

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMPEREX TECHNOLOGY LTD.,
Petitioner,

v.

SEMICONDUCTOR ENERGY LABORATORY CO., LTD.,
Patent Owner.

IPR2023-01349
Patent 11,043,660 B2

Before DONNA M. PRAISS, JON B. TORNQUIST, and
CHRISTOPHER M. KAISER, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. *Background and Summary*

Amperex Technology Ltd. (“Petitioner”) filed a petition for an *inter partes* review (Paper 2 (“Pet.”)) challenging claims 1–10 of U.S. Patent No. 11,043,660 B2 (Ex. 1001 (“the ’660 patent”)). Semiconductor Energy Laboratory Co., Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our authorization, Petitioner filed a Preliminary Reply (Paper 7, “Prelim. Reply”), and Patent Owner filed a Preliminary Sur-Reply (Paper 8, “Prelim. Sur-Reply”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2023). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted “unless the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

For the reasons set forth below, we determine the information presented in the Petition does not establish a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. Accordingly, we do not institute an *inter partes* review of any claim on any ground asserted in the Petition.

B. *Real Parties-in-Interest*

Each party identifies itself as a real party-in-interest. Pet. 2; Paper 4, 1.

C. Related Matters

The parties identify *Amperex Technology Ltd. v. Semiconductor Energy Laboratory Co., Ltd.*, No. 1:23-cv-00272 (E.D. Va.), as a related matter. Pet. 2; Paper 4, 1.

D. The '660 Patent

The '660 patent, titled “Positive Electrode Active Material Including Lithium Cobaltate Coated with Lithium Titanate and Magnesium Oxide,” issued on June 22, 2021. Ex. 1001, codes (45), (54). When particles of positive electrode active materials (PEAM) in a secondary battery go through repeated charge and discharge cycles, they can crack to expose “a new surface of the positive electrode active material,” causing the surface to come into “contact with an electrolyte solution to cause a decomposition reaction,” which leads to degradation of the “charge and discharge characteristics” of the battery. *Id.* at 4:22–28. A protective coating film on the surface of the PEAM particles can prevent this cracking, but known coatings were unable to protect all the solvent-exposed surfaces of the particles sufficiently. *Id.* at 4:29–36.

The '660 patent describes particles with novel protective layers. *Id.* at 24:43–55. In particular, the particles have three regions, including a first region containing “a composite oxide of lithium and a first transition metal,” a second region containing “an oxide of a second transition metal,” and a third region containing “a compound of representative elements,” such as magnesium oxide or lithium fluoride. *Id.* at 10:12–12:25. The second and third regions “preferably ha[ve] a rock-salt crystal structure.” *Id.* at 11:22–23, 11:59–61, 12:61–63. The third region is a protective layer that

“improve[s] stability in charging and discharging of the secondary battery.”
Id. at 12:34–37.

E. Illustrative Claim

Of the challenged claims, claims 1 and 6 are independent. Claim 1 is illustrative and reproduced below.

1. A lithium-ion secondary battery comprising
 - a positive electrode, the positive electrode comprising a positive electrode active material particle comprising lithium cobaltate,
 - wherein the positive electrode active material particle comprises a first region and a second region,
 - wherein the first region comprises a layered rock-salt crystal structure,
 - wherein the second region comprises a rock-salt crystal structure,
 - wherein the second region covers at least a first part of the first region,
 - wherein the positive electrode active material particle comprises titanium, magnesium, fluorine, and oxygen in the second region, and
 - wherein a crystal orientation of at least a second part of the first region and a crystal orientation of at least a part of the second region are substantially aligned with each other.

Ex. 1001, 76:44–62.

F. Asserted Unpatentability Challenges

Petitioner asserts that claims 1–10 are unpatentable based on the following challenges:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1–5	103	Blangero ¹
1–5	103	Blangero, Shim ²
6–10	103	Blangero
6–10	103	Blangero, Shim
6–10	103	Blangero, Yamamoto ³
6–10	103	Blangero, Shim, Yamamoto
1–3	103	Cho ⁴
1–3	103	Cho, Kim ⁵
4, 5	103	Cho
4, 5	103	Cho, Kim
4, 5	103	Cho, Blangero
4, 5	103	Cho, Kim, Blangero
6–8	103	Cho
6–8	103	Cho, Kim
6–8	103	Cho, Yamamoto
6–8	103	Cho, Kim, Yamamoto
9, 10	103	Cho
9, 10	103	Cho, Kim
9, 10	103	Cho, Yamamoto
9, 10	103	Cho, Blangero
9, 10	103	Cho, Kim, Yamamoto
9, 10	103	Cho, Kim, Blangero
9, 10	103	Cho, Yamamoto, Blangero
9, 10	103	Cho, Kim, Yamamoto, Blangero

Petitioner relies on the declaration of Troy A. Hayes, Ph.D., P.E. (Ex. 1003, “Hayes Declaration”).

¹ US 2014/0212759 A1, published July 31, 2014 (Ex. 1005).

² US 2016/0149215 A1, published May 26, 2016 (Ex. 1006).

II. ANALYSIS

A. *Legal Standards*

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103. The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when present, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

³ Kentaro Yamamoto et al., *Stabilization of the Electronic Structure at the Cathode/Electrolyte Interface via MgO Ultra-thin Layer During Lithium-ions Insertion/Extraction*, 82 ELECTROCHEMISTRY 891–96 (2014) (Ex. 1007).

⁴ US 10,283,770 B2, issued May 7, 2019 (Ex. 1008).

⁵ Hyejung Kim et al., *A New Coating Method for Alleviating Surface Degradation of LiNi_{0.6}Co_{0.2}MnO₂ Cathode Material: Nanoscale Surface Treatment of Primary Particles*, 15 NANO LETT. 2111–19 (2015) (Ex. 1009).

To show obviousness, it is not enough to merely show that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). “Rather, obviousness requires the additional showing that a person of ordinary skill at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.* (citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007)). “This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.” *KSR*, 550 U.S. at 418–19. On the other hand, an obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *Id.* at 418; *accord In re Translogic Tech., Inc.*, 504 F.3d 1249, 1259 (Fed. Cir. 2007). Nevertheless, “[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, 550 U.S. at 421.

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art “would have [had] at least a bachelor’s degree in chemistry, chemical engineering, or materials science and at least five years of experience in the field of batteries and battery materials.” Pet. 20 (citing Ex. 1003 ¶¶ 103–111⁶). According to

⁶ Dr. Hayes testifies that a person of ordinary skill in the art would have had “at least a Bachelor’s degree in chemical engineering, electrochemistry,

Petitioner, “[i]ndividuals with different education and additional experience could still [have been] of ordinary skill in the art if that additional experience compensate[d] for a deficit in their education and experience.” *Id.* On the present record, Patent Owner does not contest Petitioner’s definition of a person of ordinary skill in the art. Prelim. Resp. 19.

In light of the record before us, and for purposes of this Decision, we adopt Petitioner’s proposal regarding the level of ordinary skill in the art. Based on our review of the ’660 patent and the prior art of record, we determine that the definition offered by Petitioner comports with the qualifications a person would have needed to understand and implement the teachings of the ’660 patent and the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown”) (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985)).

C. Claim Construction

In an *inter partes* review, we construe claim terms according to the standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b) (2022). Under *Phillips*, claim terms are afforded “their ordinary and customary meaning.” 415 F.3d at 1312. “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in

mechanical engineering, materials engineering, or chemistry, with at least two years of experience in designing or developing lithium-ion batteries.” Ex. 1003 ¶ 109. This differs from the definition for which Petitioner argues.

question at the time of the invention.” *Id.* at 1313. “Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Id.*

Neither party proposes any claim terms for construction. Pet. 20; Prelim. Resp. 20. After considering the arguments and information presented in the Petition and Preliminary Response, we agree that we do not need to construe any terms expressly in order to determine whether to institute trial. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”)).

D. Challenges Based on Blangero

Petitioner contends claims 1–5 would have been obvious in view of “Blangero alone or in combination with Shim.” Pet. 5, 21–45. Petitioner also argues that claims 6–10 would have been obvious in view of “Blangero alone or in combination with Shim and/or Yamamoto.” *Id.* at 6, 45–55. Patent Owner disagrees. Prelim. Resp. 20–43.

1. Blangero

Blangero “relates to high voltage stable and high density lithium metal oxide powderous compounds, containing a core having stoichiometrically controlled lithium content and an electron insulating surface.” Ex. 1005 ¶ 1. According to Blangero, there was a need for “high capacity LiCoO₂ based cathodes which [could] be cycled in a stable manner in real cells at higher voltages.” *Id.* ¶ 5. Prior-art approaches to solving this problem involved

coating the particles, but this was unsatisfactory because “coated dense LiCoO_2 often has a lower reversible capacity, so that a part of the gain of energy density by charging to higher voltage is annulled by lower intrinsic capacity.” *Id.* ¶ 6.

To avoid these problems, Blangero teaches using PEAM particles that include both “a core material consisting of the elements Li, a metal M and oxygen,” where the metal M “has the formula $\text{M}=\text{Co}_{1-a}\text{M}'_a$,” and M’ is “one or more metals of the group consisting of Al, Ga and B,” and “a surface layer consisting of a mixture of the elements of the core material and inorganic N oxide particles, wherein N is either one or more metals of the group consisting of Mg, Ti, Fe, Cu, Ca, Ba, Y, Sn, Sb, Na, Zn, Zr and Si.” *Id.* ¶ 9.

2. Analysis

Petitioner argues that the asserted prior art teaches or suggests the limitations of the challenged claims and that a person of ordinary skill in the art would have had reason to combine the teachings of the asserted references. Pet. 5–6, 21–55. Patent Owner disagrees. Prelim. Resp. 20–43.

a) Claim 1

Claim 1 recites a “second region [that] comprises a rock-salt crystal structure.” Ex. 1001, 76:44–62. Petitioner argues that Blangero teaches or suggests this limitation. Pet. 27–30. Specifically, Petitioner argues that Blangero teaches a surface layer on its PEAM particle that includes magnesium oxide (MgO), lithium fluoride (LiF), or lithium titanate (LiTiO_2), each of which Petitioner argues has a rock-salt crystal structure. *Id.* at 27–29. Petitioner also argues that, to the extent that Blangero teaches the use of Li_2TiO_3 rather than LiTiO_2 , a person of ordinary skill in the art

would have been motivated to replace the non-rock-salt-structured Li_2TiO_3 of Blangero with the rock-salt-structured LiTiO_2 . *Id.* at 29–30. Patent Owner argues that neither MgO nor LiF necessarily has a rock-salt crystal structure and that Petitioner does not show sufficiently why a person of ordinary skill in the art would have been motivated to choose such a crystal structure from the available options. Prelim. Resp. 21–28. Patent Owner also argues that Blangero does not teach or suggest the use of LiTiO_2 in its surface layer and that a person of ordinary skill in the art would not have been motivated to substitute LiTiO_2 for Blangero’s Li_2TiO_3 . *Id.* at 28–31.

(1) Magnesium Oxide and Lithium Fluoride

Petitioner argues that Blangero teaches or suggests that MgO and LiF are present in the coating of its particles. Pet. 27–28 (citing Ex. 1005 ¶¶ 6, 11, 59, 62, 94, 133). On the present record, we agree. Blangero states that “[t]he elements F, P and S may be present on the surface under the form of LiF , Li_3PO_4 and Li_2SO_4 ” and that “the process allows to achieve an in-situ coating of the final powder with a layer that is enriched in oxidized compounds, like MgO and TiO_2 , that may also be lithiated.” Ex. 1005 ¶¶ 11, 94.

Petitioner also argues that both MgO and LiF have a rock-salt crystal structure. Pet. 28–29 (citing Ex. 1013, 80; Ex. 1030, 16). Petitioner directs us to some evidence that this can be the case. *Id.* First, both compounds appear on a list of “Some Compounds with the Sodium Chloride Structure.” Ex. 1013, 80; *see* Ex. 1030, 16 (equating “rocksalt cubic structure,” “ NaCl ,” and “space group $Fm\bar{3}m$ ”). Second, for MgO , “rocksalt cubic structure . . . is the stable phase at room temperature and pressure.” Ex. 1030, 16. But there is also evidence of record that both MgO and LiF need not have rock-

salt crystal structures. First, “[t]here are three crystal phases of magnesium oxide (MgO), namely B₁ (NaCl), B₂ (CsCl), and B₈₁ (inverse NiAs).” *Id.* Second, both MgO and LiF may be amorphous. Ex. 2003, 1 (discussing “the ferromagnetic properties of amorphous MgO”); Ex. 2004, 5–6 (“The Li₂CO₃ together with LiF can form an amorphous SEI layer coated on the particle surface”); Ex. 2005, 4–5 (“in contrast to the ex situ layer, which had a single composition (nanocrystalline LiF with no outer layer), the in situ layer was composed of a crystalline inner layer . . . and an amorphous outer layer”); Ex. 2017, 2 (“as the milling time increases, the crystallinity of the [lithium titanate] samples decreases and it is transformed into a more amorphous material”). Thus, the record as it currently stands tends to show that MgO and LiF may, but need not, have a rock-salt crystal structure.

Given this, to show that Blangero’s disclosure of MgO or LiF in its coating teaches or suggests a rock-salt crystal structure, Petitioner needs to explain why a person of ordinary skill in the art either would have understood the compounds to have a rock-salt crystal structure when manufactured according to the disclosure of Blangero or would have chosen to use MgO or LiF in a rock-salt crystal structure rather than in another available form. On the first point, Petitioner argues that “‘the stable phase at room temperature and pressure conditions’ of MgO is ‘a rocksalt cubic structure of NaCl (space group *Fm-3m*).’” Pet. 28 (quoting Ex. 1030, 16; citing Ex. 1003 ¶ 142). But, as Petitioner’s declarant, Dr. Hayes, points out, Blangero does not teach forming MgO in a room-temperature process. Ex. 1003 ¶ 142 (Blangero’s “second firing step” occurs at “925 °C for 12 hours”); *see* Ex. 1005 ¶ 110 (teaching the firing step to which Dr. Hayes refers). Thus, the significance of rock-salt-type MgO being “the stable

phase at room temperature and pressure conditions” is unclear. To the extent that Dr. Hayes explains why MgO, which “is well known to crystallize even at substantially lower temperatures,” such as “room temperature and pressure conditions,” would “do so more readily at [a higher temperature of] 925 °C,” this argument is not discussed, nor even cited, in the Petition. Ex. 1003 ¶¶ 90–94; *see* Pet. 28. Accordingly, any reliance on this argument by Petitioner constitutes improper incorporation by reference. 37 C.F.R. § 42.6(a)(3). Thus, Petitioner does not show sufficiently that a person of ordinary skill in the art either would have understood MgO to have a rock-salt crystal structure when manufactured according to the disclosure of Blangero or would have chosen to use MgO in a rock-salt crystal structure rather than in another available form. Similarly, with respect to LiF, neither Petitioner nor Dr. Hayes sufficiently explains the choice of rock-salt-type material over other options. Pet. 29 (arguing only that Ex. 1013 shows that “LiF has rock salt structure”); Ex. 1003 ¶ 143 (same). Thus, Petitioner does not show sufficiently that Blangero teaches or suggests a rock-salt crystal structure by virtue of its teaching that either MgO or LiF is present.

(2) Lithium Titanate in Blangero

Petitioner argues that Blangero “renders . . . at least obvious” the limitation of claim 1 requiring a rock-salt crystal structure “in view of its surface layer further comprising ‘TiO₂, that may also be lithiated.’” Pet. 29 (quoting Ex. 1005 ¶ 94). Petitioner also directs us to Blangero’s teaching that its “surface layer consist[s] of a mixture of the elements of the core materials [lithium, a metal, and oxygen] or inorganic N-based oxides or combination thereof, wherein N” may be titanium. Ex. 1005 ¶ 59. Finally,

Petitioner directs us to Blangero's teaching that its "surface layer contains different 'M, M', Li, and O elements' including but not limited to Li_2TiO_3 ." Pet. 29 (quoting Ex. 1005 ¶ 62). Based on these teachings of Blangero, Petitioner argues that a person of ordinary skill in the art "would have found it obvious that Blangero's particle already included rock salt lithium titanate (*e.g.*, LiTiO_2)." *Id.*

On the present record, we are not persuaded that these teachings of Blangero show sufficiently that rock-salt-type lithium titanate, LiTiO_2 , was taught or suggested by Blangero. Paragraph 59 of Blangero suggests some compound containing lithium, titanium, and oxygen, but Petitioner does not explain why a person of ordinary skill in the art would have understood this disclosure to refer to LiTiO_2 in particular. Pet. 29. Many other lithium-titanium-oxygen compounds were known, including at least $\text{Li}_4\text{Ti}_5\text{O}_{12}$, Li_4TiO_4 , $\text{Li}_2\text{Ti}_3\text{O}_7$, and Li_2TiO_3 . Ex. 1034, 1; Ex. 1037, 2. In fact, paragraph 62 of Blangero suggests that one of these other compounds, Li_2TiO_3 ,⁷ rather than LiTiO_2 , may be present. Ex. 1005 ¶ 62. Similarly, paragraph 94 of Blangero refers only to a "lithiated" version of TiO_2 , without specifying which species of lithiated TiO_2 is present. *Id.* ¶ 94. At the elevated temperatures of Blangero's process, LiTiO_2 is not the only species of lithiated titanium dioxide. Ex. 1037, Fig. 1. Given these teachings, Petitioner does not explain sufficiently why a person of ordinary skill in the art would have understood Blangero to suggest the use of LiTiO_2 rather than some other lithium-titanium-oxygen compound, such as the particular compound, Li_2TiO_3 , that Blangero actually teaches would be

⁷ Li_2TiO_3 has monoclinic crystal structure, not rock-salt crystal structure. Ex. 1029, 1.

present, or the other compounds, such as $\text{Li}_4\text{Ti}_5\text{O}_{12}$, Li_4TiO_4 , $\text{Li}_2\text{Ti}_3\text{O}_7$, that the evidence suggests also would exist at Blangero's process conditions.
Pet. 29.

(3) Substitution of Lithium Titanate

Petitioner also argues that a person of ordinary skill in the art “would have found it obvious . . . to use . . . a rock-salt form of lithium titanate which was well known at the time.” Pet. 29–30 (quoting Ex. 1029, 1, 4, 5, Figs. 4(c), 4(d); citing Ex. 1003 ¶¶ 141–146; Ex. 1034; Ex. 1037). In other words, Petitioner argues that a person of ordinary skill in the art “would have been motivated to use a rock-salt lithium titanate coating in Blangero's PEAM to the extent not already included in Blangero's surface layer.” *Id.* at 30. According to Petitioner, this is because “[r]ock salt-type LiTiO_2 ,’ was found to exhibit ‘superior structural stability . . . as compared to other Li-Ti-O oxides.’” *Id.* at 29 (quoting Ex. 1029, 1, 4). In addition, Petitioner argues that “one 2012 study . . . found that rock-salt LiTiO_2 outperformed monoclinic Li_2TiO_3 (which Blangero discloses) in terms of ‘capacity decay.’” *Id.* at 29–30 (quoting Ex. 1029, 1).

The 2012 study on which Petitioner relies did not find “superior structural stability” over other lithium-titanium-oxygen compounds, as Petitioner argues. Instead, the study noted that the structure of “ LiTiO_2 prepared by high-temperature sintering TiO_2 with lithium salt . . . impl[ies] LiTiO_2 has superior structural stability in organic electrolyte as compared to other Li-Ti-O oxides.” Ex. 1029, 1. Thus, the structural stability was implied from the chemical structure of the material rather than found through study of the material. Moreover, the implied structural stability was only for LiTiO_2 that was prepared in a particular way, by high-temperature

sintering of TiO_2 with lithium salt, and Petitioner does not allege that a person of ordinary skill in the art would have prepared the LiTiO_2 they substituted for Blangero's Li_2TiO_3 using this method.

As for Petitioner's argument that the study found that LiTiO_2 outperformed Li_2TiO_3 , we are not persuaded. The study compared particles with an LiTiO_2 coating to uncoated particles, not to particles coated with Li_2TiO_3 . Ex. 1029, 4, Figs. 4(c), 4(d). Although the study notes that particles coated with "[m]onoclinic Li_2TiO_3 and spinel $\text{Li}_4\text{Ti}_5\text{O}_{12}$ " exhibit "a noticeable capacity decay . . . when charged at high operating voltage and cycled above room temperature," it concludes only that particles coated with LiTiO_2 "exhibited inspiring high-voltage cycling capability as well as thermal stability than the pristine counterpart." *Id.* at 1, 4. In addition, the pristine particles used in the study were made from " $\text{Li}[\text{Ni}_x\text{Co}_y\text{Mn}_z]\text{O}_2$ ($0 \leq x, y, z < 1$) (called as LNCM)," and the particles in Blangero do not contain either nickel or manganese in their cores. Ex. 1005 ¶¶ 9–40 (particles contain lithium, oxygen, cobalt, and metals chosen from the group consisting of aluminum, gallium, boron, magnesium, titanium, iron, copper, calcium, barium, yttrium, tin, antimony, sodium, zinc, zirconium, silicon); Ex. 1029, 1. Petitioner does not explain why a person of ordinary skill in the art would expect the study's results to extend to Blangero's particles made from a different material. Pet. 29–30.

Because Petitioner has not shown sufficiently that Blangero teaches or suggests a second region comprising a rock-salt crystal structure or that a person of ordinary skill in the art would have had a reason to substitute rock-salt-type LiTiO_2 for the materials disclosed in Blangero, Petitioner has not

shown a reasonable likelihood that it would prevail on claim 1 on its Blangero-based grounds.

b) Remaining Claims

For claim 6, the only other independent claim of the '660 patent, Petitioner relies on its arguments with respect to claim 1 to show that Blangero teaches or suggests a second region comprising a rock-salt crystal structure. Pet. 50. Similarly, for the dependent claims of the '660 patent, Petitioner relies on its arguments with respect to claim 1. *Id.* at 37, 38, 40, 42, 54, 55. As discussed above, those arguments do not show a reasonable likelihood that it would prevail on claim 1 on its Blangero-based grounds. For the same reasons, Petitioner has not shown a reasonable likelihood that it would prevail on claims 2–9 on its Blangero-based grounds.

E. Challenges Based on Cho

Petitioner contends claims 1–3 would have been obvious in view of “Cho, alone or in combination with Kim.” Pet. 6, 56–74. Petitioner also argues that claims 4 and 5 would have been obvious in view of “Cho, alone or in combination with Kim and/or Blangero.” *Id.* at 6, 74–79. Petitioner argues that claims 6–8 would have been obvious in view of “Cho, alone or in combination with Kim and/or Yamamoto.” *Id.* at 6, 79–85. Finally, Petitioner argues that claims 9 and 10 would have been obvious in view of “Cho, alone or in combination with Kim, Yamamoto, and/or Blangero.” *Id.* at 6, 85–86. Patent Owner disagrees. Prelim. Resp. 44–60.

1. Cho

Cho relates to “a composite cathode active material, including a nickel-based lithium transition metal oxide secondary particle . . . including a coating layer containing lithium and cobalt on a surface of a primary

particle of the secondary particle.” Ex. 1008, 1:35–40. Cho’s secondary particle “may be an agglomerate of primary particles,” with each primary particle “having a coating layer . . . containing lithium and cobalt formed on [its] surface[.]” *Id.* at 6:55–60, Fig. 1. “An intermediate region . . . having a mixed phase may be formed between the primary particle . . . and the coating layer.” *Id.* at 7:12–14, Fig. 1. The coating layer may “hav[e] a rock-salt layer structure (a space group of Fm3m),” the primary particle may “hav[e] a layered structure (a space structure of R3m),” and “[a] surface phase of the primary particle may be a cation-mixing layer having a rock-salt phase.” *Id.* at 5:51–53, 7:8–12, Fig. 1.

2. *Analysis*

Petitioner argues that the asserted prior art teaches or suggests the limitations of the challenged claims and that a person of ordinary skill in the art would have had reason to combine the teachings of the asserted references. Pet. 6, 56–86. Patent Owner disagrees. Prelim. Resp. 44–60.

a) Claim 1

Claim 1 recites “a crystal orientation of at least a second part of the first region and a crystal orientation of at least a part of the second region [that] are substantially aligned with each other.” Ex. 1001, 76:44–62. Petitioner argues that Cho teaches or suggests this limitation. Pet. 63, 66, 69–70. Specifically, Petitioner argues that Cho teaches first and second regions, as well as “a ‘cation-mixing layer’ that is also part of the second region,” and that Cho teaches “substantial alignment between the rock-salt crystal of the second region (cation mixing layer) and the layered rock-salt crystal of the first region.” *Id.* Patent Owner argues that “Cho’s ‘cation-mixing layer’ is not part of Cho’s coating layer,” the layer that Petitioner

argues is the second region. Prelim. Resp. 53–55. Instead, according to Patent Owner, Cho’s cation-mixing layer is part of “the primary particle itself” that Petitioner identifies as the first region. *Id.* at 53–54.

Cho teaches “a nickel-based lithium transition metal oxide secondary particle 10 [that] may be an agglomerate of primary particles 11.” Ex. 1008, 6:44–46, Fig. 1. The primary particles may have “[a] coating layer 12 . . . formed on [their] surfaces.” *Id.* at 6:53–55. “When a secondary particle 10a having the coating layer 12 is heat-treated, a composite cathode active material secondary particle 13 having a coating layer 12a . . . may be obtained.” *Id.* at 6:55–60. “[C]oating layer 12a . . . ha[s] a rock-salt layer structure (a space group of Fm3m),” and “primay particle 11 . . . ha[s] a layered structure (a space structure of R3m).” *Id.* at 7:8–12, Fig. 1. “An intermediate region 14 having a mixed phase may be formed between the primary particle 11 and the coating layer 12a.” *Id.* at 7:12–14, Fig. 1. Petitioner identifies Cho’s “region with space group R-3m” as the first region and Cho’s “region 12a with space group Fm-3m” as the second region. Pet. 63.

Petitioner argues that Cho’s “‘cation-mixing layer’ . . . is also part of the second region.” *Id.* at 66 (quoting Ex. 1008, 5:48–52). In particular, Petitioner argues that “Cho teaches that ‘[a] **surface phase** of the primary particle [may be] a cation-mixing layer having a rock-salt phase.’” *Id.* (emphasis and first alteration in original). According to Petitioner, Cho’s surface-phase cation-mixing layer is “near the surface of the particle” in “the coating.” *Id.* at 66–67 (citing Ex. 1009, Fig. 2(d)–(f)). In making this argument, Petitioner relies on Kim, and Petitioner argues a person of ordinary skill in the art “would have understood that Kim’s teachings apply

to Cho.” Pet. 66–67 (citing Pet. 56–60; Ex. 1009, Fig. 2(d)–(f)). In particular, Petitioner argues that a person of ordinary skill in the art “would have naturally looked to Kim to illustrate the boundaries and crystal structures of Cho’s particles.” *Id.* at 60 (citing Ex. 1003 ¶¶ 209–212). But Cho itself makes clear that its “cation-mixing layer” is “[a] surface phase of the primary particle,” placing the cation-mixing layer within primary particle 11 rather than within mixed phase 14 or coating layer 12a. Ex. 1008, 5:51–53. To the extent that Kim teaches a different structure from that disclosed in Cho, Petitioner does not show sufficiently that a person of ordinary skill in the art would have ignored Cho’s clear disclosure in favor of using Kim to interpret Cho.

Thus, Petitioner does not show sufficiently that Cho teaches or suggests that a portion of the second region, Cho’s coating layer, has a crystal structure that is substantially aligned with a portion of the first region, Cho’s primary particle. Because Petitioner has not shown sufficiently that Cho teaches or suggests substantial alignment of the crystal orientations of parts of the first and second regions, Petitioner has not shown a reasonable likelihood that it would prevail on claim 1 on its Cho-based grounds.

b) Remaining Claims

For claim 6, the only other independent claim of the ’660 patent, Petitioner relies on its arguments with respect to claim 1 to show that Cho teaches or suggests substantial alignment of the crystal orientations of parts of the first and second regions. Pet. 84. Similarly, for the dependent claims of the ’660 patent, Petitioner relies on its arguments with respect to claim 1. *Id.* at 71, 73, 76, 77, 84, 85. As discussed above, those arguments do not

show a reasonable likelihood that it would prevail on claim 1 on its Cho-based grounds. For the same reasons, Petitioner has not shown a reasonable likelihood that it would prevail on claims 2–9 on its Cho-based grounds.

III. CONCLUSION

Upon consideration of the Petition, the Preliminary Response, and the evidence presented, we determine that Petitioner has not shown a reasonable likelihood that it will prevail in showing that at least one of the challenged claims is unpatentable. Accordingly, we do not institute an *inter partes* review of any challenged claim based on any ground asserted in the Petition.

IV. ORDER

For the reasons given, it is:

ORDERED that, pursuant to 35 U.S.C. § 314, the Petition is denied, and no *inter partes* review is instituted.

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