

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LG ENERGY SOLUTION, LTD.,
Petitioner,

v.

MOLECULAR REBAR DESIGN, LLC,
Patent Owner.

IPR2024-01006
Patent 8,808,909 B2

Before JON B. TORNQUIST, JEFFREY W. ABRAHAM, and
JULIA HEANEY, *Administrative Patent Judges*.

ABRAHAM, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. *Background and Summary*

LG Energy Solution, Ltd. (“Petitioner”) filed a Petition for an *inter partes* review (Paper 2 (“Pet.”)) challenging claims 1–8 of U.S. Patent No. 8,808,909 B2 (Ex. 1001 (“the ’909 Patent”)). Molecular Rebar Design, LLC (“Patent Owner”) filed a Preliminary Response. Paper 5 (“Prelim. Resp.”). After receiving authorization from the Board, Petitioner filed a Reply to the Preliminary Response (Paper 6 (“Prelim. Reply”)) and Patent Owner filed a Sur-reply (Paper 7 (“Prelim. Sur-reply”)).

We have authority to determine whether to institute an *inter partes* review. *See* 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.”

Having considered the arguments and evidence set forth by Petitioner and Patent Owner, we determine that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner would prevail on at least one of the challenged claims of the ’909 patent. We also determine that the arguments and evidence of record do not support discretionary denial of the Petition under 35 U.S.C. § 314(a). Accordingly, we institute an *inter partes* review as to all of the challenged claims of the ’909 patent on all of the grounds of unpatentability set forth therein.

B. Related Matters

The parties identify two matters involving the '909 patent: *Molecular Rebar Design, LLC v. LG Energy Solution, Ltd.*, 2-24-cv-00107 (E.D. Tex.) (“district court litigation”) and *Molecular Rebar Design, LLC v. Samsung Electronics Co., Ltd.*, 2-24-cv-00108 (E.D. Tex.). Pet. 84; Paper 4, 2.

C. The '909 Patent (Ex. 1001)

The '909 patent, titled “Lithium Ion Batteries Using Discrete Carbon Nanotubes, Methods for Production Thereof and Products Obtained Therefrom,” issued August 19, 2014, and is directed to “[c]ompositions, and methods of obtaining them, useful for lithium ion batteries comprising discrete oxidized carbon nanotubes having attached to their surface lithium ion active materials in the form of nanometer sized crystals or layers.” Ex. 1001, codes (45), (54), (57).

The '909 patent explains that commercial lithium-ion rechargeable batteries using cobalt, nickel or manganese oxides for the cathode material “are known for their poor electrical conductivity and poor electrochemical stability which results in poor cycling (charge/discharge) ability.” Ex. 1001, 1:27–32. The '909 patent further explains that olivine structures, such as LiFePO_4 or LiMnPO_4 operate at higher charge and discharge rates, “but are still limited by low electrical conductivity and the kinetics of Li-ion diffusion.” Ex. 1001, 1:32–36.

The '909 patent notes that attempts to overcome these deficiencies have included the use of nano-sized crystals of lithium salts and carbon nanotubes, which improved charge/discharge rates. Ex. 1001, 1:37–43. The carbon nanotubes of the prior art, however, were not considered to be discrete, i.e., “individually uniformly dispersed tubes,” because carbon

nanotubes conventionally made via gas phase reaction “result in a tangled bundle of tubes.” Ex. 1001, 1:42–47. The ’909 patent further states that for these conventional nanotubes, “lithium nanocrystals are not ionically or covalently attached to the surface of the discrete carbon nanotubes to provide for intimate electron transfer and enhanced mechanical strength of the active material.” Ex. 1001, 1:47–50.

The ’909 patent discloses a composition useful for lithium ion batteries that has “discrete carbon nanotubes^[1] having attached to their surface lithium ion active materials in the form of nanometer sized crystals or layers.” Ex. 1001, 2:32–35. This attachment may be ionic or chemical. Ex. 1001, 3:28–31. The discrete carbon nanotubes preferably have an aspect ratio of 10 to 500 and oxidation levels from 1 to 15 weight percent of the carbon nanotube. Ex. 1001, 2:42–45. According to the ’909 patent, “[e]xamples of ion active materials are lithium iron phosphate, lithium manganese phosphate, lithium cobalt oxide, silica, manganese dioxide, cadmium, titanium dioxide and carbon.” Ex. 1001, 4:30–33.

D. Illustrative Claims

Of the challenged claims, claim 1 is the sole independent claim, and is reproduced below.

Claim 1:

[1pre] A composition useful for lithium ion batteries comprising:

[1a] discrete carbon nanotubes

[1b] having crystals or layers of lithium ion active material attached to their surface,

¹ The ’909 patent defines “discrete carbon nanotubes” as “carbon nanotubes capable of being separated to give individual tubes.” Ex. 1001, 3:47–49.

[1c] wherein the discrete carbon nanotubes have an aspect ratio of 10 to 500 and

[1d] oxidation levels from 1% to 15% by weight of the carbon nanotube.

Ex. 1001, 7:2–8 (labels added to correspond with Petitioner’s designation of claim limitations (Pet. vii)).

E. Asserted Unpatentability Challenges

Petitioner asserts that claims 1–8 are unpatentable based on the following challenges:

Claims Challenged	35 U.S.C. §²	Reference(s)/Basis
1, 2, 5–8	103	Ohata ³ , Kavan ⁴
1, 2, 5–8	103	Lee, ⁵ Wepasnick ⁶
3, 4	103	Lee, Wepasnick, Zhamu ⁷

Pet. 1–2. Petitioner relies on the declaration of Dr. Yu Zhu (Ex. 1003).

² The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, took effect on March 16, 2013. Because the ’909 patent claims priority to a provisional application filed on June 23, 2011, prior to the effective date of the applicable AIA amendments, we apply the pre-AIA version of § 103 for purposes of this Decision.

³ US 2004/0160156 A1, published Aug. 19, 2004 (Ex. 1004).

⁴ Ladislav Kavan, et al., *Multi-walled carbon nanotubes functionalized by carboxylic groups: Activation of TiO₂ (anatase) and phosphate olivines (LiMnPO₄; LiFePO₄) for electrochemical Li-storage*, J. OF POWER SOURCES, Vol. 195, 5360–5369 (2010) (Ex. 1005).

⁵ US 2010/0136431 A1, published June 3, 2010 (Ex. 1006).

⁶ Kevin Wepasnick, et al., *Surface and structural characterization of multi-walled carbon nanotubes following different oxidative treatments*, CARBON, Vol. 49, 24–36, 2011 (Ex. 1010).

⁷ US 2012/0064409 A1, published Mar. 15, 2012 (Ex. 1008).

II. ANALYSIS

A. Legal Standard

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and “the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). 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 in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

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 Master’s degree in materials science, chemistry, chemical engineering, a field relevant to polymer science and engineering, or the equivalent, and at least three years of experience in nanomaterials, electrochemistry, batteries, or polymer related activities” and that “[a]dditional work experience can compensate for less formal education, and vice versa.” Pet. 4 (citing Ex. 1003 ¶ 11).

For purposes of its Preliminary Response, Patent Owner “does not dispute the Petition’s definition of [the] level of ordinary skill in the art.” Prelim. Resp. 2.

On this record, we preliminarily adopt Petitioner’s definition of the person of ordinary skill in the art because it appears consistent with the prior

art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (holding that the prior art itself can reflect the appropriate level of ordinary skill in the art).

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). Under *Phillips*, claim terms are afforded “their ordinary and customary meaning.” *Phillips*, 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 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.*

Petitioner argues that “no formal claim constructions are necessary.” Pet. 4–5. Patent Owner contends that all claim terms should be interpreted “in accordance with their ordinary and customary meaning.” Prelim. Resp. 2.

Upon review of the record, we determine that no claim terms require express construction for purposes of this Decision. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent

necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

D. Overview of Asserted Prior Art

1. Ohata (Ex. 1004)

Ohata discloses that an electrode for a secondary lithium-ion battery “is typically produced by mixing an electrode active material with a conductive material and a binder to form a paste, which is then applied onto a current collector.” Ex. 1004 ¶ 2. Ohata explains that the conductive material “is used to secure the conductivity of an electrode,” but if the amount of conductive material is large, the battery capacity will be decreased. Ex. 1004 ¶ 2. Ohata further explains that a masterbatch process had been proposed in the art, wherein a conductive material is uniformly dispersed in a binder in the production of a positive electrode. Ex. 1004 ¶ 2. In this method, the “primary particles of carbon black or powdered graphite are linked into a chain to form a conductive path.” Ex. 1004 ¶ 3. Such a conductive path, however, is likely to be damaged by shearing force applied to the conductive material during the masterbatch process. Ex. 1004 ¶ 3. “For this reason,” according to Ohata, “the use of the masterbatch process to uniformly disperse the conductive material in a binder does not yield an electrode superior in conductivity.” Ex. 1004 ¶ 3.

To overcome these difficulties, Ohata discloses a method of producing an electrode for a battery comprising the steps of:

- (a) producing a masterbatch comprising at least carbon nanotubes and a resin; (b) blending an electrode material mixture containing at least the masterbatch and an electrode active material with a dispersion medium to prepare an electrode material mixture paste; (c) applying the electrode material mixture paste onto an electrode substrate and then drying and

rolling the electrode material mixture paste coated on the electrode substrate to obtain an electrode plate; and (d) cutting the electrode plate to obtain an electrode with a predetermined shape.

Ex. 1004 ¶ 5.

With regard to forming a masterbatch, Ohata states that carbon nanotubes are tangled and twisted before they are blended with a resin, but are unraveled and straightened after blending. Ex. 1004 ¶ 16. Ohata provides a depiction of this effect on the nanotubes in Figure 1, reproduced below.

FIG. 1

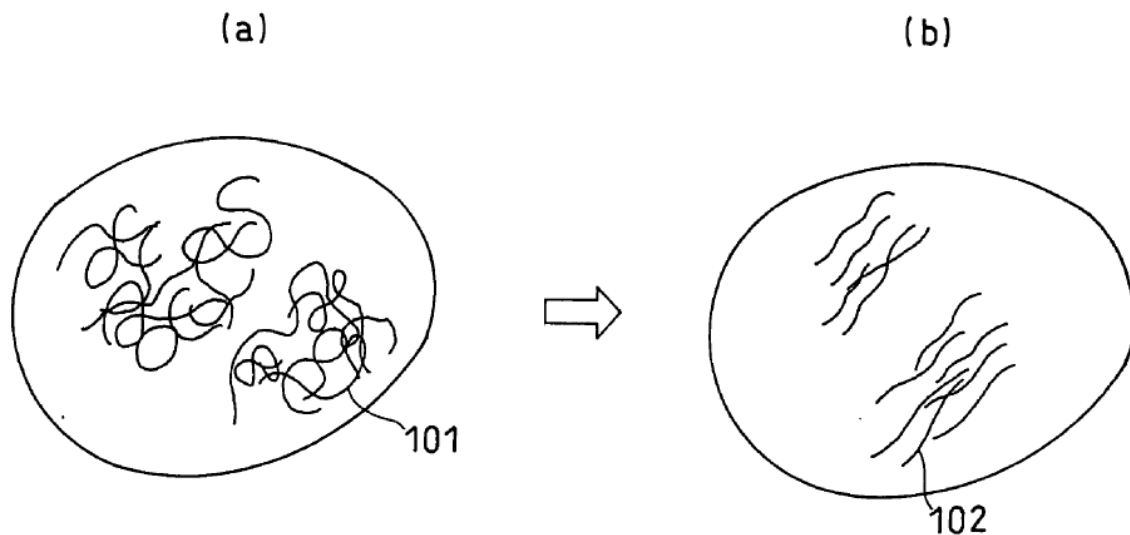


Figure 1(a) is a schematic diagram showing carbon nanotubes tangled and twisted with one another before being blended with a resin, and Figure 1(b) is a schematic diagram showing the carbon nanotubes unraveled and straightened after they have been blended with the resin. Ex. 1004 ¶¶ 12–13. Ohata explains that “[t]he unraveled and straightened carbon nanotubes 102 are expected to form an excellent conductive path in an electrode even if the

amount thereof is small.” Ex. 1004 ¶ 16. Ohata further explains that resin with the unraveled and straightened carbon nanotubes “serves to increase the mechanical strength of an electrode plate,” providing the plate with “great strength against bending and therefore electrode damage is unlikely to occur during production of an electrode group.” Ex. 1004 ¶ 17.

Ohata explains that the carbon nanotubes preferably have an average length of 1 to 100 μm . Ex. 1004 ¶ 19. According to Ohata, when the carbon nanotubes are too short, “excellent conductive paths may not be formed in some electrodes,” and when the length of carbon nanotubes is large, “the dispersibility of the carbon nanotubes in the resin may be slightly low.” Ex. 1004 ¶ 19. Ohata also explains that the carbon nanotubes preferably have an aspect ratio of not less than 100 because when the aspect ratio is too small, excellent conductive paths may not be formed in some electrodes. Ex. 1004 ¶ 20. “Conversely, when the aspect ratio is too large, the carbon nanotubes are unlikely to be straightened sufficiently even after a resin is blended thereto. Accordingly, the aspect ratio is preferably no greater than 1000.” Ex. 1004 ¶ 20. Additionally, Ohata states that “[t]he proper amount of the carbon nanotubes contained in the masterbatch is 5 to 20 parts by weight per 100 parts by weight of the resin.” Ex. 1004 ¶ 21.

Ohata states that the positive and negative electrode active materials to be used “varies depending on the battery type.” Ex. 1004 ¶¶ 26–27. For example, LiCoO_2 , LiNiO_2 or LiMn_2O_4 may be used as the positive electrode active material. Ex. 1004 ¶ 26. The negative electrode active material may be a graphite material, or other carbonaceous materials such as hard carbon. Ex. 1004 ¶ 27.

2. *Kavan (Ex. 1005)*

Kavan is a study regarding multi-walled carbon nanotubes functionalized by carboxylic groups. Ex. 1005, 1. Kavan states that “[m]ulti-walled carbon nanotubes functionalized by carboxylic groups, exhibit better affinity towards TiO_2 . . . as compared to that of pristine nanotubes.” Ex. 1005, 1. Kavan explains that “[t]he electrochemical lithium storage in carbon nanotube/ TiO_2 composites” has been studied, “reflecting the fact that TiO_2 (especially anatase),” $\text{TiO}_2(\text{B})$, and rutile “belong to the top interesting host structures for lithium insertion,” and “studies confirmed in unison that the electrochemical activity of the composite TiO_2 /nanotubes is improved compared to that of the parent pure TiO_2 .” Ex. 1005, 1.

Kavan also states that phosphate olivine materials are promising cathode materials due to their “high safety, low cost and environmental tolerability,” but “their poor electrical conductivity is a crucial issue to be addressed either by doping or by surface coating with elemental carbon.” Ex. 1005, 1 (internal citations omitted). Kavan notes that the use of carbon nanotubes to improve conductivity was disclosed in the art, but the improvement in capacity and charging rate was “quite modest.” Ex. 1005, 1–2. Kavan further notes that surface oxidation of carbon nanotubes by nitric acid (HNO_3) to produce carboxyls “was sometimes mentioned to improve the anchoring of TiO_2 or LiMPO_4 [wherein $\text{M} = \text{Fe}, \text{Mn}$].” Ex. 1005, 2 (internal citations omitted).

Kavan describes experiments in which multi-walled carbon nanotubes were prepared and oxidized in a mixture of HNO_3 . Ex. 1005, 2. The nanotubes were dispersed in water and a powder including TiO_2 (P90) and LiMnPO_4 or LiFePO_4 was added to the solution to create a suspension,

which was subsequently dried. Ex. 1005, 2. Kavan reported that film electrodes produced in this way included nanotubes “covered with individual nanocrystals of P90 in a homogeneous nanocomposite.” Ex. 1005, 3. Kavan explains “that oxidative functionalization through HNO_3 is crucial for proper anchoring of nanotubes towards TiO_2 ” and that examination of the electrode material’s surface showed “that industrial powder (P90) is a good source of nanocrystals which spontaneously self-assemble on the nanotube surface.” Ex. 1005, 4.

3. Lee (Ex. 1006)

Lee describes an anode active material for an anode of a lithium battery. Ex. 1006, code (57). Lee explains that “research is currently being conducted into a binder that can enhance the integrity of a[n] anode active material” in order to address the problem of poor cycle lifetime characteristics. Ex. 1006 ¶ 8. To achieve improved cycle lifetime characteristics, Lee discloses an embodiment of an anode active material that comprises “secondary particles that include agglomerated primary nanoparticles, wherein the primary nanoparticles include a non-carbonaceous material that is bound to hollow carbon nanofibers.” Ex. 1006 ¶ 14. One embodiment of Lee’s anode active material is shown in Figure 1, reproduced below.

FIG. 1

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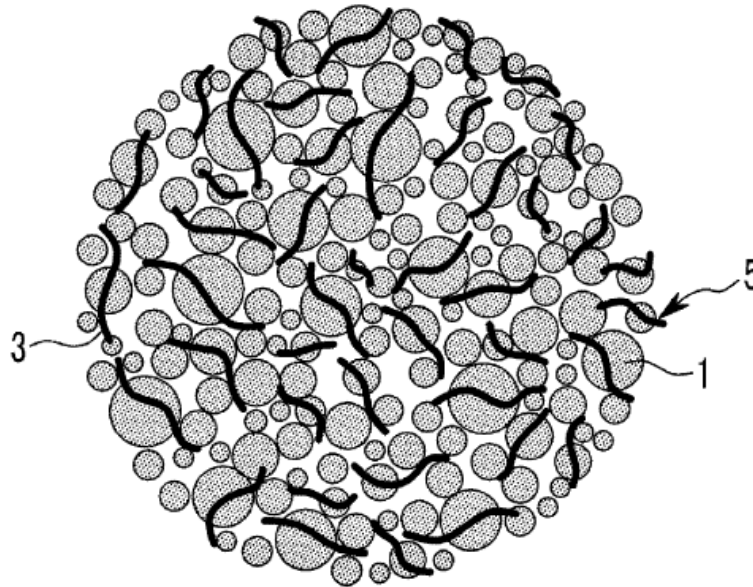


Figure 1 of Lee shows a schematic view of the structure of anode active material 10 that includes primary nanoparticles 5, comprised of non-carbonaceous material 1 and hollow carbon nanofibers 3, which are bound to the non-carbonaceous material by Van der Waals forces. Ex. 1006 ¶ 40. Lee states that “the non-carbonaceous material 1 is bound to the hollow carbon nanofibers 3 to form a composite compound,” and the carbon nanofibers may be carbon nanotubes having an aspect ratio of about 10 to about 10,000. Ex. 1006 ¶¶ 43, 46–47. Lee states that “a mixing ratio of the non-carbonaceous material 1 to the hollow carbon nanofibers 3 may be in a range of about 2:1 to about 50:1, by weight.” Ex. 1006 ¶ 48.

Lee explains that “[t]he non-carbonaceous material may be a silicon-based material, such as silicon (Si), a silicon oxide (SiO_x , where $0 \leq x \leq 2$), Si-Y, or a mixture thereof. Herein, Y may be As, Sb, Bi, Cu, Ni, Mg, In, Zn,

Ag, Al, or a combination thereof.” Ex. 1006 ¶ 41. An anode formed from an active material layer including anode active material 10 and a polymeric binder having an electron donor group may additionally include a conductive agent, which may be a carbonaceous material. Ex. 1006 ¶¶ 49, 57.

4. Wepasnick (Ex. 1010)

Wepasnick is a study in which “[s]ix commonly used wet chemical oxidants (HNO_3 , KMnO_4 , $\text{H}_2\text{SO}_4/\text{HNO}_3$, $(\text{NH}_4)_2\text{S}_2\text{O}_8$, H_2O_2 , and O_3) were evaluated in terms of their effects on the surface chemistry and structure of MWCNTs [multi-walled carbon nanotubes] using a combination of analytical techniques.” Ex. 1010, Abstract. Specifically, Wepasnick was concerned with studying the “extent of surface oxidation” and quantifying “the concentration of carboxyl, carbonyl, and hydroxyl groups at the surface.” Ex. 1010, Abstract.

Wepasnick explains that “oxidative treatments are also used to help remove amorphous carbon and metallic impurities from as-produced CNTs.” Ex. 1010, 2. Wepasnick further explains that “[t]he easiest and most reliable way to control the extent of MWCNT oxidation was to vary the oxidant concentration, specifically the w/w% HNO_3 (from 0-70%).” Ex. 1010, 7.

5. Zhamu (Ex. 1008)

Zhamu discloses “[a] nano graphene-enhanced particulate for use as a lithium-ion battery anode active material, wherein the particulate is formed of a single sheet of graphene or a plurality of graphene sheets and a plurality of fine anode active material particles with a size smaller than $10\text{ }\mu\text{m}$.” Ex. 1008, code (57).

E. Claims 1, 2, and 5–8 – Alleged Obviousness in view of Ohata and Kavan

Petitioner contends claims 1, 2, and 5–8 of the '909 patent are unpatentable as obvious over Ohata in view Kavan. Pet. 5–38. Patent Owner challenges Petitioner's arguments. Prelim. Resp. 3–24, 31–33.

For its argument, Petitioner refers to an “Ohata-Kavan combination composition.” Pet. 7. For this composition, Petitioner explains that it uses Ohata “as a starting point,” relying on Ohata’s “electrode material mixture containing [a] masterbatch and an electrode active material.” Pet. 7 (quoting Ex. 1004 ¶ 23). Petitioner explains that “[t]he masterbatch contains nanotubes dispersed in a resin where the aspect ratio of the nanotubes and the ratio of nanotubes to electrode active material are as taught by Ohata.” Pet. 7. Petitioner argues that the nanotubes used to prepare the masterbatch are first “functionalized, e.g., ‘by carboxylic groups,’ as taught by Kavan, such that ‘[t]he amount of atomic oxygen present’ on the nanotube surface is ‘7%.’” Pet. 7 (quoting Ex. 1005, Abstract, 2, 4). Following the teachings of Ohata, Petitioner contends the oxidized nanotubes are then “unraveled and straightened by blending them with a resin” to form Ohata’s masterbatch. Pet. 7–8 (quoting Ex. 1004 ¶ 16).

According to Petitioner, this masterbatch is mixed with an electrode active material—that can vary depending on the type of battery being produced—and then blended with a dispersion medium to form an “electrode material mixture paste” as described in Ohata. Pet. 8. Petitioner contends that a negative electrode material mixture paste can incorporate TiO_2 (as a negative electrode active material) and a positive electrode material mixture paste can incorporate phosphate olivine (as a positive electrode active material) as taught by Kavan. Pet. 8.

Petitioner provides reasons why a person of ordinary skill in the art would have been motivated to combine the teachings of Ohata and Kavan to form its proposed composition, and would have had a reasonable expectation of success in achieving the claimed invention. Pet. 8–16. Patent Owner opposes.

1. Claim 1

i. [1pre]

Claim 1’s preamble recites “[a] composition useful for lithium batteries.” Ex. 1001, 7:2–3. Petitioner argues that to the extent this preamble is limiting, the combined teachings of Ohata and Kavan disclose or suggest the recited composition. Pet. 17. In particular, Petitioner argues that Ohata’s “electrode material mixture paste” is a composition used to “produce ‘[a]n electrode for a battery superior in conductivity,’ *e.g.*, **the composition is useful for lithium ion batteries.**” Pet. 17 (citing Ex. 1004, code (57), ¶¶ 5, 15, 17, 26, 27, 32, 36, 37, 39, 46, 47). Patent Owner does not dispute Petitioner’s arguments about the preamble.

After reviewing Petitioner’s unchallenged evidence and arguments, we determine Petitioner has demonstrated sufficiently for purposes of institution that Ohata and Kavan disclose or suggest the preamble of claim 1.⁸

ii. [1a]

Limitation [1a] requires that the composition comprises “discrete carbon nanotubes.” Ex. 1001, 7:4. Petitioner argues that Ohata’s masterbatch includes carbon nanotubes blended with a resin, which results in

⁸ In view of this determination, we do not need to address, at this stage, whether the preamble is limiting.

the carbon nanotubes becoming “unraveled and straightened” and dispersed within the resin. Pet. 19–20 (quoting Ex. 1004 ¶¶ 16, 17 (emphasis omitted)). Petitioner refers to Figure 1(b) of Ohata, allegedly showing untangled, isolated carbon nanotubes. Pet. 18–19. Petitioner further argues that “to the extent discrete is interpreted as referring to nanotubes that are generally individually distinct,” a person of ordinary skill in the art would have understood “that at least some of these ‘unraveled and straightened carbon nanotubes’ are discrete because they are generally ‘dispersed’ as individual nanotubes in the resin, as described and illustrated by Ohata.” Pet. 20 (citing Ex. 1004 ¶ 17, Fig. 1(b); Ex. 1003 ¶ 69) (emphasis omitted).

Patent Owner argues that “Petitioner wrongly alleges that any ‘generally uniformly dispersed’ nanotubes inherently include ‘discrete carbon nanotubes.’” Prelim. Resp. 23–24 (emphasis omitted). Patent Owner further argues that a person of ordinary skill in the art would have understood “that aggregates of dispersed non-discrete carbon nanotubes may be generally uniformly dispersed.” Prelim. Resp. 24.

Patent Owner’s arguments appear to be focused on the phrase “generally uniformly dispersed.” Prelim. Resp. 23–24. We, however, do not discern any such term in Petitioner’s arguments on this limitation. Instead, Petitioner directs us to Ohata’s disclosure that its nanotubes are “unraveled and straightened” and then “dispersed” within the resin, and to Figure 1(b) showing isolated nanotubes, which support Petitioner’s position.

Patent Owner also argues that Kavan Figure 2 shows its oxidized nanotubes are not discrete, but rather are highly entangled. Prelim. Resp. 23. This argument, however, fails to account for the combined teachings of Ohata and Kavan, in which Petitioner relies on Ohata’s disclosure of

dispersing discrete, unraveled, and straightened carbon nanotubes in resin.
Pet. 19–20.

In view of the foregoing, we determine Petitioner has demonstrated sufficiently for purposes of institution that Ohata and Kavan disclose or suggest limitation [1a].

iii. [1b]

Limitation [1b] requires that the nanotubes in the composition have “crystals or layers of lithium ion active material attached to their surface.” Ex. 1001, 7:4–5. Petitioner contends that its combination composition is formed by blending the masterbatch with an electrode active material, which is a lithium ion active material, based on Ohata’s disclosure. Pet. 22 (citing Ex. 1004 ¶¶ 5, 23, 26, 27, 32, code (57)). Petitioner further contends, based on Kavan’s disclosure, that the specific composition of the electrode active material in the combination composition is either TiO_2 or a phosphate olivine, which are both lithium ion active materials, and are present in the composition as crystals. Pet. 22–25 (citing Ex. 1005, 1–4). Petitioner also argues that the TiO_2 or phosphate olivine crystals “are attached to the nanotube surface due at least in part to the surface oxidation of the nanotubes.” Pet. 23 (citing Ex. 1005, 3–4 (stating that “oxidative functionalization through HNO_3 is crucial for proper anchoring of nanotubes towards TiO_2 ”)). According to Dr. Zhu, the attachment to the nanotubes can occur through covalent bonding, Van der Waals forces, and hydrogen bonding between the lithium ion active material and the functional groups on the nanotube surfaces. Pet. 24–25 (citing Ex. 1003 ¶¶ 92–93, 98).

Patent Owner argues that Petitioner fails to explain how the use of Ohata’s masterbatch could result in crystals of lithium ion active material

attached to discrete nanotubes because the masterbatch has a small number of nanotubes in a large amount of resin. Prelim. Resp. 19. Patent Owner also argues that Petitioner fails to address Ohata's disclosure of using a resin to enable spot bonding between active material particles. Prelim. Resp. 20.

Additionally, Patent Owner contends that Kavan never says TiO_2 or a phosphate olivine is attached to the surface of its nanotubes. Prelim. Resp. 20–21. Instead, Patent Owner emphasizes that Kavan only states that surface oxidation was "sometimes mentioned to improve the anchoring" of TiO_2 or a phosphate olivine. Prelim. Resp. 21. Patent Owner also asserts that Kavan "calls for a systematic study to understand the interaction between carboxyls and the electrode material." Prelim. Resp. 22. In view of this, Patent Owner contends that "Petitioner's speculation about the 'attachment' limitation" is insufficient. Prelim. Resp. 22.

We disagree. Petitioner directs us to evidence in Kavan itself supporting its arguments. For example, as Petitioner points out, Kavan states that "oxidative functionalization through HNO_3 is crucial for proper anchoring of nanotubes towards TiO_2 ." Ex. 1005, 4. This supports Petitioner's arguments regarding the "attachment" limitation, even if Kavan does not use the word "attachment" itself. Additionally, Petitioner presents evidence in the form of testimony from Dr. Zhu regarding attachment through covalent bonding, Van der Waals forces, and hydrogen bonding. Pet. 24–25; Ex. 1003 ¶¶ 92–93, 98. Patent Owner does not address this testimony, and offers no declaration testimony of its own.

Further, Patent Owner identifies no evidence that dispersing a small amount of nanotubes in a large amount of resin would inhibit or preclude attachment of electrode active material crystals or layers to functionalized

carbon nanotubes. And, although Ohata mentions the possibility of using rubber materials to spot bond the cathode active materials, Ohata does not require such materials and Petitioner does not rely on their use.

In view of the foregoing, we determine Petitioner has demonstrated sufficiently for purposes of institution that Ohata and Kavan disclose or suggest limitation [1b].

iv. [1c]

Limitation [1c] requires the discrete carbon nanotubes have an aspect ratio of 10 to 500. Ex. 1001, 7:6–7. Petitioner argues that Ohata teaches its nanotubes have an aspect ratio of “not less than 100” and “preferably not greater than 1000.” Pet. 25 (quoting Ex. 1004 ¶ 20) (emphasis omitted). Petitioner also directs us to data from Table 2 of Ohata showing examples with aspect ratios of 50, 100, and 200. Pet. 26 (citing Ex. 1004, Table 2). Petitioner thus argues that Ohata discloses aspect ratios that fall within the claimed range, and also discloses a range of aspect ratios that overlaps the claimed range. Pet. 26–27.

Patent Owner does not directly dispute these disclosures in Ohata. Instead, Patent Owner argues that Ohata warns about going below an aspect ratio of 100 by stating that “[w]hen the aspect ratio is too small, excellent conductive paths may not be formed in some electrodes.” Prelim. Resp. 5 (quoting Ex. 1004 ¶ 20). Patent Owner contends that Petitioner does not explain how or why a person of ordinary skill in the art would “employ the claimed range that goes as low as 10” in view of Ohata’s disclosure. Prelim. Resp. 5. Patent Owner also argues that “because this is an obviousness combination, rather than anticipation based on Ohata, the issue is not

whether an overlapping range is disclosed by Ohata, but what the resulting combination discloses.” Prelim. Resp. 6.

Contrary to Patent Owner’s arguments, the law on overlapping ranges in obviousness challenges is clear. *See In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003) (“A *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art.”). Here, Petitioner directs us to evidence of an overlapping range, which is not meaningfully disputed by Patent Owner. As to Patent Owner’s arguments regarding the lower end of the claimed range of aspect ratios and Ohata’s warning about aspect ratios below 100, we note that Ohata states that its carbon nanotubes “*preferably* have an aspect ratio . . . of not less than 100,” and expressly includes examples with an aspect ratio of 50. Ex. 1004 ¶ 20 (emphasis added), Table 2 (Examples 12 and 14).

Patent Owner also criticizes Petitioner for relying on oxidizing Ohata’s nanotubes in view of Kavan (discussed in more detail below). Prelim. Resp. 6. According to Patent Owner, oxidation is known to shorten the length of nanotubes, which would impact the aspect ratio of the nanotubes in the proposed combination. Prelim. Resp. 6. Specifically, Patent Owner contends that oxidizing Ohata’s nanotubes will reduce the aspect ratio below 100, and argues that “Petitioner has not explained why a [person of ordinary skill in the art] would ignore Ohata’s warning nor has Petitioner provided evidence that the resulting combination will perform as Petitioner alleges.” Prelim. Resp. 7; *see also* Prelim. Resp. 8 (arguing Petitioner has not explained why a person of ordinary skill in the art would try to retain Ohata’s aspect ratio and expect success when Ohata is altered in view of Kavan).

Even giving Patent Owner’s arguments their full weight, there is no evidence on the present record as to how much the aspect ratio of Ohata’s nanotubes would be reduced as a result of oxidation. Rather, based on the present record, namely, the broad range of aspect ratios disclosed in Ohata (preferably 100–1000), it seems reasonably likely that the aspect ratio of at least some of the oxidized nanotubes in the proposed composition would remain within the range disclosed in Ohata and overlap the claimed range, as Petitioner asserts. Nevertheless, the parties may address during trial the expected level of carbon nanotube shortening in the proposed combination of Ohata and Kavan.

In view of the foregoing, we determine Petitioner has demonstrated sufficiently for purposes of institution that Ohata and Kavan disclose or suggest limitation [1c].

v. [1d]

Limitation [1d] requires the carbon nanotubes have “oxidation levels from 1% to 15% by weight of the carbon nanotube.” Ex. 1001, 7:7–8. Petitioner contends that the nanotubes in the proposed composition are oxidized based on Kavan, and “have 7% ‘atomic oxygen present’ on their surface as ‘analyzed by X-ray photoelectron spectroscopy [XPS].” Pet. 28 (quoting Ex. 1005, 4). Petitioner relies on Dr. Zhu’s calculations of the oxidation level for the nanotubes in the proposed composition, asserting that Kavan’s 7% atomic oxygen corresponds to an oxidation level of 9.1% by weight of the carbon nanotube, which falls within the claimed range of 1–15% by weight. Pet. 28 (citing Ex. 1003 ¶¶ 14–17, 104–106). Patent Owner does not directly dispute Petitioner’s arguments regarding limitation [1d].

In view of the foregoing, we determine Petitioner has demonstrated sufficiently for purposes of institution that Ohata and Kavan disclose or suggest limitation [1d].

For all of these reasons, we determine Petitioner has demonstrated sufficiently for purposes of institution that Ohata and Kavan disclose or suggest each limitation of independent claim 1. We next turn to the parties' arguments regarding reasons to combine the teachings of Ohata and Kavan.

vi. Reason to Combine and Reasonable Expectation of Success

Petitioner sets forth several reasons why a person of ordinary skill in the art would have combined the teachings of Ohata and Kavan, namely, to use oxidized nanotubes and TiO_2 or a phosphate olivine in the proposed composition, and would have had a reasonable expectation of success in arriving at the claimed invention. Pet. 8–16.

For example, Petitioner argues that a person of ordinary skill in the art would have used oxidized nanotubes because, when combined with TiO_2 , oxidized nanotubes provide a “beneficial effect of nanotube networking” and a higher “rate of electrochemical charge transfer” compared to composites with unfunctionalized nanotubes. Pet. 8–9 (quoting Ex. 1005, 5, 9; citing Ex. 1003 ¶ 40). Petitioner also argues that “when the combination paste is a negative electrode material mixture paste having TiO_2 as the active material (see LGES-1005, 2), oxidized nanotubes ‘exhibit better affinity towards TiO_2 ’ than do unoxidized nanotubes.” Pet. 9 (quoting Ex. 1005, Abstract).

Patent Owner argues that Petitioner's reasoning is insufficient because it is circular and Petitioner fails to address other teachings in Kavan that would not lead a person of ordinary skill in the art to oxidize nanotubes. Prelim. Resp. 10–11. In particular, Patent Owner points to Kavan's

statements that “oxidative functionalization is not necessary for anchoring to TiO₂, because the pristine MWNT [(multi-walled carbon nanotubes)] behave similarly,” and “[t]he Li-storage capacity of TiO₂ is not enhanced in the composite.” Prelim. Resp. 10–11 (quoting Ex. 1005, 2, 9).

To the extent Patent Owner is presenting a teaching away argument, these statements do not rise to the level of criticizing, discrediting, or discouraging investigation into the claimed invention. *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009). Indeed, in addition to its statement regarding oxidation not being necessary for anchoring to TiO₂, Kavan also states that oxidation of carbon nanotubes “was sometimes mentioned to improve anchoring of TiO₂.” Ex. 1005, 2. Moreover, the full statement from Kavan regarding storage capacity reads: “The Li-storage capacity of TiO₂ is not enhanced in the composite, but the rate of electrochemical charge transfer is higher due to nanotube networking.” Ex. 1005, 9. Thus, in its entirety, this statement supports Petitioner’s argument that there are advantages to using oxidized nanotubes, and, in turn, provides a reason why a person of ordinary skill in the art would have used oxidized nanotubes. Moreover, the evidence Petitioner presents regarding the use of oxidized nanotubes in combination with TiO₂, coupled with Ohata’s statement that the electrode active material to be used can vary depending on the battery type (Ex. 1004 ¶¶ 26–27), undermines Patent Owner’s criticism that Petitioner’s arguments are circular.

Petitioner also argues that Kavan teaches improvement of electrochemical performance of an electrode by using a positive electrode active material such as a phosphate olivine with oxidized nanotubes. Pet. 9. For example, Petitioner directs us to Kavan’s disclosure that “the LiFePO₄

olivine exhibits excellent performance in a composite with MWNT-ox.” Pet. 9 (quoting Ex. 1005, 7). Patent Owner does not challenge Kavan’s teaching itself, but instead argues that Petitioner’s reasoning is circular because “Ohata’s masterbatch does not have a phosphate olivine as the active material. Instead, phosphate olivine is an electrode material that Petitioner proposes substituting into Ohata as a positive electrode material.” Prelim. Resp. 12.

We disagree with Patent Owner, and determine that, for purposes of institution, Petitioner’s evidence sufficiently supports its proposed combination of teachings from Ohata and Kavan. Petitioner has directed us to teachings in Kavan itself that suggest benefits of using oxidized nanotubes and phosphate olivines, and testimony from its declarant consistent with those teachings. Pet. 9–10; Ex. 1005, 7; Ex. 1003 ¶ 42. Petitioner has also directed us to evidence in Ohata suggesting that the electrode active material to be used can vary depending on the battery type. Ex. 1004 ¶¶ 26–27. At this stage of the proceeding, Patent Owner’s attorney arguments do not undermine that evidence.

Petitioner presents additional reasons why a person of ordinary skill in the art would have had reason to use oxidized nanotubes in Ohata’s masterbatch: (1) to further Ohata’s goal of having well-dispersed nanotubes in the composite; (2) to increase purity of the starting material; and (3) because it merely involves the application of known techniques to a known structure to yield predictable results. Pet. 10–11. Patent Owner presents arguments opposing these additional reasons. *See, e.g.*, Prelim. Resp. 12 (arguing “Petitioner does not explain why only in some cases oxidizing a masterbatch enhances dispersion” or “whether or not this

combination is one of the cases”), 13 (arguing Ohata does not suggest that impurities are present in its unoxidized nanotubes). We decline to comment on these reasons and arguments because we do not rely on them for purposes of this Decision. Nevertheless, to the extent Petitioner maintains these arguments in support of its positions, the parties should continue to address them during the trial.

Petitioner also presents arguments and evidence that a person of ordinary skill in the art would have had reason to use TiO_2 or a phosphate olivine as the electrode active material in the proposed composition. For example, regarding the use of TiO_2 as the electrode active material, Petitioner argues that TiO_2 is a conventional, well-characterized negative electrode active material, and has desirable electrochemical performance characteristics. Pet. 12–13 (citing Ex. 1005, Abstract, 1, 9; Ex. 1033, Abstract, 1; Ex. 1003 ¶¶ 56–59). According to Petitioner, “Kavan identifies TiO_2 as among ‘the top interesting host structures for lithium insertion.’” Pet. 12 (quoting Ex. 1005, 1).

Patent Owner argues that this quote is from Kavan’s introduction explaining the rationale for its TiO_2 study, and that Petitioner ignores other observations in Kavan, including that “the host structure itself (TiO_2) is poorly conducting at these conditions (potentials)” (Ex. 1005, 5), and “[t]he Li-storage capacity of TiO_2 is not enhanced in the composite” (Ex. 1005, 9). Patent Owner argues that a person of ordinary skill in the art “would not be led to make the proposed substitution” in view of these disclosures. Prelim. Resp. 14.

Regardless of where in Kavan Petitioner’s quote comes from, its substance supports Petitioner’s arguments that a person of ordinary skill in

the art would have reason to consider TiO_2 as a negative electrode material. As to the specific portions of Kavan that Patent Owner cites, to the extent Patent Owner is presenting a teaching away argument, these statements do not rise to the level of criticizing, discrediting, or discouraging investigation into the claimed invention, especially considering Petitioner directs us to other statements in Kavan that suggest TiO_2 does have beneficial electrochemical properties. Pet. 12–13 (quoting Ex. 1005, Abstract (stating “the electrochemical performance of TiO_2 is improved by nanotube networking”)); *see DePuy*, 567 F.3d at 1327.

Patent Owner also criticizes Petitioner for supporting its arguments regarding the beneficial properties of TiO_2 by citing to references that do not refer to using TiO_2 with carbon nanotubes. Prelim. Resp. 15. These references, however, address the use of TiO_2 as an electrode material, and Petitioner presents testimony from its declarant supporting its position. Pet. 12–13. At this stage of the proceeding, and on the present record, Patent Owner’s attorney arguments do not undermine that evidence.

Regarding the use of phosphate olivine as the electrode active material in the proposed composition, Petitioner directs us to, *inter alia*, Kavan’s statement that phosphate olivines are desirable electrode active materials because they have a robust safety profile, are economically desirable, and are environmentally friendly. Pet. 14–15 (citing Ex. 1005, 1; Ex. 1003 ¶¶ 63–65). Patent Owner criticizes Petitioner for failing to address the next sentence in Kavan that indicates phosphate olivines have poor electrical conductivity, and argues that Petitioner fails to explain how or why, in the absence of hindsight, a person of ordinary skill in the art would ignore that

disclosure and “follow through with its proposed combination.” Prelim. Resp. 17–18.

The portion of Kavan at issue states that phosphate olivines “are promising cathode materials for Li-ion batteries due to high safety, low cost and environmental tolerability. However, their poor electrical conductivity is a crucial issue to be addressed either by doping or by surface coating with elemental carbon.” Ex. 1005, 1 (internal citations omitted). On its face, this statement supports Petitioner’s argument that phosphate olivines have desirable properties. And although Patent Owner is correct that the sentence does mention “poor electrical conductivity,” the sentence also explains different ways to address that issue, which undermines Patent Owner’s argument. Additionally, Kavan expressly addresses and resolves this issue through, among other things, the use of oxidized carbon nanotubes. Prelim. Resp. 17; Ex. 1005, 1 (“[E]xcellent performance was found for LiFePO_4 (olivine) in composite materials containing only 2 wt% of functionalized nanotubes.”). Indeed, Kavan concludes that the combination of LiFePO_4 and oxidized carbon nanotubes resulted in “excellent electrochemical activation” and near 100% reversible charging. Ex. 1005, 1, 9. As a result, on the present record, we determine this evidence favors Petitioner.

In view of the foregoing, we determine Petitioner has demonstrated sufficiently for purposes of institution that a person of ordinary skill in the art would have had reason to use TiO_2 or phosphate olivines as an active electrode material in its proposed combination.

Petitioner also directs us to evidence suggesting a person of ordinary skill in the art would have had a reasonable expectation of success incorporating oxidized nanotubes into Ohata’s masterbatch. In particular,

Petitioner argues that the use of oxidized nanotubes in compositions for lithium ion batteries was conventional, and that the composition of Kavan's slurry is "generally similar to the composition of Ohata's electrode material paste." Pet. 11–12. Petitioner also argues that a person of ordinary skill in the art would have had a reasonable expectation of success using TiO_2 or a phosphate olivine as an active electrode material in its proposed combination because these materials were "well-characterized as electrode active materials," and "Ohata indicates that various electrode active material compositions can be used with its paste." Pet. 15–16 (citing Ex. 1003 ¶ 69; Ex. 1004 ¶¶ 26, 27). Patent Owner does not separately challenge Petitioner's arguments beyond the arguments discussed above.

We have considered Petitioner's arguments and find them to be sufficiently persuasive and supported for purposes of institution. As a result, we determine, based on the present record, that Petitioner has demonstrated sufficiently for purposes of institution that a person of ordinary skill in the art would have had reason to combine the teachings of Ohata and Kavan, and would have had a reasonable expectation of success in achieving the claimed invention.

vii. Conclusion

For all of the foregoing reasons, we determine Petitioner has demonstrated a reasonable likelihood that claim 1 would have been obvious in view of the combined teachings of Ohata and Kavan.

2. Claims 2 and 5–8

Claims 2 and 5–8 depend, directly or indirectly, from claim 1. Ex. 1001, 7:9–31. Petitioner directs us to portions of Ohata and Kavan that disclose or suggest the limitations in these claims. Pet. 30–38. At this stage

of the proceeding, Patent Owner does not separately dispute that Ohata and Kavan disclose or suggest the limitations in claims 2 and 5–8.

After reviewing the evidence and arguments Petitioner presents in the Petition, including the relevant portions of the supporting Zhu Declaration, we are persuaded Petitioner has established a reasonable likelihood of prevailing on its obviousness challenge with respect to these claims.

3. Conclusion

For all of the foregoing reasons, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge that claims 1, 2, and 5–8 are unpatentable as obvious in view of Ohata and Kavan.

Because Petitioner has demonstrated a reasonable likelihood that at least one challenged claim of the '909 patent is unpatentable over the prior art of record, and because we are not persuaded that we should discretionarily deny the Petition under 35 U.S.C. § 314(a) for the reasons discussed below, we institute an *inter partes* review. Since we find some grounds sufficient for institution, we institute on all grounds in the Petition. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1353 (2018) (“The agency cannot curate the claims at issue but must decide them all.”); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute as requiring “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”). Nevertheless, in order to further guide the parties after institution, we provide the following observations

F. Obviousness Challenges Based on Lee

Petitioner argues that claims 1, 2, and 5–8 are unpatentable as obvious in view of the combined teachings of Lee and Wepasnick, and claims 3 and

4 are unpatentable as obvious in view of the combined teachings of Lee, Wepasnick, and Zhamu. Pet. 38–82.

As discussed above, claim 1 recites “[a] composition . . . comprising discrete carbon nanotubes.” Ex. 1001, 7:2–4 (limitation 1[a]). For its challenges based on Lee, Petitioner first contends Lee’s “anode active material” renders obvious the composition recited in claim 1, and that Lee’s “anode active material” includes carbon nanotubes. Pet. 52 (citing Ex. 1006 ¶ 40). Petitioner alternatively argues that Lee’s “anode active material composition” renders obvious the composition of claim 1, and that “[t]his combination anode active material composition includes ‘the anode active material’ discussed *supra*, ‘a binder, and a solvent.’” Pet. 50 (citing Ex. 1006 ¶ 16). According to Petitioner, the combination “anode active material composition” can be coated onto a current collector, and Lee shows “the structure of the active material layer” in Figure 3. Pet. 50.

With regard to the discrete nanotube limitation in claim 1, Petitioner first argues that “[a]s illustrated in Lee’s FIG. 1, the carbon nanotubes in the combination anode active material (the **composition**) are **discrete**, e.g., to the extent that discrete in this context is interpreted as referring to nanotubes present in the anode active material as generally individually distinct (e.g., non-agglomerated) nanotubes.” Pet. 53. Petitioner provides an annotated version of Figure 1 of Lee, reproduced below, to support its argument.

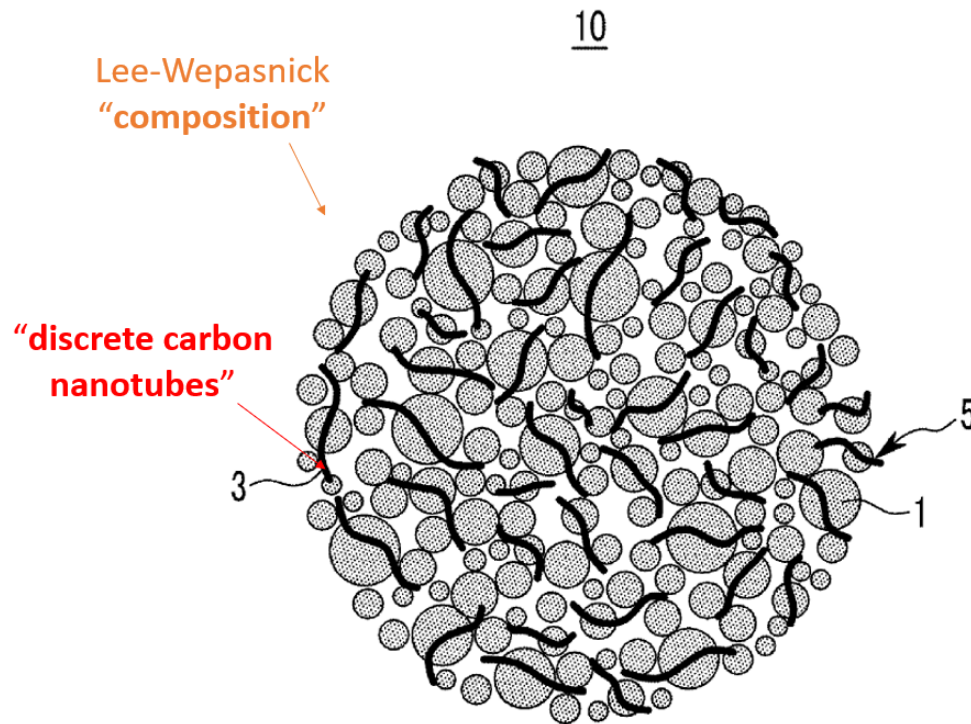
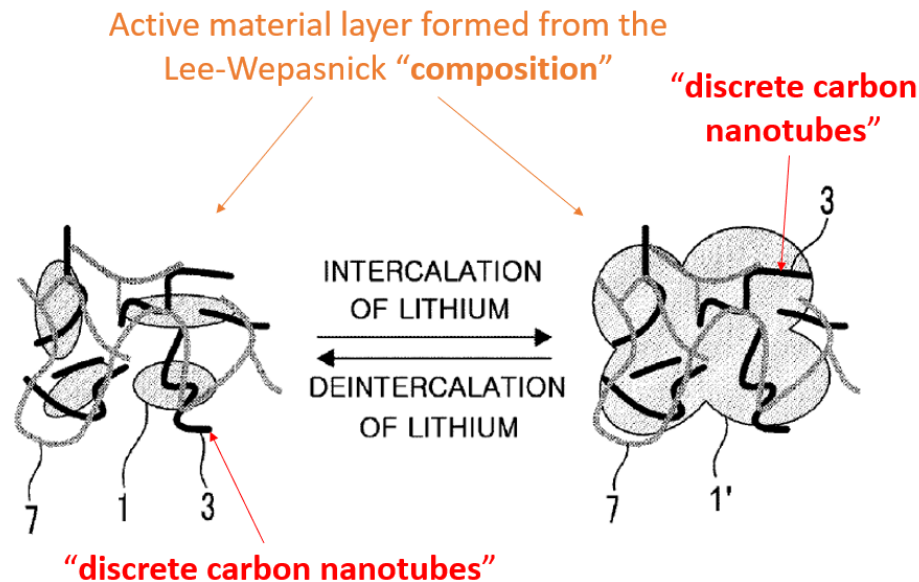


Figure 1 of Lee shows “a schematic view of the structure of an anode active material” 10 comprising primary nanoparticles 5 that include non-carbonaceous material 1 and hollow carbon nanofibers 3. Ex. 1006 ¶¶ 23, 40. Petitioner’s annotated version includes a label identifying carbon nanofibers 3 as “discrete carbon nanotubes.” Pet. 53. Petitioner also argues that a person of ordinary skill in the art would have understood that the nanotubes in the proposed composition are discrete “because, at least in some instances, oxidation of nanotubes can help promote non-agglomeration of the nanotubes.” Pet. 54.

Petitioner additionally argues in the alternative that Lee’s “anode active material composition” includes nanotubes because it contains the “anode active material,” which itself contains nanotubes. Pet. 55. Petitioner likewise contends that the nanotubes in the “anode active material composition” are discrete for the same reasons the nanotubes in the “anode

active material” are discrete. Pet. 55–56. Petitioner also relies on an annotated version of Lee Figure 3, reproduced below, to support its argument.



Lee’s Figure 3 shows the structure of the active material layer 14 including carbon nanofibers 3, Li composite 1’, non-carbonaceous material 1, and binder 7. Ex. 1006 ¶¶ 49–50. Petitioner’s annotated version includes labels identifying carbon nanofibers 3 as “discrete carbon nanotubes.” Pet. 56. Petitioner also argues that “the nanotubes in the combination anode active material composition are discrete based on Lee’s teaching that ‘[t]he electron donor group’ of the polymer binder in the anode active material composition ‘aids the dispersal of the hollow carbon nanofibers.’” Pet. 56 (quoting Ex. 1006 ¶ 53) (emphasis omitted).

We have concerns about Petitioner’s conclusions derived from Lee. Lee discloses that its “anode active material includes secondary particles formed of agglomerated primary nanoparticles,” and that the “primary nanoparticles include a non-carbonaceous material bound with hollow

carbon nanofibers.” Ex. 1006, code (57), ¶ 14. Petitioner acknowledges these disclosures in Lee (*see* Pet. 42, 48, 52), but never sufficiently addresses them. For example, Petitioner fails to reconcile Lee’s teachings regarding agglomeration of particles with its assertion that Figures 1 and 3 of Lee show discrete, non-agglomerated carbon nanotubes. Absent additional information, we decline to draw the same conclusion Petitioner does, particularly in view of Lee’s disclosures regarding agglomeration. Petitioner cites to paragraphs 162 and 167 of the Zhu declaration to support the assertions in the Petition, but these paragraphs simply restate what is provided in the Petition, offering no additional support. Pet. 53–54, 56.

We have similar concerns about Petitioner’s argument that the oxidation of nanotubes can help promote non-agglomeration of the nanotubes in the context of Lee. Pet. 54. We agree with Patent Owner that, on this record, “Petitioner’s speculation about Lee somehow having ‘discrete’ carbon nanotubes [is] directly contrary to the teachings throughout Lee of ‘agglomerated’ nanoparticles.” Prelim. Resp. 30. Moreover, Lee’s teaching regarding agglomerated nanoparticles is particularly relevant considering Petitioner’s qualification that oxidation “can” help promote non-agglomeration “in some instances.” Pet. 54.

Petitioner’s argument regarding dispersal of nanofibers is similarly problematic. We have difficulty discerning, on this record, how a composition with agglomerated nanoparticles and including a polymer binder can provide discrete nanotubes. As before, Petitioner cites to paragraph 168 of the Zhu declaration, but that paragraph offers no more than the information presented in the Petition. Pet. 56–57.

To the extent Petitioner maintains its challenges based on Lee, the parties should continue to address these arguments during the trial.

G. Discretionary Denial under 35 U.S.C. § 314(a)

Under 35 U.S.C. § 314(a) we have discretion to deny institution of an *inter partes* review. *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 273 (2016). Petitioner argues against discretionary denial under 35 U.S.C. § 314(a). Pet. 82–83; Prelim. Reply. Patent Owner argues that we should exercise our discretion under 35 U.S.C. § 314(a) and not institute trial, given the state of the parallel district court litigation. Prelim. Resp. 34–39; Prelim. Sur-reply. For the reasons set forth below, we do not exercise our discretion to deny institution in view of the parallel district court proceeding.

Institution of an *inter partes* review is discretionary. *See* 35 U.S.C. § 314(a) (authorizing institution of an *inter partes* review under particular circumstances, but not requiring institution under any circumstances); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016) (“[T]he agency’s decision to deny a petition is a matter committed to the Patent Office’s discretion.”); *SAS*, 138 S. Ct. at 1356 (“[Section] 314(a) invests the Director with discretion on the question whether to institute review” (emphasis omitted)); *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d at 1356, 1367 (Fed. Cir. 2016) (“[T]he PTO is permitted, but never compelled, to institute an IPR proceeding.”).

We consider several factors when determining whether to deny institution under § 314(a) based on a parallel district court proceeding, specifically:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;

2. proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board’s exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”). We also consider “several clarifications” made by the Director of the United States Patent and Trademark Office (“USPTO”). See USPTO Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation, 2 (June 21, 2022).⁹

1. Factor 1 – Whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted

Under the first *Fintiv* factor, we consider “whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted.” *Fintiv* at 6.

Petitioner filed a motion to stay the litigation in the parallel district court litigation, which the district court denied without prejudice to refile after the Board issues its institution decision. Prelim. Resp. 34 (citing Ex. 2001). Petitioner argues that factor 1 is neutral because the district court

⁹ The Interim Procedure is available under the “Guidance Memorandum” heading on the “Resources and guidance” page for the Patent Trial and Appeal Board, located at <https://www.uspto.gov/patents/ptab/resources>.

routinely grants motions for stays and the district court permitted Petitioner to refile its motion after this Decision is issued. Prelim. Reply 1.

Patent Owner contends the likelihood of the district court granting a stay hinges on “whether this IPR and the four other related IPRs are instituted by the Board,” which, according to Patent Owner, is unlikely in view of Board institution statistics. Prelim. Sur-reply 1. Patent Owner further argues that “the Board has acknowledged that in cases where a final written decision and a trial date are close,” and the question of “whether a court will grant a stay is ‘speculative’,” this renders *Fintiv* factor 1 “neutral.” Prelim. Sur-reply 1–2 (quoting *T-Mobile USA, Inc. v. Wireless Alliance, LLC*, IPR2024-00608, Paper 16 at 12 (PTAB Sept. 3, 2024) (“*T-Mobile*”)).

Although the parties appear to agree that this factor is neutral, we note that a district court denial of a motion to stay without prejudice, accompanied by an indication that the district court would consider a renewed motion, “suggests the district court may be willing to avoid duplicative efforts and await the PTAB’s final resolution of the patentability issues raised in the petition before proceeding with the parallel litigation.” *Fintiv* at 6–7. “This fact has usually weighed against exercising authority to deny institution.” *Id.* (also noting that factors 2 and 3 are relevant to how much weight to give to the court’s willingness to reconsider a stay); *see also T-Mobile*, Paper 16 at 12 (noting that a stay was unlikely in that case given the proximity of the trial date to the entry of the institution decision).

In view of the forgoing, we determine that *Fintiv* factor 1 weighs against exercising our authority to deny institution.

2. *Factors 2 and 3 – The proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision and investment in the parallel proceeding by the court and the parties*

Under the second *Fintiv* factor, we consider the “proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision.” *Fintiv* at 6. Under the third *Fintiv* factor, we consider the “investment in the parallel proceeding by the court and the parties.” *Id.*

Trial for the parallel district court litigation is scheduled for December 8, 2025, which, as the parties acknowledge, is “nearly the same time” as the due date for a Final Written Decision in this proceeding. Prelim. Resp. 35; Prelim. Reply 1. “If the court’s trial date is at or around the same time as the projected statutory deadline . . . , the decision whether to institute will likely implicate other factors . . . such as the resources that have been invested in the parallel proceeding.” *Fintiv* at 9.

Patent Owner contends that “[t]he parties are beginning to commit substantial resources to the parallel proceeding as discovery has begun in earnest.” Prelim. Resp. 35. Petitioner asserts in response that the majority of discovery relates to Petitioner’s motion to transfer the case, the parties “have not yet ‘commit[ted] substantial resources’ to merits-based discovery,” and fact discovery does not close until July 2025. Prelim. Reply 1–2. Petitioner also asserts that it acted diligently in filing its Petition. Prelim. Reply 2.

The district court litigation appears to be in an early stage, there is no evidence that the district court has issued any substantive orders related to the ’909 patent or the prior art set forth in the Petition, and there is evidence that Petitioner filed its Petition expeditiously. Prelim. Reply 1–2; *see Fintiv*

at 9–11. Thus, we determine that *Fintiv* factors 2 and 3 weigh against exercising our authority to deny institution.

3. *Factor 4 – Overlap between issues raised in the petition and in the parallel proceeding*

Under the fourth *Fintiv* factor, we consider the “overlap between issues raised in the petition and in the parallel proceeding.” *Fintiv* at 6.

Petitioner contends this factor favors institution because it “stipulates not to seek resolution in the district court of the same grounds presented in this Petition” if the Board institutes trial. Pet. 83.

Patent Owner argues “[t]his factor favors denial because ‘the same or substantially the same claims, grounds, arguments, and evidence’” presented in the Petition are also at issue in the parallel litigation. Prelim. Resp. 35–36 (quoting *Fintiv* at 12). With regard to Petitioner’s stipulation, Patent Owner asserts that “Petitioner has not offered to withdraw ***all*** grounds/combinations based on these references or that it reasonably could have raised” and this type of stipulation was criticized in *Sand Revolution*¹⁰ as not being as strong as a *Sotera*¹¹-type stipulation. Prelim. Resp. 36–37 (citing 35 U.S.C. § 315(e)(2); IPR2022-00069, Paper 9, 12–14 (PTAB May 25, 2022); Interim Procedure 7). In addition, Patent Owner contends Petitioner has served extensive invalidity contentions in the district court and the stipulation “does nothing to narrow the case for the Court” because the district court will be “forced to consider almost the full range of invalidity contentions served by”

¹⁰ *Sand Revolution II, LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 (PTAB June 16, 2020) (informative) (“*Sand Revolution*”).

¹¹ *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 19 (PTAB Dec. 1, 2020) (precedential) (“*Sotera*”).

Petitioner, which include “numerous invalidity references, and even more combinations, as the litigation proceeds to trial.” Prelim. Resp. 37.

In its Preliminary Reply, Petitioner argues that, “[w]hile a *Sotera*-type stipulation would entirely foreclose the possibility of discretionary denial, a *Sand Revolution*-type stipulation . . . nevertheless continues to mitigate concerns of duplicative efforts and weigh against denial.” Prelim. Reply 2. According to Petitioner, its “stipulation paired with its great diligence in filing this Petition within mere months of the service of complaint greatly mitigate any potential concerns regarding duplicative efforts between the district court and PTAB.” Prelim. Reply 2.

In its Preliminary Sur-Reply, Patent Owner maintains its position regarding the breadth of the issues to be litigated in district court. Prelim. Sur-reply 2–3. Patent Owner, however, does acknowledge that Petitioner’s stipulation would “resolve a small portion of the issues before the court,” and that *Sand Revolution*-type stipulations can weigh “slightly against discretionary denial.” Prelim. Sur-reply 3.

We agree with Patent Owner that “given the breadth of remaining grounds of invalidity in parallel litigation,” Petitioner’s stipulation “would only resolve a small portion of the issues before the court.” Prelim. Sur-reply 3. Nevertheless, the Board has indicated that the type of stipulation offered by Petitioner does mitigate, at least to some extent, concerns of “potentially conflicting decisions.” *Sand Revolution* at 12. Accordingly, we determine that this *Fintiv* factor 4 weighs, at least to some extent, against exercising our authority to deny institution.

4. *Factor 5 – Whether the petitioner and the defendant in the parallel proceeding are the same party*

Under the fifth *Fintiv* factor, we consider “whether the petitioner and the defendant in the parallel proceeding are the same party.” *Fintiv* at 6. The parties agree that the parties in this IPR are the same as those in the parallel district court litigation. Pet. 83; Prelim. Resp. 37; Prelim. Reply 2. In its Preliminary Sur-reply, however, Patent Owner asserts that “[t]he same five patents are asserted against Samsung in a case that was consolidated with [Petitioner]’s case for all pre-trial issues.” Prelim. Sur-reply 3–4 (citing *Molecular Rebar Design, LLC v. Samsung Electronics Co., Ltd.*, 2-24-cv-00108, Dkt. 11 (E.D. Tex.)). According to Patent Owner, the parties have identified this as a related matter and, “[e]ven in the unlikely case that all five petitions are instituted, Petitioner has not suggested that the district court case would somehow stay the consolidated case given that Samsung is not a party to the IPR proceedings.” Prelim. Sur-reply 4.

When the petitioner and the defendant in the parallel proceeding are the same, this tends to support discretionary denial. *See Sotera* at 19. We do not find that the district court’s consolidation for purposes of pre-trial issues strengthens this conclusion, however, because Patent Owner never indicates whether the issues in the case involving Samsung are the same as, or substantially similar to, those to be litigated in its case against Petitioner. *See Fintiv* at 13–14.

Based on the present record, we consider *Fintiv* factor 5 to favor discretionary denial.

5. *Factor 6 – Other circumstances that impact the Board’s exercise of discretion, including the merits*

Under the sixth *Fintiv* factor, we consider “other circumstances that impact the Board’s exercise of discretion, including the merits.” *Fintiv* at 6. Petitioner contends this factor weighs against discretionary denial as the “Petition presents a compelling case of invalidity.” Pet. 83; Prelim. Reply 2–5. Patent Owner contends Petitioner failed to present a *prima facie* case of obviousness. Prelim. Resp. 31.

The Director has instructed “PTAB panels to only consider compelling merits if they first determined that *Fintiv* factors 1–5 favored a discretionary denial.” *CommScope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 23 at 4–5 (PTAB Feb. 27, 2023) (decision on Director review) (precedential). Here, we determine that *Fintiv* factors 1 through 4 all weigh against exercising our discretion to deny institution, and factor 5 weighs in favor of discretionary denial. Accordingly, when considered in combination, *Fintiv* factors 1–5 do not favor discretionary denial, and we do not consider the question of compelling merits.

6. *Conclusion – Fintiv*

Absent a compelling reason to the contrary, we take “a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review” when evaluating the *Fintiv* factors. *Fintiv* at 6; Interim Procedure. Having evaluated all of the factors on this record, we determine that the circumstances presented do not support exercising our discretion under § 314(a) to deny institution of this *inter partes* review.

III. CONCLUSION

For the foregoing reasons, we determine that there is a reasonable likelihood that Petitioner would prevail with respect to at least one of the claims challenged in the Petition. In addition, we not persuaded that we should discretionarily deny the Petition under 35 U.S.C. § 314(a). Accordingly, we institute an *inter partes* review of all challenged claims based on the grounds asserted in the Petition.

At this stage of the proceeding, we have not made a final determination with respect to the patentability of any challenged claim or any underlying factual or legal issue, including claim construction.

IV. ORDER

For the reasons given, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–8 of the '909 patent is instituted with respect to all grounds of unpatentability asserted in the Petition, commencing on the entry date of this Decision; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of trial.

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FOR PETITIONER:

W. Karl Renner
Timothy Riffe
Hyun Jin In
Gretchen DeVries
FISH & RICHARDSON P.C.
axf-ptab@fr.com
riffe@fr.com
in@fr.com
devries@fr.com

FOR PATENT OWNER:

Gregory Porter
Steven Wood
HUNTON ANDREWS KURTH LLP
gregporter@Huntonak.com
swood@huntonak.com