

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

**PATENT OWNER'S PRELIMINARY RESPONSE
TO PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 8,968,924**

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EXHIBIT LIST

Exhibit No.	Description
MRD-2001	Denial of Motion to Stay in parallel civil suit in EDTX
MRD-2002	Docket Control Order in parallel civil suit in EDTX
MRD-2003	Micah J. Green, “Analysis and measurement of carbon nanotube dispersions: nanodispersion <i>versus</i> macrodispersion.” <i>Polym Int</i> 2010; 59; 1319-1322
MRD-2004	H. Golnabi, “Carbon nanotube research developments in terms of published papers and patents, synthesis and production,” <i>Scientia Iranica</i> , Vol. 19, Issue 6, Dec. 2012, pp. 2012-2022
MRD-2005	Excerpts from Defendants’ P.R. 3-3 Invalidity Contentions in parallel civil suit in EDTX

I. INTRODUCTION

Patent Owner Molecular Rebar Design, LLC (“MRD”) submits this Preliminary Response to the Petition by LG Energy Solution, Ltd. (“LGES” or “Petitioner”) seeking *inter partes* review (“IPR”) of claims of U.S. Patent No. 8,968,924 (the “’924 Patent”). MRD notes that the ’909 Patent is related to (1) U.S. Patent No. 8,808,909 which is the subject of IPR2024-1006 and (2) U.S. Patent No. 10,153,483 which is the subject of IPR2024-1013. Petitioner is the same in all three IPRs and applies the same Ohata-Kavan combination in the related patent IPRs as it applies here. The Board should deny the Petition for multiple independent reasons, none of which can be cured by LGES.¹

First, the presented Invalidity Grounds fail to render the challenged claims obvious. That is, the prior art relied upon, alone and in combination, fails to teach or suggest each and every claim element. The presented prior art combinations presented in Grounds 1 and 2 suffer from numerous deficiencies. And, even if the

¹ Petitioner presents arguments regarding the adequacy of the written description of its claimed priority application (the ’560 Application) and whether certain references qualify as proper prior art. (Petition, pp.2-7). MRD will not address those issues here but reserves the right to address these issues later if/as necessary.

prior art did not have these deficiencies, Petitioner's rationale for the combinations is lacking. Thus, Petitioner has failed to present a *prima facie* case of obviousness.

Second, the Board should deny institution based on the *Fintiv* factors.

II. PETITIONER'S SUGGESTED COMBINATIONS FAIL TO RENDER THE SOLE INDEPENDENT CLAIM OBVIOUS

As discussed below, the combinations presented in Grounds 1 and 2 fail to render obvious independent claim 1, the only independent claim in the '924 Patent. Accordingly, the Board should deny instituting this IPR.

A. Claim Construction

For purposes of this Preliminary Response only, MRD interprets all claim terms in accordance with their ordinary and customary meaning. MRD reserves the right to propose constructions and other arguments in this IPR, the parallel litigations, or other proceedings involving the '924 Patent to the extent necessary to respond to constructions proposed by Petitioner or as required to respond to the facts or circumstances.

B. Person Of Ordinary Skill In The Art

For purposes of this Preliminary Response only, MRD does not dispute the Petitioner's definition of level of ordinary skill in the art. (Petition, p.8).

C. Priority Date

Petitioner argues that the claims enjoy priority only to the June 21, 2012 PCT filing date, and not to the June 23, 2011 filing date. (Petition, p.2). For purposes of

this Preliminary Response only, MRD takes no position because the priority date, even if considered, only affects whether the secondary references of Gan (LGES-1021) and Zhao (LGES-1018) are proper prior art references. As explained below, this POPR assumes 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.

D. The '924 Patent

The '924 Patent pertains to improved technologies for lithium batteries that use “discrete carbon nanotubes having crystals or layers of lithium ion active materials attached to their surface.” (LGES-1001, 1:24-26). The claimed invention requires “[a] composition used in lithium ion batteries” comprising:

- (1) “discrete carbon nanotubes having ion active material attached to their surface”;
- (2) “the discrete carbon nanotubes have an aspect ratio of 10 to 500 and oxidation levels from 1% to 15% by weight of the carbon nanotube”; and
- (3) “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.”

(LGES-1001, Claim 1).

E. The Cited References And Asserted Combinations Do Not Render Any Independent Claim Obvious

The Petition alleges two main invalidity grounds, Grounds 1 and 2, covering claims 1-5 and comprising three different combinations. *Ground 1* is based on the alleged obviousness of claims 1, 4, and 5 over Ohata and Kavan; *Ground 2A* is based on the alleged obviousness of claims 1, 4, and 5 over Cheng and Gan; and *Ground 2B* is based on the alleged obviousness of claims 2 and 3 over Cheng, Gan, and Zhao.

Claim 1 is the only independent claim at issue and this response will focus on claim 1. As discussed below, both Ground 1 and Ground 2A fail to show that independent claim 1 is obvious. Thus, since Ground 2A fails to show why independent claim 1 is obvious, Ground 2B similarly fails to show the obviousness of claims 2 and 3 depending therefrom.

1. The primary reference of Ohata (LGES-1004) in the Ohata-Kavan combination of Ground 1 discloses a fundamentally different composition than independent Claim 1's composition

The Ohata primary reference discloses a fundamentally and materially different composition than the composition recited in independent claim 1 of the '924 Patent. The thrust of Ohata is to use a masterbatch process with unoxidized nanotubes and resin when preparing an electrode to reduce the amount of conductive material in the electrode which allegedly results in improved electrode capacity:

[0060] [T]he use of a masterbatch process can reduce the amount of conductive material in an electrode, resulting in a greatly improved electrode capacity. In addition, since carbon nanotubes are used as a conductive material, the conductive paths are not damaged by shearing force, which is applied during the production of the masterbatch.

[0061] Furthermore, the use of carbon nanotubes as a conductive material improves the strength of an electrode plate, providing a secondary battery with an improved cycle life.

(LGES-1004, paras. [0060]-[0061]).

Ohata's masterbatch is made by first mixing the unoxidized carbon nanotubes and a resin. (LGES-1004, abstract). The unoxidized nanotubes have an "aspect ratio of not less than 100" and "preferably not greater than 1000." (LGES-1004, para. [0020]). Ohata's resin is a fluorocarbon resin. (LGES-1004, para. [0022]). An electrode active material is then added to the masterbatch, and steps are performed to make electrodes from the starting masterbatch. (LGES-1004, abstract).

As described by Petitioner, Ohata provides the starting point of the Ground 1 Ohata-Kavan combination:

The Ohata-Kavan combination composition uses Ohata as a starting point. LGES-1003, ¶33. An "electrode material mixture containing the masterbatch and an electrode active material" is blended with "a

dispersion medium” to form “[a]n electrode material mixture paste.”

LGES-1004, [0023]. The 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. *See id.*, [0015], [0020], [0024]; LGES-1003, ¶33.

(Petition, p.11).

a. Ohata fails to disclose three fundamental requirements of Independent Claim 1

Petitioner is forced to suggest that Ohata be combined with Kavan because Ohata does not teach or suggest at least three fundamental requirements of independent claim 1:

- oxidized nanotubes;
- nanotubes having ion active material attached to their surface; or
- the required ion active material.

In addition to Ohata missing these three key limitations, Petitioner’s reliance on Ohata somehow teaching or suggesting the ’924 Patent’s claimed aspect ratio of “10 to 500” is misplaced. Ohata teaches an aspect ratio of “not less than 100” explaining, “When the aspect ratio is too small, excellent conductive paths may not be formed in some electrodes.” (LGES-1004, para. [0020]). Petitioner does not explain how or why a person of ordinary skill would deviate from Ohata’s “not less than 100” aspect ratio that achieves “excellent conductive paths” to somehow employ the

claimed range that goes as low as 10 in the “10-500” aspect ratio recited in independent claim 1.

And, 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. As described above, Ohata warns about going below an aspect ratio of 100 and its impact on lack of “excellent conductive paths.” This impacts the lower end of the claimed range (i.e., 10-100).

Further, given that Ohata discloses non-oxidized carbon nanotubes and Kavan discloses oxidized carbon nanotube, to supposedly meet the recited element, Petitioner alleges the resulting nanotubes of the combination will be oxidized. But oxidation is known to shorten the nanotubes. (*See, e.g.*, Petitioner’s cited reference LGES-1009, Abstract) (stating oxidation using “nitric acid treated material under reflux conditions suffered the highest degree of degradation, such as, nanotube shortening and additional defect generation in the graphitic network.”).

Since aspect ratio is based the length to diameter ratio, shortening nanotubes length via oxidation as Petitioner proposes would necessarily decrease the nanotube aspect ratio in the proposed combination. (Petition, p.45). Petitioner relies solely upon Ohata’s disclosure (table 2) regarding aspect ratio for the combination. (*Id.*).

Petitioner’s suggestion to oxidize Ohata’s nanotubes based on Kavan will reduce the aspect ratio below 100 since oxidation reduces length, and having an

aspect ratio below 100 is something that Ohata warns about because “excellent conductive paths may not be formed in some electrodes.” (LGES-1004, para. [0020]). Petitioner has not explained why a POSITA would ignore Ohata’s warning nor has Petitioner provided evidence that the resulting combination will perform as Petitioner alleges. And this is critical since chemical arts have a degree of unpredictability, which has been long recognized. *See, e.g., In re Carelton*, 599 F.2d 1021, 1026 (C.C.P.A. 1979) (“Although there is a vast amount of knowledge about general relationships in the chemical arts, chemistry is still largely empirical, and there is often great difficulty in predicting precisely how a given compound will behave.”). Petitioner fails to address this issue. “If the prior art discloses its own range, rather than a specific point, then the prior art is only anticipatory if it describes the claimed range with sufficient specificity such that a reasonable fact finder could conclude that there is no reasonable difference in how the invention operates over the ranges.” *Ineos USA LLC v. Berry Plastics Corp.*, 783 F.3d 865, 869 (Fed. Cir. 2015).

This is yet another reason Petitioner’s rejection is flawed as explained in more detail below.

b. Petitioner fails to explain how Ohata’s aspect ratio would be retained based on the modifications

In addition to not accounting for nanotube shortening due to oxidation, Petitioner also does not explain why a person of ordinary skill in the art would

somehow try to retain Ohata's aspect ratio in the combination (Petition, pp.11-12) even though Petitioner suggests changing Ohata's fundamental electrode chemistry by modifying three other key aspects of Ohata, i.e., the (1) unoxidized nanotubes that (2) do not have ion active material attached to a nanotube surface, and (3) the electroactive material.

Ohata's aspect ratio is directly related to the unoxidized carbon nanotube performance in Ohata's electrode as it is these unoxidized carbon nanotubes that are used as conductive material (LGES-1004, paras. [0060]-[0061]). As Ohata explains, when Ohata's aspect ratio is too small (<100), the conductive path is adversely affected (LGES-1004, para. [0020]). Petitioner has not explained why a person of ordinary skill in the art would try to retain Ohata's nanotube aspect ratio and expect success when the conductive path is altered by substituting chemically different nanotubes, i.e., shortened oxidized nanotubes with a smaller aspect ratio due to oxidation, while also substituting Ohata's electroactive material with something else that Ohata does not contemplate.

The fact that Ohata's "not less than 100" disclosed aspect ratio would lead a person of ordinary skill away from the claimed lower limit of 10 is reason enough alone that Ground 1 fails. Petitioner's lack of explanation for somehow retaining Ohata's aspect ratio in its suggested combination (even though Petitioner's proposed oxidation would necessarily reduce the aspect ratio) while also suggesting to

fundamentally change Ohata's electrode chemistry is a second independent reason why the Ohata-Kavan combination in Ground 1 fails.

2. Petitioner's suggested substitutions to modify Ohata based on Kavan (LGES-1005) lack proper rationale

Petitioner is forced to look to Kavan because, as noted above in Section II.E.1a, Ohata does not teach or suggest at least three fundamental requirements of independent claim 1:

- oxidized nanotubes;
- the required ion active material; or
- nanotubes having ion active material attached to their surface.

Kavan generally pertains to a study "carried out to investigate composite materials in which multi-walled carbon nanotubes, either pristine or functionalized by carboxyls, were interfaced to three different materials, viz. TiO₂, LiMnPO₄ and LiFePO₄." (LGES-1005, p.9, left column). Petitioner suggests modifying Ohata's masterbatch by alleging: "[b]ased on the teachings of Kavan, the carbon nanotubes used in the masterbatch are oxidized, as discussed *infra*." (Petition, p.12). Petitioner also suggests substituting Ohata's electrode material by alleging, "[a]lso based on the teachings of Kavan, the electrode material is a phosphate olivine such as LiMnPO₄ or LiFePO₄ (for a positive electrode composition)." (*Id.*).

As an initial matter, Petitioner's Ohata-Kavan combination is deficient on its face. Petitioner does not make any attempt in its 76-page Petition or its 37 exhibits

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. Nor does the Petition discuss how to even oxidize the small amount of nanotubes present in the large masterbatch. The Board need look no further than these fundamental deficiencies to deny institution of Ground 1.

What's more, as explained below, Petitioner's rationale for each of its proposed substitutions from Ohata into Kavan is deficient.

a. Petitioner's rationale to try and oxidize nanotubes in Ohata's masterbatch is deficient and Ground 1 fails for at least this reason

Petitioner says that its first reason to try and oxidize nanotubes in Ohata's masterbatch is because "when the electrode material mixture paste is a positive electrode material mixture paste having a phosphate olivine as the active material (see LGES-1005, 2), electrochemical performance of an electrode is improved by oxidized nanotubes." (Petition, p.13). However, 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. Thus, Petitioner's primary reasoning for the purported motivation is circular.

Petitioner next says for its second reason, a "POSITA would have been motivated to use oxidized nanotubes because, at least in some cases, doing so is consistent with, and can enhance, Ohata's goal of dispersed nanotubes in the

masterbatch.” (Petition, p.14) (emphasis added). First, Petitioner does not explain why only in some cases oxidizing a masterbatch enhances dispersion. Nor does Petitioner say whether or not this combination is one of the cases. Second, Ohata nowhere suggests it is in need of better dispersion and instead says that its unoxidized nanotubes “form an excellent conductive path” and that the resin with dispersed nanotubes “serves to increase the mechanical strength.” (LGES-1004, paras. [0016]-[0017]). Despite this being an unpredictable art, Petitioner does not explain whether or how its proposed substitution could or would affect these key properties that Ohata touts. This purported rationale, like the first above, is deficient.

Petitioner’s third purported reason to combine brings a third reference (LGES-1010) into the combination: Wepasnick. Petitioner rationalizes based on that reference that “oxidative treatments can ‘remove amorphous carbon and metallic impurities, thus leading to a higher-purity starting material.’” (Petition, p.14). However, Ohata does not suggest anywhere that amorphous carbon or metallic impurities are present in its unoxidized nanotubes and the Petition does not speculate that either. Thus, this purported reason is without any foundation.

Petitioner’s fourth and final reason that its suggests for trying to oxidize Ohata’s masterbatch is the catch-all of applying known techniques to a known structure to yield predictable results. (Petition, pp.14-15). Petitioner’s conclusory reason does not explain any of the following:

- how one can oxidize the small amount of nanotubes in Ohata's large masterbatch of resin without the oxidizing agent reacting with or harming Ohata's other ingredients; or
- whether nanotubes shortened by Kavan's oxidation to a low aspect ratio somehow would be or could be compatible in Ohata's masterbatch.

Thus, this catch-all reason for Ground 1's combination is also deficient.

All of Petitioner's "reasons" to try and oxidize nanotubes in Ohata's masterbatch are deficient and Ground 1 fails for this additional reason. As described below, Petitioner's rationale as to substituting Ohata's electrode material with some Kavan material are just as deficient.

b. Petitioner's rationale to substitute phosphate olivine for Ohata's electrode material is deficient and Ground 1 fails for at least this additional reason

Petitioner says the purported motivation to use the phosphate olivine of Kavan instead of Ohata's electrode material is "because of their good electrochemical performance when combined with oxidized nanotubes, as described by Kavan." (Petition, p.16). But Ohata does not have oxidized nanotubes. Instead, Ohata employs unoxidized nanotubes, and the oxidized nanotubes are what Petitioner proposes substituting into Ohata. Thus, Petitioner's primary reasoning is circular.

Petitioner then speculates in reasons 2-4 that phosphate olivines would be substituted for Ohata's electrode material because purportedly they are safe,

economical, and environmentally friendly. (Petition, pp.16-17). Petitioner cites to Kavan LGES-1005, page 1 as support but does not provide the full quote. However, the full quote from that page of Kavan is as follows:

They 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 [28] either by doping [29] or by surface coating with elemental carbon [30,31].

(LGES-1005, page 1, emphasis added). Petitioner does not explain how or why in the absence of hindsight that a person of ordinary skill in the art would ignore that “crucial issue” of “poor electrical conductivity” and follow through with Petitioner’s proposed combination.

In addition to the above unaddressed electrical conductivity disadvantage with phosphate olivines, Petitioner does not allege, and Ohata does not disclose, that Ohata’s electrode material has any problem with safety, economics, or environmental issues. Thus, Petitioner’s reasons 2-4 for making the alleged substitution are deficient.

Petitioner’s fifth reason for the alleged combination brings a third and fourth reference (Chen (LGES-1028) and Feng (LGES-1042)) into the combination and rationalizes based on those references that phosphate olivines have “good electrochemical performance.” (Petition, p.17). However, that purported reason is

directly contradicted by the Kavan reference (which recall is the secondary reference basis of the combination) which states that the “poor electrical conductivity” of phosphate olivines “is a crucial issue to be addressed [28] either by doping [29] or by surface coating with elemental carbon [30,31].” (LGES-1005, page 1). Thus, this reason 5 to combine, like the others, fails.

Petitioner’s sixth and final reason is the catch-all of applying known techniques to a known structure to yield predictable results. (Petition, p.17). But Petitioner’s conclusory reason does not explain any of the following:

- how one can oxidize the small amount of nanotubes in Ohata’s large masterbatch without the oxidizing agent reacting with or harming Ohata’s other ingredients; or
- whether nanotubes shortened by Kavan’s oxidation to a low aspect ratio somehow would be or could be compatible in Ohata’s masterbatch.

Thus, this catch-all reason for Ground 1’s combination is also deficient.

All of Petitioner’s “reasons” to try and use phosphate olivine in Ohata’s masterbatch are deficient, and Ground 1 fails for this additional reason.

c. Petitioner does not explain how the “attached” limitation of independent claim 1 is met by the Ohata-Kavan combination

Independent claim 1 of the ’924 Patent requires “discrete carbon nanotubes having ion active material attached to their surface.” Ohata lacks this limitation and

Petitioner thus looks to modify Ohata with Kavan to somehow meet it. It fails to do so.

First, the Petition does not explain how the use of Ohata's masterbatch could somehow result in ion active material attached to nanotubes. That is, the masterbatch only has a small amount of nanotubes in a large amount of resin (LGES-1004, para. [0021]) and the amount of nanotubes is even smaller "not greater than 0.8 parts by weight" in the electrode (*Id.*, para. [0024]). Petitioner does not explain what steps would be used in such a masterbatch process that could result in "ion active material" "attached" to the surface of "discrete carbon nanotubes." That is, how does this process occur in Petitioner's proposed combination?

Second, Ohata teaches that a resin is typically added to the electrode material mixture which "may be the same resin as or a resin analogous to the one used during the production of the masterbatch, or a resin other than the above. In order to obtain a high-capacity electrode, the resin to be added is preferably particulate rubber that enables spot bonding between the active material particles." (LGES-1004, para. [0023]) (emphasis added).

Petitioner nowhere mentions Ohata's spot bonding and therefore does not account in any way for Ohata's active material particles being spot bonded to each other for the stated advantage of obtaining "a high-capacity electrode." That is, why would an ordinarily skilled artisan modify Ohata to attach ion active material

particles to the surface of a discrete carbon nanotubes as claimed instead of the active material particles being attached to each other as expressly taught in Ohata.

In alleging the combination meets the attached limitation, Petitioner must first assume that the substitutions of the oxidized nanotubes and phosphate olivine would be made (which they would not be as discussed above). Petitioner then speculates that “based on Kavan, the nanotubes in the combination electrode material paste have phosphate olivine crystals (crystals of ion active material) attached to their surface.” (Petition, p.26). However, Kavan does not say this.

What Kavan actually states is that “surface oxidation of carbon nanotubes by HNO_3 [6,8,10,15,16,32,37,41,44], $\text{H}_2\text{SO}_4/\text{HNO}_3$ [4] or H_2O_2 [9], producing among other groups also carboxyls, was sometimes mentioned to improve the anchoring of TiO_2 [4,6,8–10,15,16,44] or LiMPO_4 [32,37,41].” (LGES-1005, p.2) (emphasis added).

In addition to the anchoring only being “sometimes mentioned,” Kavan does not teach or suggest that any such anchoring is to a surface of a discrete carbon nanotube. Nor does Kavan teach or suggest that any such anchoring could or would occur in a masterbatch such as Ohata wherein there are only a small amount of carbon nanotubes present when an electrode material is combined in the masterbatch. And the Petition fails to account for any masterbatch when making its

conclusory allegations about the suggested combination meeting the aforementioned “attached” limitation.

Further, in regard to oxidative functionalization for anchoring, Kavan states:

However, there are also reports that the oxidative functionalization is not necessary for anchoring to TiO₂, because the pristine MWNT behave similarly [15]. The interaction of carboxyls with phosphate olivine surface is less understood, but certainly important, too [45,46].

To the best of our knowledge, there is no systematic study of these contradictory issues, although detailed understanding is desirable of the MWNT functionalization (by surface oxidation forming carboxyls) for optimum attachment of MWNT towards titania or olivine surfaces.

(LGES-1005, p.2, emphasis added). Petitioner’s speculation relies on Kavan’s teachings (Petition, p.25), but Kavan is uncertain as to any carbon nanotube attachment. Kavan instead calls for a systematic study to understand the interaction between carboxyls and the electrode material. Petitioner’s speculation about the “attachment” limitation does not meet the preponderance burden Petition must show. This is an additional reason Ground 1 fails.

Further, Petitioner does not prove that there are discrete carbon nanotubes in the Ohata-Kavan combination as explained below.

d. Petitioner wrongly alleges that any “generally uniformly dispersed” nanotubes inherently include “discrete carbon nanotubes”

The Petition only states in regard to the “discrete” limitation:

[T]o the extent **discrete** is interpreted as referring to nanotubes that are generally individually distinct, a POSITA would have found it obvious 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.

LGES-1004, [0017]; *see* LGES-1001, 3:52-54; LGES-1003, ¶69.

(Petition, p.22) (emphasis in original). It appears Petitioner is somehow alleging—without actually saying so, and critically without evidence—that any “generally uniformly dispersed” nanotubes somehow inherently include “discrete carbon nanotubes.” This is not true.

First, Ohata does not use the Petition’s term in the quote above of “individual, distinct nanotubes (separated into individual tubes) in the resin” as stated in the quotation from Petitioner’s p.22 quote above.

Second, the oxidized nanotubes of Kavan that Petitioner proposes using are not discrete, but rather, are highly entangled as shown in Kavan Figure 2 upper right and Figure 3. (LGES-1005, pp.2-3).

Third, a person of ordinary skill understands that aggregates of dispersed non-discrete carbon nanotubes may be generally uniformly dispersed. *See, e.g.*, Micah J. Green, “Analysis and measurement of carbon nanotube dispersions: nanodispersion *versus* macrodispersion.” *Polym Int* 2010; 59; 1319-1322 (defining macrodispersion as “the dispersion of small CNT bundles” and stating that researchers may use “well dispersed” to “mean a lack of large nanotube aggregates, i.e. macrodispersion.”) (MRD-2003, p.1).

Thus, contrary to Petitioner’s allegations, “generally uniformly dispersed” nanotubes do not have to include “discrete” carbon nanotubes as claimed. This is yet another independent reason to deny institution of all grounds since all grounds rely on the deficient Ohata-Kavan combination.

3. The primary reference of Cheng (LGES-1007²) in the Cheng-Gan combination of Ground 2 discloses a much different composition than independent claim 1’s composition

Cheng teaches a composite cathode material wherein “carbon nanotubes are uniformly dispersed in a bulk phase and on surfaces of lithium iron phosphate, wherein the carbon nanotubes account for 0.5-15% by weight, and the lithium iron phosphate accounts for 85-99.5% by weight.” (LGES-1007, abstract).

² LGES-1006 is the original Chinese Patent Publication of Cheng and LGES-1007 is the certified English translation thereof.

Unlike the composition of independent claim 1, Cheng's nanotubes are not oxidized as conceded by Petitioner. Therefore, Petitioner looks to Gan to remedy the deficiency by alleging: "[i]n the Cheng-Gan combination, the carbon nanotubes in Cheng's carbon nanotube/lithium iron phosphate composite would have carbon nanotubes that are functionalized or oxidized with carboxyl or hydroxyl groups at "about 2.5 to 10 wt%" based on Gan's disclosure." (Petition, p.41). Petitioner is wrong that the Cheng-Gan combination would be made by a POSITA as will be described in Section II.D.4 below. However, as an initial matter Petitioner is wrong to speculate that Cheng meets a number of other limitations of independent claim 1.

a. Cheng does not teach or suggest (1) "discrete carbon nanotubes" (2) "having ion active material attached to their surface"

Cheng is missing both "discrete carbon nanotubes" and nanotubes "having ion active material attached to their surface." In regard to "discrete carbon nanotubes" Petitioner states:

Cheng emphasizes that the carbon nanotube composite material obtained based on the disclosed methods result in **nonaggregated** and **uniform dispersion** of nanotubes. See LGES-1007, Abstract, [0007], [0010], [0021].

(Petition, p.52) (emphasis in original). None of Petitioner's four cites to Cheng here include "nonaggregated."

Yet, Petitioner doubles down on its “nonaggregated” statement, alleging:

Cheng emphasizes that the nanotubes are in **non-aggregated state**. For instance, Cheng describes that when there is an “agglomerat[ion],” it is difficult to form an “effective conductive network” or an “uniformly distributed network structure.” *Id.*, Abstract, [0007], [0010], [0021], [0023], [0073]; LGES-1003, ¶129.

(Petition, p.53) (emphasis in original).

Once again, none of these Petitioner’s six Cheng cites uses the term “non-aggregated” or even something similar. And only one of Petitioner’s six Cheng cites uses any derivative of the word “agglomerat[ion].” Moreover, that lone Cheng cite does not state that Cheng’s composition had discrete nanotubes or that it even has nanotubes in a non-aggregated or non-agglomerated state. Instead, the single citation refers to a comparative example involving nanotubes agglomerated with acetylene black which states that in Comparative Example 4, “[t]he carbon nanotubes and the acetylene black were agglomerated, and it was difficult to form an effective conductive network.” (LGES-1007, para. [0073]). Thus, Cheng

nowhere teaches or suggests using “discrete carbon nanotubes,”³ and the Cheng-Gan combination Ground 2 fails for this first independent reason.

The Cheng-Gan combination fails for a second independent reason. In addition to missing “discrete carbon nanotubes,” Cheng also is missing discrete carbon nanotubes having “ion active material attached to their surface.” On this point, Petitioner states only:

Cheng’s methods of forming the composite, including [1] mixing carbon nanotube, acetylene black, and dispersant mixture with lithium source, iron source, phosphate salt, and organic carbon source using mixing medium, [2] ball milling, [3] drying, [4] calcination, and [5] sieving indicate that the ion active material [lithium iron phosphate] is

³ To the extent that Petitioner is somehow alleging without saying so and without evidence that any “uniform dispersion” of nanotubes inherently includes “discrete carbon nanotubes”, it should be noted that is not true. Aggregates of non-discrete carbon nanotubes may be uniformly dispersed. *See, e.g.*, (MRD-2003, p.1) (defining macrodispersion as “the dispersion of small CNT bundles” and stating that researchers may use “well dispersed” to “mean a lack of large nanotube aggregates, i.e. macrodispersion.”)

attached to the surfaces of carbon nanotubes. *See* LGES-1007, [0013]-

[0018], claim 2; LGES-1003, ¶134.

(Petition, p.56).

But Cheng does not disclose anything about ion active material being “attached” to the surfaces of carbon nanotubes in Petitioner’s six cited Cheng paragraphs, Petitioner’s cited Cheng claim 2, or anywhere else in Cheng for that matter. Instead, Cheng merely says, “The carbon nanotubes not only are present on the surface of the material, but also form a uniformly distributed network structure inside the material.” (LGES-1007, para. [0023]). Of course, these non-discrete nanotubes being “present” on the surface of lithium iron phosphate cathode material or even “inside” the material is not the same as being “attached”. Petitioner does not offer any other explanation of how Cheng somehow meets (1) “discrete carbon nanotubes” (2) “having ion active material attached to their surface.” Thus, Ground 2 fails for these two additional independent reasons.⁴

⁴ Cheng calcines its nanotubes at “600°C to 850°C in an inert protective atmosphere for 4 to 48 hours” in order to obtain “the carbon nanotube lithium iron phosphate composite cathode material.” (LGES-1007, pp.6, 17, bottom). However, such calcining would remove any oxidized groups from the nanotubes in the Chen-Gan combination of oxidized carbon nanotubes and thus claim 1 could not result. *See*,

b. Cheng leads away from independent claim 1's claimed "aspect ratio of from 10 to 500"

The Cheng-Gan combination fails for a third independent reason: the combination fails to teach or suggest the claimed 10-500 aspect ratio of independent claim 1. Petitioner alleges that “[i]n the Cheng-Gan combination, Cheng describes nanotubes that have an aspect ratio in the preferred range of 67-300, which falls within the claimed range (“10 to 500”).” (Petition, p.60). The Petition ignores and does not explain how a person of ordinary skill would arrive at a conclusion of the claimed 10-500 aspect ratio in light of Cheng’s actual disclosure.

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.” (Ex. 1007, para. [0071]). Thus, the carbon nanotubes in Comparative Example 4 have an aspect ratio (length/diameter) of 600 (30 μm equals 30,000 nm / 50 nm). As Cheng states, “since the tube diameter of the carbon nanotubes was too small and the length was greater, mutual entanglement was severe. The carbon nanotubes and the acetylene black were agglomerated, and it was difficult to form an effective conductive network.” (Ex. 1007, para. 0073). Stated differently, Cheng discloses that an aspect ratio of

e.g., LGES-1009, 7 (stating “[t]he second stage - from 150 to 350C - is attributed to the decarboxylation of the carboxylic groups present on the MWCNT walls [36].”)

600 did not work and the preferred range is 67-300. Therefore why would a POSTIA be led to use an aspect ratio of up to 500 as claimed relying upon Cheng's disclosure? Thus, contrary to Petitioner's assertions Cheng's disclosure leads away and does not support an aspect ratio of independent claim 1's range of up to 500. Petitioner does not explain.

Cheng also leads away from independent claim 1's lower limit of 50. That is, Cheng's Comparative Example 5 uses, "[c]arbon nanotubes having a length less than 10 μm and a tube diameter greater than 200 nm were selected as a raw material." (Ex. 1007, para. [0076]). Thus, the carbon nanotubes in Chen's Comparative Example 5 have an aspect ratio (length/diameter) of 50 (10 μm which equals 10,000 nm / 200 nm). But Cheng then 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." (Ex. 1007, para. [0078]). The Petition nowhere explains why or how a POSITA nevertheless would employ the claimed lower limit of an aspect ratio of 50 in light of Chen's teaching that an aspect ratio of exactly 50 does not even work in Comparative Example 5. The suggested Chen-Gan does not obtain the claimed invention of independent claim 1 and Ground 2 should be rejected for this third independent reason.

4. The secondary reference of Gan (LGES-1021) would not be combined with Cheng as Petitioner suggests

Gan is not alleged by Petitioner to resolve the three independent deficiencies above with respect to the Cheng-Gan combination's failure to disclose independent claim 1's requirement of (1) "discrete carbon nanotubes", (2) "having ion active material attached to their surface," or (3) "an aspect ratio of from 10 to 500." Thus, any Cheng-Gan combination fails (even without considering Gan's inclusion), and Ground 2 should be denied. That said, Petitioner's rationale to combine Cheng and Gan also fails.

Petitioner provides six purported reasons over eight pages trying to justify why a Cheng-Gan combination would somehow be made by an ordinary artisan to employ Gan's oxidized nanotubes in place of Chen's unoxidized nanotubes. (Petition, pp.42-50). Like Petitioner's misstatements and overstatements described above, all six of Petitioner's scattershot purported reasons for a combination fail.

Petitioner first alleges that Gan's oxidized carbon nanotubes would be used in Cheng **"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. See LGES-1007, [Abstract], [0003]-[0010], [0021], [0030]-[0033]; LGES-1003, ¶110." (Petition, pp.42-43) (emphasis in original). However, a review of Petitioner's 14 cited Cheng paragraphs reveals that not one of the cited paragraphs support any such "design objective" of a "better constructed

electrically conductive network.” Instead, Cheng teaches in these same cited paragraphs that it’s disclosed, unmodified composition already exhibits:

- “good electrochemical performance: the capacity > 150 mAh/g, the cycle life > 1500 times under high current use conditions, and discharge performance satisfying $10C/0.5C > 90\%$.” (LGES-1007, para. [0031]).
- “power output and the cycle characteristics can be significantly improved, and in addition, the capability of binding with an aluminum foil current collector is strong. The electrode sheet has high compacted density. Surface density of the compressed positive electrode sheet ≥ 2.3 g/cm³. The flexibility and winding property of the positive electrode sheet are good.” (LGES-1007, para. [0032]).
- a “lithium battery comprising the carbon nanotube lithium iron phosphate composite cathode material prepared in the present invention has a high specific capacity and a long cycle life.” (LGES-1007, para. [0033]).

Petitioner’s first and primary reason for the purported Cheng-Gan combination is thus not supported and, therefore, wrong.

Petitioner suggests in reason two to use Gan’s oxidized nanotubes to “enhance **dispersion of carbon nanotubes in water** and/or conducting agent in Cheng.” (Petition, pp.43-44) (emphasis in original). However, this purported reason to combine is illusory as Cheng already states that “[u]niform dispersion of carbon

nanotubes in the bulk phase and on surfaces of lithium iron phosphate is achieved ... solving the problem in which the properties of carbon nanotubes cannot be fully utilized because the carbon nanotubes cannot be fully dispersed.” (LGES-1007, para. [0010]).

Because Cheng already solves Petitioner’s purported issues as described above in relation to first two purported reasons, Petitioner tries to manufacture other reasons to combine. Petitioner alleges in reason three that Gan’s 2.5 to 10 wt.% oxidation is “within a safe threshold.” (Petition, p.44). However, this ignores that, given Cheng’s teachings described above, there is no reason for a person of ordinary skill in the art to oxidize carbon nanotubes within any threshold, and therefore there is no need to be concerned about any “safe threshold.”

Petitioner’s fourth and fifth reasons for combining Cheng and Gan are equally non-persuasive. Petitioner states for reason four that “Gan identifies multiple commercial sources where oxidized nanotubes having specific oxidation levels can be obtained.” (Petition, p.45). Citing to a new reference (Wepasnick, LGES-1010) that is not in Petitioner’s suggested Cheng-Gan combination, Petitioner then states for reason five that oxidized carbon nanotubes improve the “colloidal stability of

CNTs”. (Petition, p.46).⁵ However, since Petitioner has not provided a reason why an ordinarily skilled artisan would oxidize Cheng in the first instance, these fourth and fifth reasons use circular reasoning and are irrelevant.

Petitioner’s sixth and final suggested reason for trying to oxidize Cheng based on Gan in the absence of any reason in Cheng to do so is the “catch-all” of applying known techniques to a known structure to yield predictable results. (Petition, pp.47-48). Of course, the weakness of this argument is shown by Petitioner’s unwillingness to introduce it until page 47 as the final reason for the suggested combination. Furthermore, Petitioner’s conclusory reasoning still does not explain why a person of ordinary skill would somehow consider modifying Cheng which already has:

- “good electrochemical performance: the capacity > 150 mAh/g, the cycle life > 1500 times under high current use conditions, and discharge performance satisfying 10C/0.5C > 90%.” (LGES-1007, para. [0031]).

⁵ Petitioner states, “[t]his supports Cheng’s design objective of achieving better dispersion of both the carbon nanotubes themselves and throughout the lithium iron phosphate. *See* LGES-1007, [0010]– [0014].” (Petition, p. 46). But there is no such “design objective” in the Cheng cited paragraphs or anywhere else.

- “power output and the cycle characteristics can be significantly improved, and in addition, the capability of binding with an aluminum foil current collector is strong. The electrode sheet has high compacted density. Surface density of the compressed positive electrode sheet ≥ 2.3 g/cm³. The flexibility and winding property of the positive electrode sheet are good.” (LGES-1007, para. [0032]).
- a “lithium battery comprising the carbon nanotube lithium iron phosphate composite cathode material prepared in the present invention has a high specific capacity and a long cycle life.” (LGES-1007, para. [0033]).

Petitioner’s sixth reason, like the primary reason, for the purported Cheng-Gan combination thus is not supported and wrong.

For all of the independent reasons described above, Petitioner’s petition should be denied at to both Ground 1 and Ground 2.

F. Petitioner Has Failed To Present A Prima Facie Case Of Obviousness

Petitioner’s Grounds all rely upon obviousness as described above in Section II.E. A patent claim is unpatentable under 35 U.S.C. § 103 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 before the effective filing date of the claimed invention 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 by the factual determinations of four factors: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the pertinent art; and (4) when presented, objective evidence of nonobviousness, i.e., secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements,” but “must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Here, Petitioner’s obviousness case fails on the first two *Graham* factors (the scope and content of the prior art and differences between the prior art and the claims at issue). As described above in Sections II.E.1-4, the combinations of Ohata-Kavan and Cheng-Gan are deficient. The disclosures of the references are such that even if combined, the combination fails to disclose the recited elements. Furthermore, Petitioner has failed to present sufficient rationale to support the proposed combinations of references (i.e., Ohata and Kavan, Cheng and Gan). Obviousness determinations must include “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Here, Petitioner, as described, may provide some articulated reasoning but any such reasoning lacks any

rational underpinning. Thus, a legal conclusion of obviousness cannot be supported here.

For example, as described above in Section II.E.1, Ohata discloses a fundamentally different composition than that recited in claim 1. Ohata lacks disclosure of at least three elements of claim 1: oxidized nanotubes; the required ion active material; and nanotubes having ion active material attached to their surface. Petitioner then relies upon Kavan as a secondary reference to combine with Ohata to cure these deficiencies and therefore allegedly render the claims obvious. However, the combination fails for at least the reasons given above in Section II.E. Indeed, Kavan's disclosure differs significantly from that of Ohata. For example, Ohata employs a masterbatch which includes nanotubes with an aspect ratio larger than 100 and Petitioner makes no attempt to rationalize this with Kavan's shortened oxidized nanotubes.

The combination of Cheng and Gan suffers from similar deficiencies as described in Sections II.E.3 and II.E.4 above. That is, Cheng discloses a different composition from that recited in claim 1. For example, Cheng's nanotubes are not oxidized as recited and nor do such discrete carbon nanotubes have ion active material attached to their surface. Petitioner fails to allege how Gan cures the deficiencies of Cheng and its rationale to combine the two references also fails as

described above. Therefore, Petitioner's obviousness combinations fail for at least the reasons presented in Section II.E above.

Petitioner has failed to present a *prima facie* case of obviousness since it has only presented conclusory statements, unsupported by the evidence instead of meeting its burden of "articulat[ing] specific reasoning, based on evidence of record, to support the legal conclusion of obviousness." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Accordingly, the Petition fails to establish a reasonable likelihood that the claims are obvious over any of the asserted Grounds. Thus, the Board should decline to institute this IPR.

III. THE *FINTIV* FACTORS FAVOR DENIAL OF INSTITUTION UNDER § 314(a)

As detailed below, the *Fintiv* factors favor denial.⁶

A. Factor 1: A Stay Is Unlikely In The Parallel Proceeding

The first factor favors denial, or is at most neutral, because there is presently no stay in the parallel proceeding before the Eastern District of Texas. To be fair, Petitioner filed a motion to stay the litigation after filing this Petition. The motion was denied without prejudice to refile after institution decisions. *Molecular Rebar*

⁶As a threshold issue, Petitioner already addressed the factors in its Petition and should not be afforded an opportunity to reply to this response on this basis.

Design, LLC et al v. LG Energy Solution, Ltd., 2-24-cv-00107, ECF No. 60 (E.D. Tex. July 19, 2024) (MRD-2001).

Thus, if the Board declines to speculate on the possibility of a stay following institution, this factor is—at most—neutral. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 15 at 12 (PTAB May 13, 2020). However, MRD notes that, at the institution stage, the case will be significantly into discovery, and the parties will have expended significant resources, such as completing invalidity contentions and the technical document production, and thus, this factor would shift to favoring denial. (See MRD-2002).

B. Factor 2: The Median Time To Trial Is Before The Deadline For A Final Written Decision

This factor favors denial because trial in the parallel district court proceeding is set for December 8, 2025 (MRD-2002), proximate an expected Final Written Decision if the IPR is instituted, as admitted by Petitioner. The proximity of these critical dates (i.e., the trial and a Final Written Decision) could result in conflicting decisions from the Board and the District Court, at nearly the same time, and the parties will then have to proceed to the Federal Circuit, which will face potentially inconsistent decisions with different records and different findings. Combining this inefficiency and with the other factors discussed herein, the Board should exercise its discretion to deny institution. *Fintiv*, Paper 11 at 9 (“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...”).

C. Factor 3: The Parties Have Invested Significant Time And Money In The Parallel Proceeding

This factor strongly favors denying institution, or is at most neutral. The parties are beginning to commit substantial resources to the parallel proceeding as discovery has begun in earnest, as noted above with respect to Factor 1. (See MRD-2002).

D. Factor 4: All Issues In The Petition Overlap With The Parallel Proceeding

This factor favors denial because “the same or substantially the same claims, grounds, arguments, and evidence” in this Petition are also at issue in the parallel litigation. *Fintiv*, IPR2020-00019, Paper 11 at 12. Thus, addressing these same issues here would duplicate efforts. Petitioner’s stipulation “not to seek resolution in the district court of the same grounds presented in this Petition” in the parallel litigation for instituted claims rings hollow. (Petition, p.71) Petitioner has not offered to withdraw **all** grounds/combinations based on these references or that it reasonably could have raised—i.e., the full scope of estoppel if this IPR proceeds to final written decision. 35 U.S.C. §315(e)(2).

Petitioner’s proposed stipulation here is the same narrow stipulation criticized in *Sand Revolution*, and even narrower than the “intermediate ground between the

stipulations in *Sotera* and *Sand Revolution*” that “precludes Petitioner from relying in the district court on any of the same *references* used in the Petition, and is not limited to only the same *grounds*.” *Ericsson Inc. v. Koninklijke KPN N.V.*, IPR2022-00069, Pap. 9 at 12-14 (PTAB May 25, 2022) (emphasis in original). Unlike a *Sotera* stipulation where “a petitioner stipulates not to pursue in a parallel district court proceeding the same grounds as in the petition ***or any grounds that could have reasonably been raised in the petition***,” Petitioner’s proposed stipulation is limited only to the “same grounds” raised in the Petition and thus would not “mitigate[] concerns of potentially conflicting decisions and duplicative efforts between the district court and the PTAB.” See Katherine K. Vidal, *Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation* (June 21, 2022) (“Vidal Memo”) at 7 (citing *Sotera*).

Further, Petitioner (as Defendant in the parallel litigation) has served extensive invalidity contentions. Petitioner’s narrow stipulation detailed above does nothing to narrow the case for the Court. Given the timing of the litigation, as discussed above in Factor 2, and that a stay is not likely (Factor 1), the Court is already forced to consider almost the full range of invalidity contentions served by Defendant that includes numerous invalidity references, and even more combinations, as the litigation proceeds to trial. (See MRD-2005, excerpts from invalidity contentions, served by Petitioner, as Defendant, in the parallel litigation

showing the vast number of references relied upon). Thus, the Board spending its finite resources on this IPR that will only resolve, at most, two grounds of the multitude of invalidity positions taken in the parallel litigation, is not judicially effective or efficient.

Thus, the Board should exercise its discretion to deny institution here where Petitioners' proposed stipulation fails to cover the full scope of statutory estoppel.

E. Factor 5: The Parties In Both Proceedings Are The Same

This factor weighs in favor of denying institution because “petitioner and the defendant in the parallel proceeding are the same party.” *Fintiv*, IPR2020-00019, Paper 15 at 15; *see also SK Innovation Co., LTD v. LG Chem, LTD*, IPR2020-01239, Paper 14 at 20-21 (PTAB Jan. 12, 2021).

F. Factor 6: Petitioner's Arguments Do Not Plainly Lead To A Conclusion Of Unpatentability

Given that the first five factors favor denial of institution, the Board must consider whether a compelling invalidity case is presented. *Commscope Technologies LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 23 at 5 (PTAB Feb. 27, 2023). Importantly, “the compelling merits standard is a higher standard than the standard for institution set by statute.” *Id.* at 3. Petitioner does not present a compelling invalidity challenge sufficient to outweigh the preceding five factors as MRD has demonstrated herein. *See Vidal Memo* at 4 (“Compelling, meritorious challenges are those in which the evidence, if unrebutted in trial, would plainly lead

to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.”); *Vector Flow, Inc. v. HID Glob. Corp.*, IPR2023-00353, Paper 8 at 25 (PTAB July 17, 2023) (“A conclusion of unpatentability cannot ‘plainly’ follow from an analysis that declines to offer nothing more than ‘possibilities’ as how the claims might be understood.”); *see also* Vidal Memo at n.6.

Here, Petitioner has done exactly what the Board noted in *Vector Flow* is insufficient—offer nothing more than possibilities and assumptions on how the cited art might be combined. Petitioner’s proposed Grounds do not meet the articulated standard for obviousness as described above in Section II.F. Petitioner fails to present a *prima facie* case of obviousness because the combinations, even if made lack the claimed elements. Coupled with the fact that Petitioner does not even meet the reasonable likelihood of success standard for institution (as described above), it cannot meet the significantly higher standard for a compelling invalidity challenge.

Further, it is telling that Petitioner’s primary reference of Ohata lacks at least three express claim elements. In a period from 2000-2010 alone there were over 52,000 papers published and over 5,000 patents issued in the area of research and development of carbon nanotubes. (MRD-2004) (“Progress of carbon nanotube (CNT) research and development in terms of published papers and patents is reported . . . Publication growth of CNTs and related fields are analyzed for the period of 2000–2010. From the explored search term, ‘carbon nanotubes’, the total

number of papers containing the CNT concept is 52,224, and for patents is 5,746.’’).

Given this vast array of potential prior art, since Petitioner was unable to find any primary reference more on point for the claimed elements than one missing three express elements, this shows the non-obviousness of the ’924 Patent. Petitioner’s cobbling together of disparate references and having an expert opine on such meeting each and every claim element (when in fact the references do not) is further weakened by this data on the breadth of information available in the carbon nanotube technology area.

Accordingly, this factor favors denying institution.

IV. CONCLUSION

The Board should deny institution.

Dated: September 17, 2024

Respectfully Submitted,
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CERTIFICATE OF WORD COUNT

The undersigned certifies pursuant to 37 C.F.R. § 42.24(d) that the foregoing Patent owner Preliminary Response excluding any table of contents, table of authorities, certificates of service or word count, or appendix of exhibits or claim listing, contains 9,094 words according to the word-processing program used to prepare this paper (Microsoft Word). Petitioner certifies that this Patent Owner Preliminary Response does not exceed the applicable type-volume limit of 37 C.F.R. § 42.24(b)(1); that is, a 14,000 word limit.

Dated: September 17, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4), lead counsel for Patent Owner hereby certifies that on September 17, 2024, a copy of this PATENT OWNER'S PRELIMINARY RESPONSE was served to the email correspondence addresses of record for Petitioner's counsel of record:

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