rejection. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990) ("The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims . . . . These cases have consistently held that in such a situation, 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.”) (citations omitted).

We, accordingly, sustain the Examiner’s rejection of claims 1–7 under 35 U.S.C. § 103.

CONCLUSION

Claims Rejected	**Basis**	**Affirmed**	**Reversed**
1–7	§ 103 over Yu in view of Taguchi	1–7	
Overall Outcome		1–7	

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