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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte KOUJI OONO, HIROFUMI YASUMIISHI, and
TAKAO KITAGAWA

Appeal 2019-004290
Application 15/009,312
Technology Center 1700

Before GEORGE C. BEST, GRACE KARAFFA OBERMANN, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

OBERMANN, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant¹ seeks review of the Examiner's decision rejecting claims 1–3 and 5–7. Appeal Br. 5. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

¹ We use “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party-in-interest as Sumitomo Osaka Cement Co. Appeal Br. 3.

STATEMENT OF THE CASE

The claims relate to an electrode material for a lithium-ion rechargeable battery. Spec. ¶ 1, Claim 1. The written description explains that to increase electron conductivity of an electrode, which includes a lithium phosphate compound, a carbonaceous film is formed on the surfaces of particles of the electrode material. *Id.* ¶ 4. However, the carbonaceous film causes a decreased migration rate of lithium ions, which results in increased battery resistance and lower voltages during charging. *Id.* ¶ 6. Consequently, there is a trade-off between improving electron conductivity and improving lithium ion conductivity. *Id.* According to the written description, when the micropore diameter distribution of an electrode material has a peak in a range of 0.4 nm to 5.0 nm, it is possible to achieve favorable lithium ion conductivity even when the coating ratio of the particles with a carbonaceous film is high. *Id.* ¶ 9.

Claim 1 is illustrative of the subject matter and is reproduced below:

1. An electrode material for a lithium-ion rechargeable battery comprising:

inorganic particles represented by Formula

$\text{LiFe}_x\text{Mn}_{1-x-y}\text{M}_y\text{PO}_4$ ($0.05 \leq x \leq 1.0$, $0 \leq y \leq 0.14$; in which M represents at least one element selected from the group consisting of Mg, Ca, Co, Sr, Ba, Ti, Zn, B, Al, Ga, In, Si, Ge, and rare earth elements); and

a carbonaceous film coating surfaces of the inorganic particles and having micropores,

wherein the electrode material has at least one peak of a micropore diameter distribution in a range of 0.4 nm to 5.0 nm, measured using a nitrogen adsorption amount measurement instrument,

wherein the carbonaceous film coats 75 % or more of the surface of the inorganic particles,

wherein an average film thickness of the carbonaceous film is from 1.0 nm to 5.0 nm,

and wherein the carbonaceous film is 0.8 to 3% by weight of the coated inorganic particles.

Appeal Br. Claims App., at 20.

OPINION

The Examiner rejects claims 1–3 and 5–7 as obvious over Nien² in view of Zaghbi³ and Wong.⁴ Final Act. 4–6. Appellant argues claims 1, 2, and 5–7 as a group. Appeal Br. 10–17. We select claim 1 as representative of that group. *See* 37 C.F.R. § 41.37(c)(1)(iv). Appellant also presents separate arguments with respect to claim 3. Appeal Br. 18.

Claim 1

The Examiner finds that Nien discloses an electrode material for a lithium-ion rechargeable battery. Final Act. 4. The Examiner turns to Zaghbi for a teaching of an average thickness of the carbonaceous film of from 1.0 nm to 5.0 nm, and cites Wong as support for a finding that it would have been obvious to combine Nien and Zaghbi. *Id.* at 5–6.

² Nien, Y., *Physical and electrochemical properties of LiFePO₄/C composite cathode prepared from various polymer-containing precursors*, J. Power Sources, 193(2), 822–827 (2009).

³ Zaghbi et al., US 2009/0155689 A1, published June 18, 2009.

⁴ Wong, H., *Physical and electrochemical properties of LiFePO₄/C composite cathode prepared from aromatic diketone-containing precursors*, Int'l J. Electrochem. Sci., 5(8), 1090–1102 (2010).

The Examiner finds that Nien discloses substantially the same materials and methods as described by Appellant, and on that basis, interprets Nien to produce an electrode material with the micropore diameter distribution recited in claim 1. *Id.* at 4–5. In making this finding, the Examiner compares the process described in the written description with the process disclosed in Nien. *Id.* at 14 (quoting Final Act. 4–5). According to the written description, micropores of the required diameters are formed by dissolving inorganic particles and an organic compound in water to form a slurry; and spray drying, followed by heat treatment in a non-oxidative atmosphere at 600°C–900°C for up to 40 hours. Final Act. 4–5 (citing Spec. ¶¶ 32, 35); Ans. 7 (citing Spec. ¶ 37). The inorganic particles are of the formula $\text{LiFe}_x\text{Mn}_{1-x-y}\text{M}_y\text{PO}_4$, where $0.05 \leq x \leq 1.0$, and $0 \leq y \leq 0.14$. *See* Claim 1. The organic compound contains a large amount of oxygen in its structure—for example, a polyether, such as polyoxyethylene, and polyoxyethylene sorbitan esters. Final Act. 5 (citing Spec. ¶¶ 21, 28); Ans. 7 (citing Spec. ¶¶ 28, 34). The Examiner shows that Nien, likewise, discloses mixing lithium iron phosphate particles in water with polyethylene oxide (PEO) and heat-treating in a reducing atmosphere at 600°C for 8 hours. *Id.* at 4 (citing Nien 823, 823 tbl.1).

Appellant disagrees with the Examiner’s finding that Nien discloses the micropore diameter distribution recited in claim 1. Appeal Br. 14–16. The Examiner, however, shows that the written description and Nien each disclose substantially the same process for producing the electrode material. That is, each describes (1) inorganic particles of LiFePO_4 —i.e., where $x=1$ and $y=0$ in the formula $\text{LiFe}_x\text{Mn}_{1-x-y}\text{M}_y\text{PO}_4$ (e.g., Claim 1; Nien 823); (2) forming a slurry by mixing the inorganic particles and a polyether,

specifically, PEO, in water (Spec. ¶¶ 28, 32, 34; Nien 823, 823 tbl.1); and (3) heat treating in a non-oxidative (i.e., reducing) atmosphere at 600°C–900°C for up to 40 hours (Spec. ¶ 35; Nien 823 (600°C for 8 hours)). In particular, the written description instructs, “to impart a desired micropore diameter distribution to the electrode material by appropriately using a substance (polyether or the like) including a large amount of oxygen in the structure of the carbon source organic substance.” Spec. ¶ 34. The written description specifically identifies polyoxyethylene—the same polymer disclosed in Nien—as an example of the carbon source organic substance that includes a large amount of oxygen in the structure, and which is suitable for use in obtaining the desired micropore diameter distribution. *Id.* ¶ 28.

Under these circumstances, the Examiner has an adequate basis for finding that Nien’s particles have substantially the same properties as those claimed by Appellant, including the micropore diameter distribution recited in claim 1. In other words, the Examiner correctly finds that the claimed micropore diameter distribution is an inherent attribute of the electrode material in Nien because it is made by a substantially identical process as that disclosed in the written description.

Appellant makes several arguments directed to the legal standards required to show inherency in the context of an obviousness rejection. Appeal Br. 14–15, 17; Reply Br. 4–7. For example, Appellant points out that the use of inherency in the obviousness context must be carefully circumscribed. Appeal Br. 17; Reply Br. 7. Appellant also asserts that a prior art reference inherently discloses a claimed feature only when that feature occurs 100% of the time from the substantially similar process disclosed in the prior art. Appeal Br. 11, 14, and 17. Appellant further

argues that a rejection for obviousness is improper when the rejection applies a motivation to combine different elements to arrive at an inherent feature. Appeal Br. 17; Reply Br. 7.

As to the latter argument, we do not agree that the Examiner’s rejection combines different prior elements in finding that the claimed micropore diameter distribution is inherent. Rather, the Examiner relies on Nien alone in finding that the claimed micropore diameter distribution is inherent in particles prepared according to Nien’s disclosed process steps. Final Act. 4–5. To the extent the Examiner combines teachings of a different prior art reference with Nien, the Examiner does so only to establish that the claimed carbon film thickness—i.e., a different claim limitation (not the inherent feature)—would have been obvious. *Id.* at 5–6.

As to the correct legal standard, “[i]nherency is established in the context of obviousness when ‘the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art.’” *Hospira, Inc. v. Fresenius Kabi USA, LLC*, 946 F.3d 1322, 1329 (Fed. Cir. 2020) (quoting *Par Pharm. v. TWi Pharm., Inc.*, 773 F.3d 1186, 1194 (Fed. Cir. 2014)). On the question, whether a claim limitation necessarily is present in the prior art, we follow this guidance:

Where, as here, the claimed and prior art products . . . 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.

In re Best, 562 F.2d 1252, 1255 (CCPA 1977) (footnote omitted) (citation omitted).

The Examiner applies the correct legal standard under *In re Best*. Ans. 9–10 (citing *Best*, 562 F.2d at 1255). As explained above, the Examiner establishes that Nien discloses a substantially identical process as that set forth in the written description. Accordingly, we find the Examiner properly shifts the burden to Appellant to show that Nien's particles do not necessarily possess the specified micropore diameter distribution. *Id.*

Appellant further argues that the written description discloses that, to form the micropores, a template substance is mixed with the organic compound used as a carbonaceous film precursor, and that template substance is in a range of 10–100 parts by mass of the organic compound. Appeal Br. 15 (citing Spec. ¶¶ 29–30). Appellant contends that the Examiner does not address those conditions. *Id.* at 16. The Examiner, however, correctly explains that the Specification describes “a number of equivalent alternatives including mixing active material with ‘a carbon source organic substance including a large amount of oxygen in the structure’ or mixing a common carbon precursor like sucrose with ‘a template substance.’” Ans. 7–8 (citing Spec. ¶¶ 28–29, 32).

Illustrating those different alternatives, Example 1 of the Specification teaches an aqueous solution of polyoxyethylene sorbitan ester, and Examples 2 and 6 of the Specification use a template substance as an alternative method for achieving the specified result. *Id.* at 8–9; *see also* Spec. ¶¶ 44–46, 50 (Examples 1, 2, and 6). The Examiner asserts that, “[w]hile some methods of the instant specification require ‘a template

substance,’ not all of them do, and Appellant has not addressed Nien’s use of PEO, identified in the instant specification as a substance capable of ‘impart[ing] a desired micropore diameter.’” Ans. 9 (quoting Spec. ¶ 34). We agree with the Examiner on that critical point.

The written description supports the Examiner’s position. It describes using either an organic compound having a large amount of oxygen in its structure (including a polyether, such as polyoxyethylene, and polyoxyethylene sorbitan esters) *or* a template substance, as two alternatives for forming the desired micropore diameter distribution. Spec. ¶¶ 28–29, 34. Example 1 illustrates the first alternative—use of polyoxyethylene sorbitan ester. *Id.* ¶ 45. Examples 2 and 6 show the second alternative—a template substance. *See* Spec. ¶¶ 29, 46, 50. Appellant confines its argument to the fact that Nien does not disclose a template substance, and does not address the Examiner’s point that Nien uses PEO, which the written description of the instant application expressly describes as an alternative to the template substance. *See* Appeal Br. 15–16.

In addition, Appellant argues that the Examiner’s citation of Example 5 of the written description to support the finding that the prior art necessarily exhibits the claimed properties is misplaced. Reply Br. 4–6. Appellant asserts that Example 5 does not meet the claimed carbonaceous film coverage of 75% or more as required by claim 1. *Id.* at 4–5.

The Examiner, however, cites both Examples 1 and 5 in support of the finding that Nien discloses substantially the same process as Appellant. Ans. 8–9. Example 5 does not result in the claimed carbonaceous film coverage (Spec. ¶ 62 tbl.1), but the Examiner does not use Example 5 to demonstrate the amount of carbonaceous film coating present in the prior art

(see Ans. 8–9 (citing Examples 1 and 5 of the written description to show the use of polyoxyethylene sorbitan to form the claimed micropore diameters)). In any event, Appellant does not challenge the Examiner’s reliance on Example 1. See Reply Br. 4–6.

Example 1 provides the best comparison to Nien. For instance, Example 5 includes 50 ppm of oxygen in the thermal treatment atmosphere (Spec. ¶ 49), but Example 1 and Nien do not (*id.* ¶ 45 (“atmosphere not including oxygen”); Nien 823 (“reducing atmosphere”)). Although Nien discloses polyoxyethylene (Nien 823 tbl.1), whereas Examples 1 and 5 disclose a polyoxyethylene sorbitan ester (Spec. ¶¶ 45, 49), the written description indicates that polyoxyethylene is interchangeable with polyoxyethylene sorbitan ester (*see id.* ¶ 28). Accordingly, we discern no reversible error in the Examiner’s reliance on Example 1 to show that Nien discloses substantially the same process set forth in the written description.

Appellant also argues that Zaghieb does not teach micropores having the diameters claimed by Appellant. Appeal Br. 16. In response, the Examiner explains that Zaghieb is relied upon solely for its teaching of the claimed carbonaceous film thickness. Ans. 10. The Examiner correctly states, “One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references.” *Id.* (citing *In re Merck & Co.*, 800 F.2d 1091 (Fed. Cir. 1986) and *In re Keller*, 642 F.2d 413 (CCPA 1981)).

Appellant makes a conclusory statement that “Zaghieb do[es] not disclose or suggest . . . an average film thickness of the carbonaceous film is in a range of 1.0 nm to 5.0 nm.” Appeal Br. 16. Appellant does not discuss or provide any further explanation on that point. *Id.* The Examiner finds

that Zaghbi teaches a thickness of 1–10 nm, which falls within the specified range. Final Act. 5–6 (citing Zaghbi ¶ 15). Appellant does not contest that finding. *See* Appeal Br. 16. Accordingly, on this record, there is no basis to conclude that the Examiner erred in applying the teachings of Zaghbi.

Appellant also contends that the Examiner’s rejection suffers from hindsight bias; that is, according to Appellant, a motivation to combine can be found only from the patent application, as it is undisputed that the prior art applied by the Examiner does not disclose an inherent feature (by which, we conclude, Appellant means to refer to the micropore diameter distribution). Appeal Br. 17. It stands to reason that an inherent feature is not expressly disclosed in an asserted prior art reference. We agree with the Examiner that Appellant’s argument, in that regard, misconstrues the rejection, which does not depend on a “motivation” to account for the inherently disclosed micropore diameter distribution. *See* Ans. 11. Even if the claimed micropore diameter distribution is not expressly disclosed in Nien, the Examiner adequately explains how Nien discloses substantially the same process set forth in the written description, such that this property inherently results from the process of Nien. Final Act. 4–5.

Claim 3

Claim 3 depends from claim 1, and further requires that the “activation energy for a migration reaction of lithium ions in an interface between the inorganic particle and the carbonaceous film is 70 kJ/mol or less.” Appeal Br. Claims App., at 20. The Examiner rejects claim 3 on the basis that it is directed to a product produced by an identical or substantially identical process as described in Nien, such that a prima facie case of obviousness has been established. Final Act. 6.

Appellant argues that an electrode material having at least one peak of a micropore diameter distribution in the range of 0.4 nm to 5.0 nm cannot be obtained on the basis of Zaghieb. Appeal Br. 18. The Examiner maintains that claim 3 refers to a property that is rendered obvious by Nien in view of Zaghieb because the claiming of an unknown property that is inherently present in the prior art does not necessarily make the claim patentable. Ans. 11 (citing *Best*, 562 F.2d at 1254).

Appellant argues that in Zaghieb, there is not a micropore diameter distribution in the claimed range of 0.4 nm to 5.0 nm. Appeal Br. 18. The Examiner, however, does not rely on Zaghieb for teaching the claimed micropore diameter distribution range. Accordingly, for the same reasons discussed above with respect to the Examiner's reliance on Zaghieb in rejecting claim 1, Appellant does not establish that the Examiner erred in applying the teachings of Zaghieb in the rejection of claim 3.

CONCLUSION

The Examiner's decision to reject claims 1-3 and 5-7 is affirmed.

Claims Rejected	35 U.S.C. §	References/Basis	Affirmed	Reversed
1-3, 5-7	103	Nien, Zaghieb, Wong	1-3, 5-7	

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).

AFFIRMED