

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.

IPR2024-01011
Patent 8,968,924 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 1–5 of U.S. Patent No. 8,968,924 B2 (Ex. 1001 (“the ’924 Patent”)). Molecular Rebar Design, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). After receiving authorization from the Board, Petitioner filed a Reply to the Preliminary Response (Paper 7 (“Prelim. Reply”)) and Patent Owner filed a Sur-reply (Paper 8 (“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 ’924 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 ’924 patent on all of the grounds of unpatentability set forth therein.

B. Related Matters

The parties identify two matters involving the '924 patent: *Molecular Rebar Design, LLC v. LG Energy Solution, Ltd.*, 2-24-cv-00107 (E.D. Tex.) (the “district court litigation”) and *Molecular Rebar Design, LLC v. Samsung Electronics Co., Ltd.*, 2-24-cv-00108 (E.D. Tex.). Pet. 72–73; Paper 4, 2.

C. The '924 Patent (Ex. 1001)

The '924 patent, titled “Lithium Ion Batteries Using Discrete Carbon Nanotubes, Methods for Production Thereof and Products Obtained Therefrom,” issued March 3, 2015, 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 '924 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, 1:32–37. The '924 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, 1:37–41.

The '924 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, 1:42–47. 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, 1:47–52. The ’924 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, 1:52–55.

The ’924 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, 2:37–40. This attachment may be achieved ionically or chemically. Ex. 1001, 3:33–36. 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, 2:47–50. According to the ’924 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, 4:34–37.

D. Illustrative Claims

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

Claim 1:

[1pre] A composition used in lithium ion batteries comprising:

[1a] discrete carbon nanotubes

¹ The ’924 patent defines “discrete carbon nanotubes” as “carbon nanotubes capable of being separated to give individual tubes.” Ex. 1001, 3:52–54.

[1b] having ion active material attached to their surface,

[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,

[1b (continued)] and wherein the ion active material comprise a lithium metal salt and an element selected from the group consisting of: iron, manganese, cobalt, copper, nickel, vanadium, titanium, and mixtures thereof.

Ex. 1001, 7:7–15 (labels added to correspond with Petitioner’s designation of claim limitations (Pet. vii)).

E. Asserted Unpatentability Challenges

Petitioner asserts that claims 1–5 are unpatentable based on the following challenges:

Claims Challenged	35 U.S.C. § ²	Reference(s)/Basis
1, 4, 5	103	Ohata ³ , Kavan ⁴
1, 4, 5	103	Cheng, ⁵ Gan ⁶
2, 3	103	Cheng, Gan, Zhao ⁷

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

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

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 parties agree that the ’924 patent has an effective filing date of at least June 21, 2012, which is prior to the effective date of the applicable AIA amendments, we apply the pre-AIA version of § 103.

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 CN 101714627 A, published May 26, 2010 (Ex. 1006 (original language); Ex. 1007 (certified English translation)).

⁶ US 2012/0058255 A1, published Mar. 8, 2012 (Ex. 1021).

⁷ CN 102136576 A, published July 27, 2011 (Ex. 1017 (original language); Ex. 1018 (certified English translation)).

(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. 8 (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. 9. 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

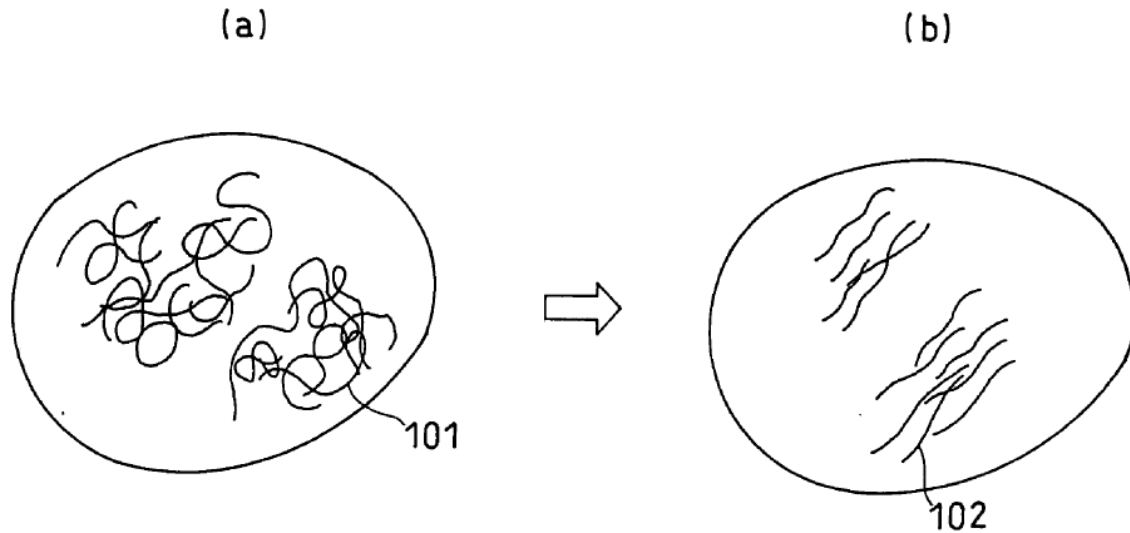


Figure 1(a) is a schematic diagram showing carbon nanotubes tangled and twisted with one another before being blended with a resin, and Figure 1(b) is a schematic diagram showing the carbon nanotubes unraveled and straightened after they have been blended with the resin. Ex. 1004 ¶¶ 12–13. Ohata explains 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 TiO₂/nanotubes is improved compared to that of the parent pure TiO₂.” 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 (HNO₃) to produce carboxyls “was sometimes mentioned to improve the anchoring of TiO₂ or LiMPO₄ [wherein M = Fe, Mn].” Ex. 1005, 2 (internal citations omitted).

Kavan describes experiments in which multi-walled carbon nanotubes were prepared and oxidized in a mixture of HNO₃. Ex. 1005, 2. The nanotubes were dispersed in water and a powder including TiO₂ (P90) and LiMnPO₄ or LiFePO₄ 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 HNO₃ is crucial for proper anchoring of nanotubes towards TiO₂” 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. Cheng (Ex. 1007)

Cheng is directed to lithium ion battery materials and, in particular, “a carbon nanotube/lithium iron phosphate composite cathode material.” Ex. 1007, code (57). Cheng describes a method of preparing its battery material that includes ultrasonically dispersing carbon nanotubes, acetylene black, and a dispersing agent in water or an organic solvent; adding a lithium source, an iron source, and a phosphate salt; adding an organic carbon source; ball milling and drying; and calcining the mixture to obtain a composite cathode material. Ex. 1007, code (57).

According to Cheng, the “carbon nanotubes are uniformly dispersed in a bulk phase and on surfaces of lithium iron phosphate.” Ex. 1007, code (57). Cheng states:

Uniform dispersion of carbon nanotubes in the bulk phase and on surfaces of lithium iron phosphate is achieved by means of an in situ solid phase reaction process, thereby solving the problem in the prior art in which carbon nanotubes are distributed only on the surface of the electrode material and cannot form a continuously connected three-dimensional electrically conductive network structure both in the interior and on the surface of the material, and also solving the problem in which the properties of carbon nanotubes cannot be fully utilized because the carbon nanotubes cannot be fully dispersed.

Ex. 1007 ¶ 10.

Cheng further states that the carbon nanotubes have a “tube diameter of 10 to 200 nm and the length of 5 to 20 μm ” and “the carbon nanotubes account for 0.5-15% by weight.” Ex. 1007 ¶¶ 21, 23. According to Cheng, “[c]ompared with carbon nanotubes having a smaller tube diameter and a greater length, the carbon nanotubes are less entangled with each other and are more easily dispersed.” Ex. 1007 ¶ 21.

4. Gan (Ex. 1021)

Gan is directed “to composites of carbon nanotubes and conductive polymer materials, . . . articles made from such composites, and methods of making such composites and articles.” Ex. 1021 ¶ 2. Gan describes the functionalization of carbon nanotubes (“CNTs”) and explains that such functionalization “[i]mproves the solubility and dispersibility of the CNTs in water and conductive polymer materials into which the CNTs are to be mixed,” “[r]educes contact resistance between CNTs incorporated into the conductive polymer material by drawing the CNTs closer together,” and “[p]rovides a conductive bridge between CNTs to reduce the electrical contact resistance therebetween.” Ex. 1021 ¶¶ 18–21.

Gan describes embodiments in which “suitable functionalization with carboxyl or hydroxyl groups ranged from about 2.5 to about 10 wt%.” Ex. 1021 ¶ 24.

5. Zhao (Ex. 1018)

Zhao discloses “a conductive agent for a lithium-iron-phosphate battery.” Ex. 1018, code (57). Zhao states that the conductive agent “consists of a carbon nanotube/carbon black composite material, graphene, and a binder, and the weight ratio of the components is: carbon nanotube/carbon black composite material : graphene : binder = 1 : (0.001 to 0.1) : (0.01 to 1).” Ex. 1018, code (57). According to Zhao, the conductive agent has high electron conductivity and uniform heat conductivity and “effectively utilizes respective advantages of fibrous carbon nanotubes, spherical carbon black, and sheet-like graphene, and cause[s] the same to achieve a synergistic effect, thereby significantly improving electrochemical performance of the battery.” Ex. 1018 ¶¶ 4, 12. In addition, Zhao states:

graphene has a greater electron transport rate and better heat dissipation performance than carbon nanotubes, so that further addition of graphene to the carbon nanotube/carbon black composite material can not only reduce the internal resistance of the carbon nanotube/carbon black composite material, but also improve heat dissipation performance of a unit cell.

Ex. 1018 ¶ 11.

E. Claims 1, 4, and 5 – Alleged Obviousness in view of Ohata and Kavan

Petitioner argues that claims 1, 4, and 5 are unpatentable as obvious in view of the combined teachings of Ohata and Kavan. Pet. 9–35. Patent Owner challenges Petitioner’s arguments and assertions. Prelim. Resp. 4–20.

For its argument, Petitioner refers to an “Ohata-Kavan combination composition.” Pet. 11. 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. 11 (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. 11. 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. 12 (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. 12.

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. 12. Petitioner contends that a positive electrode material mixture paste can incorporate a phosphate olivine (as a positive electrode active material) as taught by Kavan. Pet. 12–13.

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. 13–18. Patent Owner opposes.

1. Claim 1

i. [1pre]

Claim 1’s preamble recites “[a] composition used in lithium ion batteries.” Ex. 1001, 7:7. Petitioner argues that to the extent this preamble is limiting, the combined teachings of Ohata and Kavan disclose or suggest the recited composition. Pet. 18. 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,’” and Ohata includes an example of a lithium ion battery in Figure 2. Pet. 18–19 (citing Ex. 1004, code (57), ¶¶ 5, 15, 17, 26, 36, Fig. 2). 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, 7:8. Petitioner argues that Ohata’s masterbatch includes carbon nanotubes blended with a resin, which results in the carbon nanotubes becoming “unraveled and straightened” and dispersed within the resin. Pet. 21–22 (quoting Ex. 1004 ¶¶ 16, 17 (emphasis omitted)). Petitioner refers to Figure 1(b) of Ohata, allegedly showing untangled, isolated carbon nanotubes. Pet. 22–23. 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. 22 (citing Ex. 1004 ¶ 17, Fig. 1(b); Ex. 1003 ¶ 69).

Patent Owner argues that “Petitioner wrongly alleges that any ‘generally uniformly dispersed’ nanotubes inherently include ‘discrete carbon nanotubes.’” Prelim. Resp. 19–20 (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. 20.

Patent Owner’s arguments appear to be focused on the phrase “generally uniformly dispersed.” We, however, do not discern any such

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

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. 20–23.

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 "ion active material attached to their surface . . . wherein the ion active material comprise[s] a lithium metal salt and an element selected from the group consisting of: iron, manganese, cobalt, copper, nickel, vanadium, titanium, and mixtures thereof." Ex. 1001, 7:8–15. Petitioner contends that its combination composition is formed by blending the masterbatch with an electrode active material, which is an ion active material, based on Ohata's disclosure. Pet. 24–25 (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 can be a phosphate olivine, such as LiMnPO_4 or LiFePO_4 , which are both lithium ion active materials. Pet. 25–26 (citing Ex. 1005, 1–2, 4). Petitioner

also argues that the phosphate olivine material is “attached to the nanotube surface due at least in part to the surface oxidation of the nanotubes.”

Pet. 26 (citing Ex. 1005, 2, 4).

Patent Owner argues that Petitioner fails to explain how the use of Ohata’s masterbatch could result in 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. 15–16. 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. 16–17.

Additionally, Patent Owner emphasizes that Kavan only states that surface oxidation was “sometimes mentioned to improve the anchoring” of a phosphate olivine. Prelim. Resp. 17 (quoting Ex. 1005, 2). Patent Owner also asserts that Kavan is uncertain as to any carbon nanotube attachment, and instead “calls for a systematic study to understand the interaction between carboxyls and the electrode material.” Prelim. Resp. 18. In view of this, Patent Owner contends that “Petitioner’s speculation about the ‘attachment’ limitation” is insufficient. Prelim. Resp. 18.

We disagree. Kavan states that “surface oxidation of carbon nanotubes by HNO_3 . . . was sometimes mentioned to improve anchoring of . . . LiMnPO_4 .” Ex. 1005, 2. This language in Kavan (as well as the references Kavan cites in support) at least suggests some anchoring of LiMnPO_4 to oxidized nanotubes, which supports Petitioner’s arguments regarding the “attachment” limitation. The fact that Kavan refers to the desirability of a detailed understanding in order to *optimize* attachment of multi-walled nanotubes (“MWNTs”) towards olivine surfaces does not foreclose the existence of some attachment occurring, as Kavan suggests.

Additionally, Kavan embarked on a systematic study to understand optimized attachment of functionalized carbon nanotubes towards olivine surfaces. Ex. 1005, 2 (noting that “the central motivation for the study” was to provide a “systematic study” of functionalization of carbon nanotubes “for optimum attachment . . . towards titania and olivine surfaces”). Kavan also reports that functionalized nanotubes provided “excellent electrochemical activation of LiFePO_4 .” Ex. 1005, 9.

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, 7:9–10. Petitioner argues that Ohata teaches its nanotubes have an aspect ratio of “not less than 100” and “preferably not greater than 1000.” Pet. 27 (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. 27 (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. 28–29.

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. 6 (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. 6–7. 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. 7.

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. With regard 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. 7. 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. 7–8. 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. 7–8; *see also* Prelim. Resp. 8–9 (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, 7:10–12. 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. 29 (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. 29–30 (citing Ex. 1003 ¶¶ 14–17, 82–84). 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 a phosphate olivine in the proposed composition, and would have had a reasonable expectation of success in arriving at the claimed invention. Pet. 13–18.

For example, Petitioner argues, *inter alia*, that Kavan teaches electrochemical performance of an electrode is improved by using a positive electrode active material such as a phosphate olivine with oxidized nanotubes. Pet. 13. Petitioner directs us to Kavan’s disclosure that “the

LiFePO₄ olivine exhibits excellent performance in a composite with MWNT-ox.” Pet. 13 (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 the electrode material that Petitioner proposes substituting into Ohata.” Prelim. Resp. 11.

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. 13; Ex. 1005, 7; Ex. 1003 ¶ 40. 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. Moreover, we disagree that Petitioner’s arguments are circular in view of the evidence Petitioner presents regarding the use of oxidized nanotubes in combination with phosphate olivines in Kavan, coupled with Ohata’s statement that the electrode active material to be used can vary depending on the battery type (Ex. 1004 ¶¶ 26–27).

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. 13–15. Patent Owner presents arguments opposing these additional reasons. *See, e.g.*, Prelim. Resp. 11–12 (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”), 12 (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 a phosphate olivine as the electrode active material in the proposed composition. For example, Petitioner directs us to 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. 16–17 (citing Ex. 1005, 1; Ex. 1003 ¶¶ 53–55). 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 Petitioner’s proposed combination.” Prelim. Resp. 13–14.

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 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. 15. Petitioner also argues that a person of ordinary skill in the art would have had a reasonable expectation of success using a phosphate olivine as an active electrode material in its proposed combination because

these materials were “well-characterized as positive electrode active materials,” and “Ohata indicates that various electrode active material compositions can be used with its paste.” Pet. 17–18.

Patent Owner contends that Petitioner “does not make any attempt . . . to present any evidence or even allege that Ohata’s nanotubes shortened by Kavan’s oxidation to a low aspect ratio somehow would be or could be compatible in Ohata’s masterbatch.” Prelim. Resp. 10–11. Patent Owner does not otherwise 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. In particular, we disagree that Petitioner does not present evidence regarding the compatibility of oxidized nanotubes in Ohata’s masterbatch. *See* Pet. 15. 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 4 and 5

Claims 4 and 5 depend from claim 1. Ex. 1001, 7:21–26. Petitioner directs us to portions of Ohata and Kavan that disclose or suggest the limitations in these claims. Pet. 31–35. At this stage of the proceeding,

Patent Owner does not separately dispute that Ohata and Kavan disclose or suggest the limitations in claims 4 and 5.

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, 4, and 5 are unpatentable as obvious in view of Ohata and Kavan.

F. Priority

The '924 patent was filed on July 8, 2014 as a divisional application of U.S. Application No. 14/128,392 (“the '392 Application”), which was filed as International Application No. PCT/US2012/043534 on June 21, 2012 (“PCT application”), and claims the benefit of U.S. Provisional Application No. 61/500,560 (“the '560 provisional application”), filed on June 23, 2011. Ex. 1001, codes (60), (62). Petitioner contends that the '924 patent is not entitled to the benefit of its priority claim to the '560 provisional application because the '560 provisional application does not provide sufficient written description support for the aspect ratio limitation in claim 1 or the weight ratio limitation in dependent claim 3. Pet. 3–6; Ex. 1001, code (60). In view of this, Petitioner asserts that the earliest possible priority date for the challenged claims is June 21, 2012, the filing date of the PCT application. Pet. 2–7; Ex. 1001, code (62).

Patent Owner states that, “[f]or purposes of this Preliminary Response only,” Patent Owner takes no position because this issue only affects

whether Gan and Zhao are prior art references. Prelim. Resp. 2–3. Patent Owner argues “that, even if Gan and Zhao are proper prior art, the Petition does not meet the Petitioner’s required preponderance burden, and the Board should deny institution.” Prelim. Resp. 3.

In view of this, and our determination regarding Petitioner’s challenge based on Ohata and Kavan, we need not address Petitioner’s priority arguments for purposes of this Decision. We, however, encourage the parties to address this issue during the course of the trial.

G. Claims 1, 4, and 5 – Alleged Obviousness in view of Cheng and Gan

Petitioner contends claims 1, 4, and 5 of the ’924 patent are unpatentable as obvious over Cheng in view of Gan. Pet. 36–66. Patent Owner challenges Petitioner’s arguments. Prelim. Resp. 20–34.

1. Claim 1

i. [Ipre]

The preamble of claim 1 recites “[a] composition used in lithium ion batteries.” Ex. 1001, 7:7. Petitioner argues that, to the extent claim 1’s preamble is limiting, Cheng teaches a composition used to produce a cathode material for the positive electrode of a lithium ion battery. Pet. 50 (citing Ex. 1007, code (57); Ex. 1003 ¶¶ 124–125). 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 Cheng and Gan disclose or suggest the preamble of claim 1.⁹

⁹ In view of this determination, we do not need to address, at this stage, whether the preamble is limiting.

ii. [1a]

Limitation [1a] requires that the composition comprises “discrete carbon nanotubes.” Ex. 1001, 7:8. According to Petitioner, “Cheng focuses on solving the issues of nanotube dispersion and states that resulting composite material contains nanotubes that are ‘uniformly dispersed.’” Pet. 51–52 (citing Ex. 1007, code (57), ¶¶ 10, 12–19, 41, claims 1, 2; Ex. 1003 ¶¶ 127–128) (emphasis omitted). Petitioner asserts, *inter alia*, that “the method of carbon nanotube dispersion” in the proposed combination “is similar to a dispersion method disclosed in the ’924 patent,” and argues that “this suggests that similar steps in forming the composite would have likely yielded similar dispersion results.” Pet. 53–54 (citing Ex. 1007, code (57), ¶¶ 13–19, 21, claim 2; Ex. 1001, 5:30–67, 6:1–4; Ex. 1003 ¶ 131).

Patent Owner contends that Cheng does not teach or suggest “discrete carbon nanotubes.” Prelim. Resp. 21–22. Although Patent Owner responds to some of Petitioner’s arguments on this limitation, it does not address Petitioner’s assertion that the method of carbon nanotube dispersion disclosed in the combined teachings of Cheng and Gan is similar to a dispersion method disclosed in the ’924 patent or the conclusion that the similar steps would yield similar results, which we determine to be sufficiently persuasive for purposes of institution.

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

iii. [1b]

Limitation [1b] requires that the nanotubes in the composition have “ion active material attached to their surface . . . wherein the ion active

material comprise[s] a lithium metal salt and an element selected from the group consisting of: iron, manganese, cobalt, copper, nickel, vanadium, titanium, and mixtures thereof.” Ex. 1001, 7:8–15. Petitioner argues that Cheng’s composition includes a lithium iron phosphate that corresponds to the claimed ion active material and would be a lithium metal salt that includes iron. Pet. 55–56 (citing Ex. 1007, code (57); Ex. 1003 ¶ 133). Petitioner argues that this lithium iron phosphate would be attached to nanotube surfaces because, *inter alia*, the proposed combination’s steps of attaching or coating ion active material to the surface of carbon nanotubes are similar to those of the ’924 patent, and “that similar steps in ‘coat[ing]’ or attaching the lithium iron phosphate would have likely yielded similar attachment results.” Pet. 58 (emphasis omitted).

Patent Owner contends that Cheng does not suggest discrete carbon nanotubes having ion active material attached to their surface because “Cheng does not disclose anything about ion active material being ‘attached’ to the surfaces of carbon nanotubes in Petitioner’s six cited Cheng paragraphs.” Prelim. Resp. 23–24 (citing Pet. 56; Ex. 1007 ¶ 23).

Patent Owner, however, does not address Petitioner’s assertion that the steps disclosed in the combined teachings of Cheng and Gan are similar to those disclosed in the ’924 patent or the assertion that the similar steps would yield similar results, which we determine to be sufficiently persuasive for purposes of institution.

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

iv. [1c]

Limitation [1c] requires the discrete carbon nanotubes have an aspect ratio of 10 to 500. Ex. 1001, 7:9–10. Petitioner asserts that Cheng teaches a tube diameter of 10–200 nm and a length of 5–20 μm , which corresponds to an aspect ratio range of 67–300, a range that falls within the claimed range. Pet. 60–61 (citing Ex. 1007 ¶ 21; Ex. 1003 ¶ 142). Alternatively, Petitioner argues that the proposed combination’s aspect ratio overlaps with the claimed range. Pet. 61 (citing Ex. 1007 ¶ 21; Ex. 1003 ¶¶ 143–144).

Patent Owner contends that the proposed combination does not teach or suggest the claimed aspect ratio because “Cheng’s Comparative Example 4 states that ‘nanotubes having a length of 30 μm and a tube diameter of 50 nm were selected as a raw material,’ which provides an aspect ratio of 600. Prelim. Resp. 25 (citing Pet. 60; Ex. 1007 ¶ 71). According to Patent Owner, “Cheng discloses that an aspect ratio of 600 did not work and the preferred range is 67–300” and thus one of ordinary skill in the art would not be led to use an aspect ratio of up to 500. Prelim. Resp. 25–26 (citing Ex. 1007 ¶ 73). Patent Owner further asserts that Cheng teaches away from claim 1’s lower limit of 50 because the nanotubes in Cheng’s Comparative Example 5 have an aspect ratio of 50 and Cheng “emphasizes that this aspect ratio was undesirable as ‘it was difficult to form a limited conductive network due to the limited length of the carbon nanotubes.’” Prelim. Resp. 26 (quoting Ex. 1007 ¶ 78).

Patent Owner’s arguments do not dissuade us from instituting trial. Petitioner directs us to evidence of an overlapping range, which is not meaningfully disputed by Patent Owner. *See In re Peterson*, 315 F.3d at 1329. Furthermore, the disclosed range of aspect ratios Petitioner relies

upon, 67–300, does not include the two aspect ratio values Patent Owner focuses on to support its arguments (50 and 600).

In view of the foregoing, we determine Petitioner has demonstrated sufficiently for purposes of institution that Cheng and Gan 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, 7:10–12. Petitioner contends that “Gan describes [a] ‘carbon nanotube that is functionalized with carboxyl group at about 2.5 to 10 wt%,’ which equates to oxidation levels at about 2.5 to 10 wt%.” Pet. 61 (citing Ex. 1021 ¶ 24; Ex. 1003 ¶ 145). According to Petitioner:

Gan emphasizes controlling the oxidation levels of the carbon nanotubes with carboxyl and/or hydroxyl groups “at about 2.5 to 10 wt%” to obtain [1] improved dispersibility of nanotubes in water or polymer, [2] reduced contact resistance of the carbon nanotubes, and [3] preservation of the intrinsic properties of the carbon nanotubes, including the electrical conductivity of pristine carbon nanotubes.

Pet. 61–62 (citing Ex. 1021 ¶¶ 19–24; Ex. 1003 ¶ 146). Alternatively, Petitioner asserts that one of ordinary skill in the art would have understood that oxidized nanotubes were “extensively used in various applications, including lithium ion batteries and further, the effect of oxidized nanotubes with oxidation level such as 9.1% was known to improve dispersibility of the carbon nanotubes and thus to enhance electrical conductivity of conductive network in the electrode composite in lithium ion battery industry.” Pet. 63–64 (citing Ex. 1003 ¶¶ 152–154). 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 Cheng and Gan disclose or suggest limitation [1d].

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

vi. Rationale to Combine and Reasonable Expectation of Success

Petitioner argues several rationales to combine Cheng and Gan. For example, Petitioner contends that one of ordinary skill in the art “would have been motivated to use [1] oxidized carbon nanotubes or [2] oxidized carbon nanotubes having the oxidation levels taught in Gan to achieve a better constructed electrically conductive network of nanotubes within Cheng’s nanotube / lithium iron phosphate composite, which is a design objective in Cheng.” Pet. 42 (emphasis omitted) (citing Ex. 1007 ¶¶ 3–10, 21, 30–33, code (57)). Patent Owner argues that none of the paragraphs Petitioner cites “support any such ‘design objective’ of a ‘better constructed electrically conductive network.’” Prelim. Resp. 27–28.

We disagree. Several of the paragraphs in Cheng that Petitioner cites refer to the benefits of forming electrically conductive networks. *See* Ex. 1007 ¶¶ 5, 8, 10, 21. These paragraphs support Petitioner’s arguments and undermine Patent Owner’s. 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 Cheng and Gan.

Petitioner also argues a person of ordinary skill in the art would have had a reasonable expectation of success in using nanotubes having the oxidation levels described by Gan. Pet. 48–50. Patent Owner does not directly challenge Petitioner’s arguments and evidence. We have reviewed Petitioner’s unchallenged arguments and evidence, and determine that Petitioner has demonstrated sufficiently that a person of ordinary skill in the art 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 Cheng and Gan.

2. Claims 4 and 5

Claims 4 and 5 depend from claim 1. Ex. 1001, 7:21–26. Petitioner directs us to portions of Cheng and Gan that it asserts disclose or suggest the limitations in these claims. Pet. 64–66. At this stage of the proceeding, Patent Owner does not separately dispute that Cheng and Gan disclose or suggest the limitations in claims 4 and 5. *See generally* Prelim. Resp.

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

After considering Petitioner’s arguments and evidence, we determine Petitioner has established a reasonable likelihood of prevailing on its

challenge that claims 1, 4, and 5 are unpatentable as obvious in view of Cheng and Gan.

H. Claims 2 and 3 – Alleged Obviousness in view of Cheng, Gan, and Zhao

Petitioner contends claims 2 and 3 of the '924 patent are unpatentable as obvious over Cheng and Gan and further in view of Zhao. Pet. 67–70.

Claims 2 and 3 depend from claim 1. Ex. 1001, 7:16–20. Petitioner directs us to portions of Cheng, Gan, and Zhao that it contends disclose or suggest the limitations in these claims, and presents reasons why a person of ordinary skill in the art would have combined the teachings of the references. Pet. 67–70. At this stage of the proceeding, Patent Owner does not separately dispute Petitioner's arguments regarding claims 2 and 3. *See generally* Prelim. Resp.

After considering Petitioner's arguments and evidence, we determine Petitioner has established a reasonable likelihood of prevailing on its challenge that claims 2 and 3 are unpatentable as obvious in view of Cheng, Gan, and Zhao.

I. 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. 70–71. 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. 34–40. 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).¹⁰

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. 34–35 (citing Ex. 2001). Petitioner argues that factor 1 is neutral because the district court 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*”)).

¹⁰ 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>.

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. 36. 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 ’924 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. 71.

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. 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*¹¹ as not being as strong as a *Sotera*¹²-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 Defendant,” which include “numerous invalidity references, and even more combinations, as the litigation proceeds to trial.” Prelim. Resp. 37–38 (citing Ex. 2005).

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.

¹¹ *Sand Revolution II, LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 (PTAB June 16, 2020) (informative) (“*Sand Revolution*”).

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

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. 71; Prelim. Resp. 38; 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. Texas)). 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. 71; 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 1–5 of the ’924 patent is instituted with respect to all

IPR2024-01011
Patent 8,968,924 B2

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.

IPR2024-01011
Patent 8,968,924 B2

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