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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* DO-YO KIM, JIN-HYOUNG SEO, MI-RAN SONG, YONG-CHUL PARK, GYEONG-JAE HEO, HYUN-DEOK LEE, YONG-SEON KIM, MIN-JU KIM, and NA-LEUM YOO

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Appeal 2018-003035  
Application 13/761,449  
Technology Center 1700

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Before GEORGE C. BEST, CHRISTOPHER C. KENNEDY, and  
JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant<sup>1</sup> requests our review under 35 U.S.C. § 134(a) of the Examiner's decision to reject claims 1, 17, and 18. We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

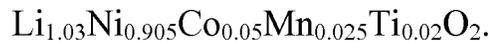
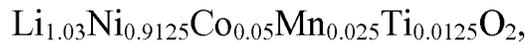
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<sup>1</sup> Appellant is the applicant, Samsung SDI Co., Ltd., which, according to the Appeal Brief, is the real party in interest. Appeal Brief filed May 30, 2017 ("Br.") 2.

STATEMENT OF THE CASE

Appellant's invention is generally directed to a positive active material for a lithium secondary battery. Spec. ¶ 1. Independent claims 1 and 17 illustrate the subject matter on appeal and are reproduced below:

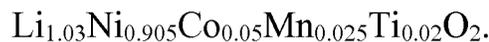
1. A positive active material for a lithium secondary battery, the positive active material being in a form of primary particles having a particle diameter in a range of 100 to 400 nm, wherein the positive active material is



17. A positive electrode for a lithium secondary battery, the positive electrode comprising

a positive active material for a lithium secondary battery, the positive active material being in a form of primary particles having a particle diameter in a range of 100 to 400 nm,

wherein the positive active material is



Br. 12 (Claims Appendix) (spacing added).

The Examiner sets forth the following rejections in the Non-Final Office Action entered December 29, 2016 ("Office Act."), and maintains the rejections in the Examiner's Answer entered September 22, 2017 ("Ans."):

- I. Claims 1, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Hur et al. (US 2008/0118835 A1, published May 22, 2008); and

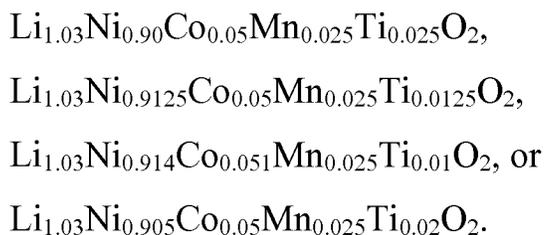
II. Claims 1, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Inoue et al. (US 2009/0081550 A1, published March 26, 2009).

### DISCUSSION

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, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Hur for the reasons set forth in the Appeal Brief and below, and affirm the Examiner's rejection of claims 1, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Inoue for the reasons set forth in the Office Action, the Answer, and below.

#### Rejection I

Independent claims 1 and 17 both recite, in part, a positive active material for a lithium secondary battery that is:



The Examiner finds that Hur discloses a positive active material for a lithium secondary battery of the formula:



where M may be Ti, and  $0.95 \leq a \leq 1.1$ ,  $0 \leq b \leq 0.999$ ,  $0 \leq c \leq 0.999$ ,  $0 \leq d \leq 0.999$ , and  $0.001 \leq e \leq 0.2$ . Office Act. 2–3 (citing Hur abstract, ¶¶ 9–13, 31–40).

The Examiner finds that Hur's formula includes

$\text{Li}_{1.03}\text{Ni}_{0.90}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.025}\text{O}_2$ , as recited in claims 1 and 17. *Id.*

The Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify “the invention of Hur” so that Hur’s positive active material is  $\text{Li}_{1.03}\text{Ni}_{0.90}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.025}\text{O}_2$  because “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” Office Act. 3 (citing *In re Aller*, 220 F.2d 454, 456 (CCPA 1955)). The Examiner further indicates that the “discovery of an optimum value of a known result effective variable, without producing any new or unexpected results, is within the ambit of a person of ordinary skill in the art.” Office Act. 3 (citing *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980); MPEP § 2144.05, II.).

Claims 1 and 17 recite four positive active material species for lithium secondary batteries, while Hur discloses a broad genus of positive active materials for lithium secondary batteries. Hur ¶¶ 31, 32, 36. Hence, case law directed to the obviousness of claimed species when the prior art discloses a genus is more relevant to the present factual situation than the overlapping range cases cited by the Examiner. Office Act. 3.

In particular, it is well-established that although a claimed species may be encompassed by a prior art genus, this, by itself, is insufficient to establish a prima facie case of obviousness. For example, in *In re Baird*, 16 F.3d 380 (Fed. Cir. 1994), the Federal Circuit estimated that a generic diphenol formula disclosed in the applied prior art “encompasses more than 100 million different diphenols,” but found that there was nothing in the disclosure of the prior art reference that would have led one of ordinary skill in to art to select the particular diphenol species claimed; consequently, the

court held that the prior art reference failed to render the claimed species prima facie obvious. *Id.* at 382. Similarly, in *In re Jones*, 958 F.2d 347, 350 (Fed. Cir. 1992), the applied prior art reference disclosed a “potentially infinite genus” of substituted ammonium salts of dicamba, whereas the claim was directed to a particular salt species that was not “specifically disclosed” in the prior art reference. *Id.* at 350. The court found that “[c]onspicuously missing from the record is any *evidence* other than the PTO’s speculation . . . that one of ordinary skill in the art . . . would have been motivated to make the modifications of the prior art salts necessary to arrive at the claimed 2-(2'-aminoethoxy)ethanol salt.” *Id.* at 351. The court concluded that the prior art did not render the claimed species prima facie obvious. *Id.*

Similar to *Baird* and *Jones*, in the present case, Hur discloses a large genus of positive active materials encompassed by the following formula:



where  $0.95 \leq a \leq 1.1$ ,  $0 \leq b \leq 0.999$ ,  $0 \leq c \leq 0.999$ ,  $0 \leq d \leq 0.999$ , and  $0.001 \leq e \leq 0.2$ .

Hur ¶¶ 9, 10. As Appellant points out, although M can be titanium, it can also be any of a number of additional elements. Hur ¶ 36. Appellant also points out that the amounts of nickel, cobalt, and manganese that can be included in Hur’s material span broad ranges. Br. 5; Hur ¶¶ 32, 36.

Appellant further notes that none of the positive active materials of Hur’s experimental Examples 1–45 includes nickel, and all of the exemplified materials include magnesium, which is not included in the positive active material species recited in claim 1. Br. 7; Hur ¶¶ 96, 104. In addition, the 15 positive active materials of Hur’s experimental Example 2, and the 10 positive active materials of Hur’s experimental Example 3, do not include

either nickel or titanium, and each includes magnesium. Hur ¶¶ 107, 115, 119, 127.

On this appeal record, the Examiner does not identify any disclosure in Hur that would have led one of ordinary skill in the art to select the particular species of positive active material recited in claims 1 and 17 from the broad genus of positive active materials disclosed in Hur. For example, the Examiner does not identify any disclosure in Hur of a particular positive active material that includes nickel, much less disclosure indicating that inclusion of nickel in a positive active material as described in the reference is preferred, desirable, or advantageous, particularly in combination with titanium. Nor does the Examiner, for example, identify any disclosure in Hur of one or more particular positive active materials that include nickel in an amount of about 0.90, cobalt in an amount of about 0.05, and manganese in an amount of 0.025, much less disclosure that such amounts of nickel, cobalt, and manganese are preferred, desirable, or advantageous in a positive active material as described in the reference.

Accordingly, the Examiner does not provide a persuasive, reasoned explanation, supported by objective evidence, for why one of ordinary skill in the art would have been led by the relied-upon disclosures of Hur to form a positive active material for a lithium secondary battery that is

$\text{Li}_{1.03}\text{Ni}_{0.90}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.025}\text{O}_2$ ,  $\text{Li}_{1.03}\text{Ni}_{0.9125}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.0125}\text{O}_2$ ,  
 $\text{Li}_{1.03}\text{Ni}_{0.914}\text{Co}_{0.051}\text{Mn}_{0.025}\text{Ti}_{0.01}\text{O}_2$ , or  $\text{Li}_{1.03}\text{Ni}_{0.905}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.02}\text{O}_2$ , as  
required by claims 1 and 17.

We accordingly do not sustain the Examiner's rejection of claims 1 and 17 under 35 U.S.C. § 103(a) as unpatentable over Hur, and also of claim 18, which depends from claim 17.

Rejection II

Appellant argues claims 1, 17, and 18 together. Br. 8–10. We accordingly select claim 1 as representative, and decide the appeal as to claims 1, 17, and 18 based on claim 1 alone. 37 C.F.R. § 41.37(c)(1)(iv).

Appellant argues that even if Inoue renders the positive active material recited in claim 1 *prima facie* obvious, “such *prima facie* case of obviousness is rebutted by the evidence provided in the Examples of the specification as filed and in the Rule 132 Declaration” of Do-Yu Kim filed December 9, 2016 (“the Kim Declaration”). Br. 9. Appellant argues that Inoue “is silent regarding the advantages disclosed in the present application of combining a high amount of nickel ( $0.9 \leq x \leq 0.93$ ) in a lithium nickel composite oxide with titanium oxide to obtain positive active material that achieves both an increased capacity per unit weight.” *Id.*

The burden of analyzing and explaining Specification disclosures and other data to establish unexpected results rests with the Appellant. *In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972) (“the burden of showing unexpected results rests on he who asserts them”). Appellant does not provide any description whatsoever of the “evidence provided in the Examples of the specification,” and thus does not explain why and how the Specification examples “rebut” a *prima facie* case of obviousness based on Inoue, if the Examiner establishes such a *prima facie* case. Br. 8–10. Nor does Appellant describe in any further detail—including providing a citation to the relevant portions of the Specification—how and why the asserted “advantages disclosed in the present application of combining a high amount of nickel ( $0.9 \leq x \leq 0.93$ ) in a lithium nickel composite oxide with titanium oxide” “rebut” a *prima facie* case of obviousness. *Id.* Accordingly,

Appellant’s conclusory assertions regarding unidentified disclosures in the Specification and the Specification Examples lack persuasive merit. *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 or conclusory statements in the specification does not suffice.”); *cf. In re Baxter Travenol Labs.*, 952 F.2d 388, 391 (Fed. Cir. 1991) (“It is not the function of this court to examine the claims in greater detail than argued by an appellant, looking for nonobvious distinctions over the prior art.”).

Appellant argues that the Kim Declaration describes experiments in which the rate capabilities of the four positive active materials recited in claim 1 were compared to the rate capabilities of the following three positive active materials (the positive active materials of Comparative Preparation Examples A, B, and C):

1.  $\text{Li}(\text{Ni}_{0.55}\text{Co}_{0.25}\text{Mn}_{0.115}\text{Ti}_{0.025})\text{O}_2$  having a primary particle diameter of 300–400 nm,
2.  $\text{Li}(\text{Ni}_{0.5}\text{Co}_{0.2}\text{Mn}_{0.275}\text{Ti}_{0.025})\text{O}_2$  having a primary particle diameter of 600–1100 nm, and
3.  $\text{Li}(\text{Ni}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05})\text{O}_2$  having a primary particle diameter of 500–800 nm. Br. 9. Appellant indicates that the positive active material species of Comparative Preparation Example 3 corresponds to Example 1 of Inoue. *Id.* Appellant argues that “[a]s shown in Table 1 of the Rule 132 Declaration, the rate capabilities of Examples 1 and 2 were superior to those of Comparative Preparation Examples 1, 2, and 3.” *Id.* Appellant argues that this result would have been unexpected because while Inoue discloses that the metal (Me) in its lithium nickel composite oxide may be Al, Mn, Ti, or Ca, Inoue “provides no hint or suggestion of the superior results obtained

by combining a high amount of nickel ( $0.9 \leq x \leq 0.93$ ) in a lithium nickel composite oxide with titanium oxide, and no indication of superior results of a positive active material” as specifically recited in claim 1. Br. 9–10.

Appellant’s arguments and the information provided in the Kim Declaration do not constitute persuasive evidence of unexpected results, for reasons that follow.

The Kim Declaration states that the Examples and Comparative Examples provided in the Declaration “demonstrate the criticality of positive active materials having the formulas . . . [recited in claim 1] particularly with regard to the amount of nickel therein.” Kim Declaration pg. 3.

Preparation Examples 1 and 2 of the Kim Declaration describe production of  $\text{Li}_{1.03}\text{Ni}_{0.90}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.025}\text{O}_2$  and  $\text{Li}_{1.03}\text{Ni}_{0.9125}\text{Co}_{0.05}\text{Mn}_{0.025}\text{Ti}_{0.0125}\text{O}_2$ , respectively, which are recited in claim 1. Kim Declaration pgs. 3–4. The Kim Declaration does not describe the preparation or testing of the remaining two positive active materials recited in claim 1, contrary to Appellant’s arguments and the above statement in the Kim Declaration.

The Kim Declaration further includes Comparative Preparation Examples A, B, and C (also referred to in other portions of the Declaration Comparative Examples 1, 2, and 3) that describe preparation of the three electrode active materials set forth above in the context of Appellant’s arguments. Kim Declaration pgs. 4–5. Evaluation Example 2 of the Kim Declaration describes experiments in which the rate capabilities of the positive active materials of Preparation Examples 1 and 2 and Comparative Preparation Examples A, B, and C were determined. Kim Declaration pgs. 7–8. The results of Evaluation Example 2 are set forth in Table 1 of the Kim

Declaration, and the Declaration states that “[r]eferring to Table 1, it can be seen that rate capabilities of Examples 1 and 2 were improved compared to those of Comparative Preparation Examples 1, 2, and 3.” Kim Declaration pgs. 8–9.

Appellant’s arguments and the Kim Declaration do not establish the criticality of the amount of nickel in combination with titanium oxide in the positive active materials recited in claim 1. Nor do Appellant’s arguments and the Kim Declaration establish that the results set forth in the Declaration would have been unexpected by one of ordinary skill in the art at the time of the invention.

To show the criticality of claimed amounts of a material encompassed by a prior art range of amounts, an Appellant must present data for a sufficient number of tested amounts within the prior art range that are above and below the claimed amounts to establish that the unexpected property occurs only for the claimed amounts (and not for other amounts within the prior art range). *In re Hill*, 284 F.2d 955, 958–59 (CCPA 1960).

The active materials of the comparative examples in the Kim Declaration do not include nickel in amounts above and below the amounts of nickel included in the four active materials recited in claim 1 (0.90, 0.9125, 0.914, 0.905). Rather, the amount of nickel in the active material of Comparative Examples A, B, and C is 0.55, 0.5, and 0.8, respectively, each of which is below the amount of nickel in the active materials recited in claim 1. Kim Declaration pgs. 4–5. It is therefore unclear whether amounts of nickel above the amounts recited in claim 1 (0.90, 0.9125, 0.914, 0.905) that are within the range disclosed in Inoue would also produce the asserted “superior” results.

A similar situation exists for the amount of titanium in the active materials of Comparative Examples A, B, and C. The materials of Comparative Examples A and B include titanium in an amount of 0.025, which is the same as the amount of titanium in one of the active materials recited in claim 1. Kim Declaration pgs. 4–5. The material of Comparative Example C does not include any titanium, which is below the amount of titanium in each of the active materials recited in claim 1 (0.025, 0.0125, 0.01, and 0.02). Kim Declaration pg. 5. Thus, the materials of Comparative Examples A, B, and C do not include amounts of titanium that are both greater than and less than the amounts of titanium included in the active materials recited in claim 1, and it is therefore unclear whether amounts of titanium above the amounts recited in claim 1 (0.025, 0.0125, 0.01, and 0.02) that are within the range disclosed in Inoue would also produce the asserted “superior” results.

In addition, the material of Comparative Example A has a particle size of 300–400 nm, the material of Comparative Example B has a particle size of 600–1100 nm, and the material of Comparative Example C has a particle size of 500–800 nm. Kim Declaration pgs. 4–5. The materials of all three comparative examples include different amounts of nickel, cobalt, and manganese, and comparative Example C includes aluminum and does not include titanium. *Id.* It is therefore unclear whether the asserted inferior rate capabilities of the materials of Comparative Examples A, B, and C is due to the low nickel content of the materials, the absence or amount of titanium in the materials, the particle size of the materials, or the amount of cobalt or manganese in the materials. In other words, it is unclear from the data provided in the Kim Declaration whether the asserted superior rate

capability of the materials of Examples 1 and 2 is due to a high amount of nickel in combination with titanium oxide, as Appellant argues, because the cause-and-effect relationship between the nickel content in combination with titanium oxide and the rate capability is lost in a “welter of unfixed variables.” *In re Dunn*, 349 F.2d 433, 439 (CCPA 1965) (“While we do not intend to slight the alleged improvements, we do not feel it an unreasonable burden on appellants to require comparative examples relied on for non-obviousness to be truly comparative. The cause and effect sought to be proven is lost here in the welter of unfixed variables.”).

Furthermore, although Appellant argues that Inoue “provides no hint or suggestion of the superior results obtained by combining a high amount of nickel ( $0.9 \leq x \leq 0.93$ ) in a lithium nickel composite oxide with titanium oxide, and no indication of superior results of a positive active material” as recited in claim 1, the difference in rate capabilities between the materials of Examples 1 and 2 and the materials of Comparative Examples A, B, and C is relatively small. Br. 9. Specifically, the material of Examples 1 and 2 exhibited rate capabilities of 90.26 and 87.1, respectively, while the material of Comparative Example C (the material of Inoue’s Example 1) exhibited a rate capability of 86.3, and the materials of Comparative Examples A and B exhibited rate capabilities of 85.6 and 85.2, respectively. Kim Declaration pg. 8. It appears that the slight difference in rate capabilities between the materials of Examples 1 and 2 and the materials of Comparative Examples A, B, and C is a mere difference in degree, rather than a difference in kind necessary to demonstrate unexpected results. *In re Lilienfeld*, 67 F.2d 920, 924 (CCPA 1933) (“It is well established that, while a change in the proportions of a combination shown to be old, such as is here involved, may

be inventive, such changes must be critical as compared with the proportions used in the prior processes, producing a difference in kind rather than degree.”)

On this record, neither Appellant nor the Declarant explains why one of ordinary skill in the art would have considered such a small difference in rate capabilities to evince “superior results,” particularly because the Declaration itself states that the that rate capabilities of the materials of Examples 1 and 2 were “improved”—rather than superior, surprising, or unexpected—compared to those of Comparative Examples 1, 2, and 3. Kim Declaration pg. 9. Thus, Appellant and the Declarant do not establish that the results set forth in the Kim Declaration would have been unexpected by one of ordinary skill in the art at the time of the invention. *In re Freeman*, 474 F.2d 1318, 1324 (CCPA 1973) (to show unexpected results, applicant must establish: “(1) that there actually is a difference between the results obtained through the claimed invention and those of the prior art, . . . and (2) that the difference actually obtained would not have been expected by one skilled in the art at the time of invention”) (citation omitted).

Accordingly, Appellant does not provide sufficient evidence to establish that the positive electrode active material recited in claim 1 exhibits results that would have been unexpected to one of ordinary skill in the art at the time of the invention relative to the closest prior art, Inoue. *In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991) (“[W]hen unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art.” (citation omitted)).

Considering the totality of the evidence relied-upon in this appeal, a preponderance of the evidence weighs in favor of the Examiner’s conclusion

Appeal 2018-003035  
Application 13/761,449

of obviousness. We accordingly sustain the Examiner's rejection of claims 1, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Inoue.

#### DECISION

We reverse the Examiner's rejection of claims 1, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Hur, and affirm the Examiner's rejection of claims 1, 17, and 18 under 35 U.S.C. § 103(a) as unpatentable over Inoue.

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