

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.

Case IPR2024-01012
Patent 10,608,282

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

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LIST OF EXHIBITS

LGES-1001	U.S. Patent No. 10,608,282 to Bosnyak, et al. (“the ’282 Patent”)
LGES-1002	Excerpts from the Prosecution History of the ’282 Patent (“the Prosecution History”)
LGES-1003	Declaration of Dr. Sam Gido
LGES-1004	Curriculum Vitae of Dr. Sam Gido
LGES-1005	PCT Publication WO 2010/117392 (“Bosnyak-392”)
LGES-1006	PCT Publication WO 2011/163129 (“Bosnyak-129”)
LGES-1007	Korean Patent Publication KR 10-2010-0086854
LGES-1008	Certified English Translation of KR 10-2010-0086854 (“Son”)
LGES-1009	“Modification of Multiwall Carbon Nanotubes by <i>Grafting from</i> Controlled Polymerization of Styrene: Effect of the Characteristics of the Nanotubes,” J. Albuerne, et al., Journal of Polymer Science Part B: Polymer Physics, 48(2020), 1035-1046 (“Albuerne”)
LGES-1010	U.S. Patent Publication No. 2012/0052363 (“Fleischer”)
LGES-1011	“Cap removal and shortening of double-walled and very-thin multi-walled carbon nanotubes under mild oxidative conditions,” R. Marega, et al., <i>Carbon</i> , 47(2009), 675-682 (“Marega”)
LGES-1012	U.S. Patent Publication No. 2008/0192407 (“Lu”)
LGES-1013	Japanese Patent Publication JP 2005-262391
LGES-1014	Certified English Translation of JP 2005-262391 (“So”)
LGES-1015	U.S. Patent No. 9,896,341 to Noyes (“Noyes”)
LGES-1016	“Layered and interfacially blended polyelectrolyte multi-walled

carbon nanotube composites for enhanced ionic conductivity,”
X. Gu et al., *Thin Film Solids*, Vol. 520, Issue 6, (January
2012), pp. 1872-1879 (“Gu”)

LGES-1017	PCT Publication WO 2013/192513
LGES-1018	U.S. Provisional Application No. 61/662,393
LGES-1019	U.S. Provisional Application No. 61/663,513
LGES-1020	Declaration of June Munford (Albuerne)
LGES-1021	RESERVED
LGES-1022	“The effect of carbon nanotube aspect ratio and loading on the elastic modulus of electrospun poly(vinyl alcohol)-carbon nanotube hybrid fibers,” K. K. H. Wong et al., <i>Carbon</i> 47 (2009) 2571-2578 (“Wong”)
LGES-1023	“Dispersion State and Damage of Carbon Nanotubes and Carbon Nanofibers by Ultrasonic Dispersion: A Review,” H. Rennhofer et al., <i>Nanomaterials</i> 2021, 11, 1469 (“Rennhofer”)
LGES-1024	“Nanocomposites from styrene-butadiene rubber (SBR) and multiwall carbon nanotubes (MWCNT) part 1: Morphology and rheology,” S.K. Pedini et al., <i>Polymer</i> 55 (2014) 258-270 (“Peddini”)
LGES-1025	File History of European Patent No. 2,865,031 (EP counterpart to the ’282 Patent)
LGES-1026	U.S. Patent Application Publication US2009/0242850 (“Park”)
LGES-1027	<i>Molecular Rebar Design, LLC, and Black Diamond Structures, LLC v. LG Energy Solution, Ltd.</i> , Plaintiffs’ Disclosure of Asserted Claims and Infringement, 2:24-cv-00107-JRG
LGES-1028	<i>Molecular Rebar Design, LLC, et al. v. LG Energy Solution, Ltd.</i> , Sample Docket Control Order, 2:24-cv-00107-JRG

LGES-1029	Deposition of Dr. Deborah D. L. Chung for '282 Patent.
LGES-1030	Gido Supplemental Declaration
LGES-1031	Deposition of Dr. Deborah D. L. Chung for '649 Patent (IPR2024-01005).
LGES-1032	Deposition Exhibit 1100 from Deposition of Dr. Deborah D. L. Chung for '649 Patent (IPR2024-01005).
LGES-1033	Deposition of Dr. Deborah D. L. Chung for '909 Patent (IPR2024-01006).
LGES-1034	Dictionary definition of “discrete,” Webster’s Dictionary (2009).
LGES-1035	Dictionary definition of “discrete,” Merriam-Webster’s Collegiate Dictionary, Eleventh Edition (2009).
LGES-1036	“Percolation and gel-like behavior of multiwalled carbon nanotube/polypropylene composites influenced by nanotube aspect ratio.” Yongzheng Pan, Lin Li. Polymer, 54 (2013) 1218-1226. (“Pan”)
LGES-1037	“Correlations between Percolation Threshold, Dispersion State, and Aspect Ratio of Carbon Nanotubes.” Jing Li, Peng-Cheng Ma, Wing Sze Chow, Chi Kai To, Ben Zhong Tang, J.-K. Kim. Advanced Functional Materials 2007, 17, 3207–3215. (“Li”)
LGES-1038	“The effect of the aspect ratio of carbon nanotubes on their effective reinforcement modulus in an epoxy matrix.” Alfonso Martone, Gabriella Faiella, Vincenza Antonucci, Michele

Giordano, Mauro Zarrelli. Composites Science and Technology
71 (2011) 1117–1123. (“Martone”)

LGES-1039 “Discrete carbon nanotubes increase lead acid battery charge
acceptance and performance.” Steven W. Swogger, Paul
Everill, D.P. Dubey, Nanjan Sugumaran. Journal of Power
Sources 261 (2014) 55-63. (“Swogger”)

LGES-1040 RESERVED

LGES-1041 RESERVED

LGES-1042 Patent Owner Response for '909 Patent (IPR2024-01006)

LGES-1043 Patent Owner Response for '924 Patent (IPR2024-01011)

LGES-1044 Patent Owner Response for '483 Patent (IPR2024-01013)

I. INTRODUCTION

The Patent Owner Response (“POR”) fails to rebut the Petition’s showing that claims 1-16 are unpatentable over prior art combinations based on Bosnyak-392-Son as well as Bosnyak-129-Albuerne. Patent Owner’s (“PO”) arguments are based on an unjustifiably narrow interpretation of “discrete carbon nanotube fibers,” mischaracterizations of the references and combinations, and failures to rebut the Petition’s showing of motivations underpinning these combinations.

For these and the reasons explained further below, PO’s arguments are unavailing and the Challenged Claims should be found unpatentable.

II. PO’S CLAIM CONSTRUCTION POSITION IS INCONSISTENT AND UNSUPPORTED

Patent Owner proposes that the plain and ordinary meaning of “discrete carbon nanotube fibers” should be “carbon nanotubes that are separate and distinct from other nanotubes; not attached to other nanotubes.” POR, 14. But as demonstrated below, PO’s proposal is flawed, unsupported, and directly contradicted, *inter alia*, by the intrinsic record, relevant dictionary definitions, and even its own infringement contentions. Once PO’s strained and unsupported construction attempt is debunked, remaining arguments, too, quickly collapse. Ultimately, because the Challenged Claims are obvious under any reasonable

interpretation of “discrete carbon nanotube fibers,” Petitioner maintains that no formal claim construction is necessary.¹

A. PO’s Construction Is Unsupported by the Specification, Relevant Dictionary Definitions, and Other Prior Art

The ’282 Patent describes that “discrete” carbon nanotubes are “*alternatively termed exfoliated* carbon nanotubes” and that they can be “obtained from as-made bundled carbon nanotubes[.]” LGES-1001, 6:50-54.² It says nothing about prohibiting discrete nanotubes from being attached to one another, or from touching one another, and as such provides no support for PO’s assertion that discrete

¹ Patent Owner and its expert, Dr. Chung, apply the same definition of “discrete” across all five pending IPR proceedings (IPR2024-01006, IPR2024-01011, IPR2024-01013, IPR2024-01005, IPR2024-01012). *See, e.g.*, LGES-1031, 118:14-24. But while PO contends that “claim construction [of discrete] is necessary” in the instant proceeding (POR, 13), it says that “no construction is required” for the same term in IPR2024-01006, IPR2024-01011, and IPR2024-01013 (LGES-1042, 17; LGES-1043, 17; LGES-1044, 16). Petitioner agrees that no formal construction is necessary—in those three proceedings as well as in this one.

² All emphasis added unless otherwise noted.

nanotubes must be “not attached to other nanotubes.” In fact, PO’s expert Dr. Deborah Chung acknowledged that having an exfoliated carbon nanotube “doesn’t imply that the nanotubes are not touching at all.” LGES-1031, 103:13-25.

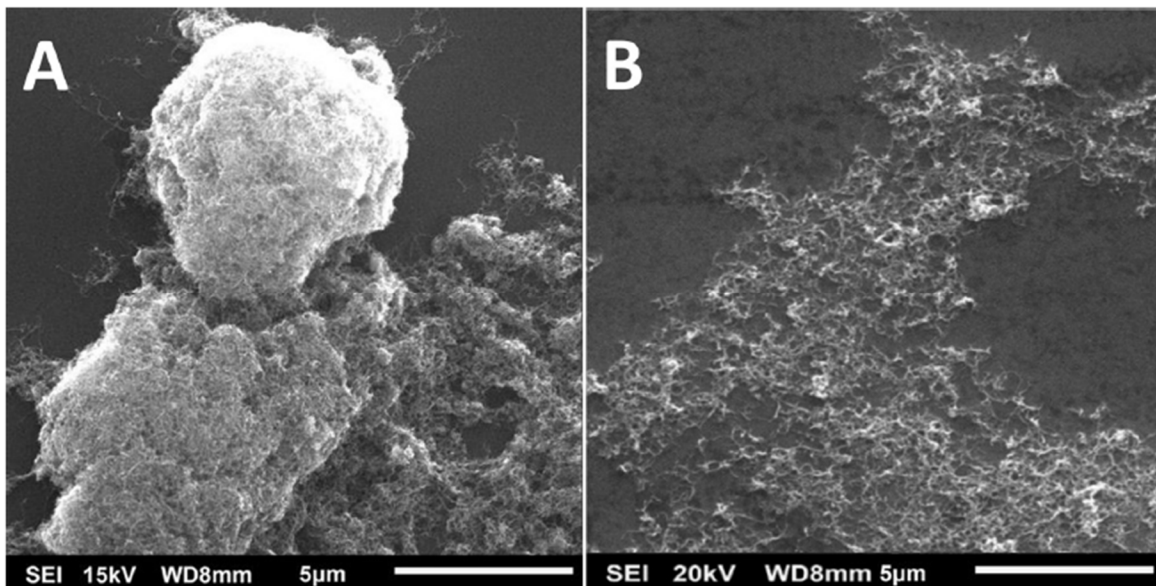
Notably, the ’282 Patent instructs that to the extent a dictionary is needed, “Webster’s Dictionary, 3rd Edition, 2009” should be used. LGES-1001, 6:43-46. Yet PO ignores this prescription, instead citing a *different* dictionary, Webster’s New World College Dictionary, 4th Edition, 1999 (MRD-2008; *see* POR, 14), in an attempt to support its construction. Remarkably, this difference in dictionaries is not a meaningless one: the prescribed dictionary defines “discrete” as merely “individually distinct” (LGES-1034, 3), and does not include the “not attached to others” (MRD-2008, 4) phrase that PO was able to find only in its single dictionary from 1999. Another Webster dictionary from the prescribed 2009 time period likewise does not mention “not attached to others.” LGES-1035, 3. Yet PO’s expert, Dr. Chung, consulted with only the single (wrong) 1999 dictionary that PO’s counsel provided her with. LGES-1068, 19:6-20:8. Patent Owner offers no other evidence to support its bold claim that “discrete” nanotubes cannot touch each other. *See* LGES-1029, 101:7-102:19. Thus, PO is thus unjustified in adding this non-attachment criterion into its proposed construction.

Patent Owner also points to the ’282 Patent’s description of a separator’s need to “provide the necessary electrical insulation between the electrodes” as a reason

why a “POSITA would understand that discrete CNTs can provide electrical insulation because they are not attached to one another.” POR, 13. While it may be theoretically possible that CNTs that are not attached to one another can help provide electrical insulation, there is nothing in the ’282 Patent to suggest that “discrete” requires being “not attached” or that the inventors of the ’282 Patent were somehow interested in achieving non-touching nanotubes. LGES-1030, ¶6. In contrast, the ’282 Patent touts the importance of adding more “discrete carbon nanotubes” to achieve “low electrical resistivity” when making a conductive binder as per the ’282 Patent. LGES-1001, 9:18-29; LGES-1030, 6. Dr. Chung confirmed that to increase electrical conductivity, “carbon nanotube ... can also be added [to the binder] as needed to render the electrode electronically conductive.” MRD-2004, ¶65. And as Dr. Chung further confirmed, “you need to have a plurality of *nanotubes coming together and making electrical contact between one another* that is, *touching one another*” in order to create an electrically conductive structure as desired in the ’282 Patent. LGES-1033, 36:18-37:5.

Moreover, as explained by Dr. Gido, because of the high aspect ratio of carbon nanotubes, it is simply not feasible to have even a very small concentration of nanotubes without them crossing and contacting one another in the context of the ’282 Patent. LGES-1030, ¶¶7-16.

Patent Owner's construction for "discrete" is also at odds with the usage of the term "discrete" in the art. For instance, Fig. 1A of Swogger reproduced below, which comes from MRD's own publication, illustrates "bundled carbon nanotubes," in contrast with the "discrete, untangled carbon nanotubes" of Fig. 1B. Swogger's description of the Fig. 1B nanotubes as "discrete" is a clear indication that the common usage of this term encompasses non-bundled nanotubes that nevertheless can still cross and contact one another. LGES-1030, ¶17.

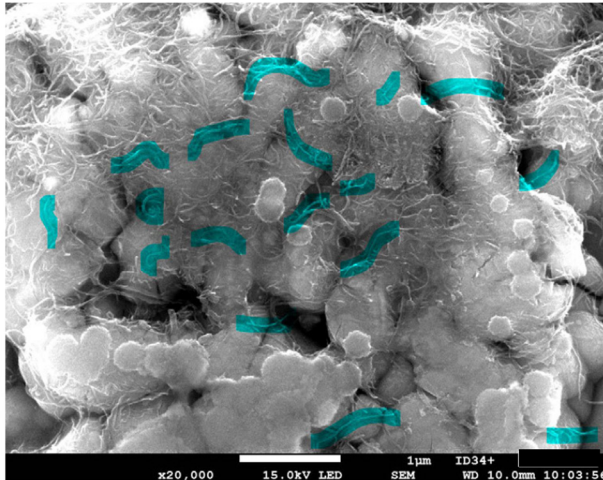


LGES-1039, 3 (showing "entangled tubes" at left, "discrete, untangled carbon nanotubes" at right)

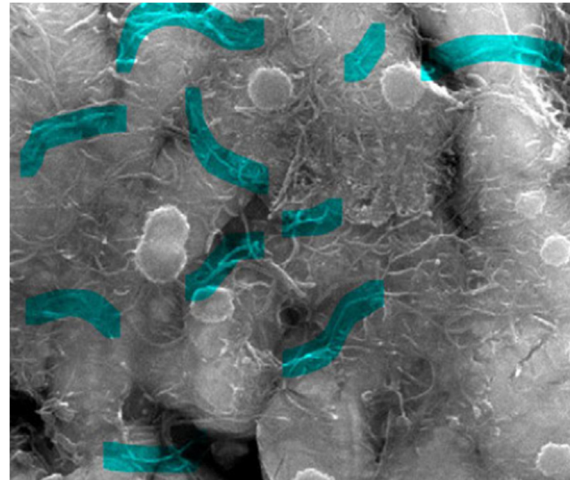
B. PO's Construction Contradicts Its Own Positions in Co-pending Litigation

Patent Owner's narrow construction is further undermined by its own infringement contentions. In asserting infringement, Patent Owner alleged that the

SEM images below depict “discrete” carbon nanotubes; the alleged nanotubes they highlight clearly depict nanotubes touching each other, as seen below (original highlighting by PO). *See* LGES-1027, 35-42; LGES-1030, ¶18.



LGES-1027, 40 (original)



LGES-1027, 40 (cropped, magnified)

Patent Owner has thus acknowledged that “discrete” nanotubes need not be physically separated. LGES-1030, ¶18. Patent Owner cannot maintain such contradictory positions simultaneously—advocating for one interpretation here and an entirely different interpretation in district court proceedings. This contradiction alone highlights the implausibility and inconsistency of Patent Owner's claim construction.

C. PO's Citations to Dr. Zhu's Opinions Are Misplaced and Not Supported by Record Evidence

Patent Owner's reliance on Dr. Zhu's opinion in an effort to support its proposed construction for "discrete" is also inappropriate and misplaced. POR, 14-18. For one thing, Dr. Zhu has not provided any opinions regarding the '282 Patent.

Moreover, Dr. Zhu's testimony (in this entirely different proceeding for an unrelated patent) cited by PO refers to "discrete, non-agglomerated, and exfoliated carbon nanotubes." POR, 15. The limited context supplied by PO provides no way to discern whether Dr. Zhu's opinions reflect his understanding of the meaning of the term "discrete" in a vacuum.

Furthermore, PO simply mischaracterizes the statement it quotes from Dr. Zhu. While Dr. Zhu may have agreed that a nanotube that is "fully isolated from nanotubes" can certainly be discrete (POR, 15-16), this in no way constitutes an admission that a nanotube must necessarily be fully isolated to be considered discrete. As Dr. Guido aptly explains, just as a carbon nanotube is undeniably a nanotube without all nanotubes needing to be carbon nanotubes, a fully isolated nanotube can be discrete without all discrete nanotubes needing to be fully isolated. LGES-1030, ¶19.

With Patent Owner's flawed claim construction dismantled, its remaining arguments related to "discrete" quickly collapse. Indeed, their patentability position relies on an artificially narrowed interpretation of "discrete carbon

nanotube fibers,” unsupported by intrinsic or extrinsic evidence, contradicted by their own infringement evidence, and inconsistent with industry usage.

III. GROUNDS BASED ON BOSNYAK-392 AND SON RENDER OBVIOUS CLAIMS 1-16

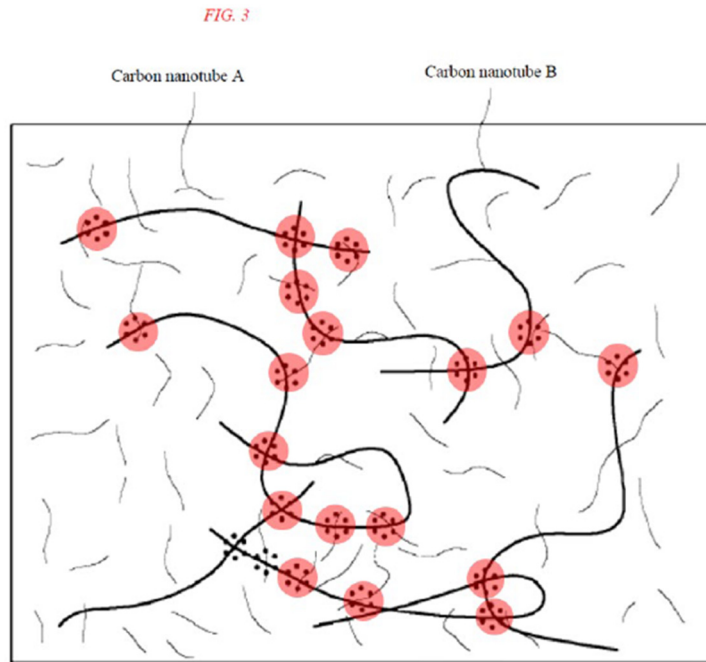
A. The CNTs in Bosnyak-392-Son Are Discrete

Patent Owner’s main arguments against the Bosnyak-392-Son combination stems from its assertion that any CNT that touches another CNT cannot, by definition, be “discrete.” *See* POR 19-32. For reasons discussed above in Section II, such a view is grossly misguided.

Specifically, the Bosnyak-392-Son combinations rely on Bosnyak-392’s “compositions of *exfoliated carbon nanotubes*.” Petition, 13-15; LGES-1003, ¶¶39-42. As noted above, the ’282 Patent explicitly describes that “discrete” carbon nanotubes are “*alternatively termed exfoliated* carbon nanotubes[.]” LGES-1001, 6:50-54. Thus, in the Bosnyak-392-Son combinations where a POSITA would have looked to “apply the specific aspect ratio distribution teachings of Son to ... Bosnyak-392’s nanocomposite material,” the POSITA would have found it obvious that the “exfoliated carbon nanotubes” in Bosnyak-392-Son are discrete. Petition, 12, 15; LGES-1003, ¶¶36-37, 42. Moreover, during deposition, Dr. Chung acknowledged that “fully exfoliated” nanotubes are necessarily “discrete.” LGES-1029, 80:12-22. Bosnyak-392 specifically describes

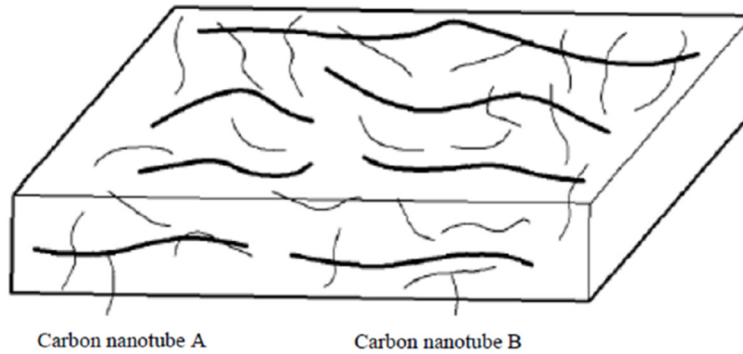
that “[i]n some embodiments, “the carbon nanotubes become *fully exfoliated*[.]” LGES-1005, [0056]. Thus, even by PO’s own admissions, the CNTs in Bosnyak-392—and by extension the CNTs in Bosnyak-392-Son—are discrete.

Continuing with its flawed interpretation of “discrete” as requiring CNTs that cannot touch each other, PO further contends that in Son, only the “smaller aspect ratio CNTs” are “discrete,” while the “larger aspect ratio CNTs” are not. POR, 25. That is, PO argues that the larger aspect CNTs in Son (*i.e.*, Carbon Nanotube A) are not discrete because *every single one of those CNTs* are touching each other. *Id.* PO makes this assumption about millions of CNTs in Son by looking at its FIG. 3. POR, 25. Specifically, by looking at the top-down, two-dimensional depiction of *seven* larger aspect ratio CNTs in FIG. 3 (reproduced below), PO concludes that “FIG. 3 *clearly shows* that each and every one of the larger aspect ratio CNTs in FIG. 1 is purposefully interconnected with another larger CNT.” *Id.*



POR, 23 (showing LGES-1008, FIG. 3 as annotated by PO)

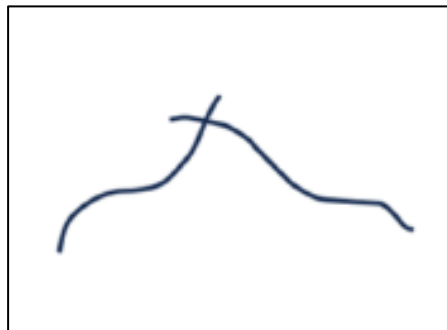
Said another way, instead of relying on the three-dimensional (3-D) depiction of Son's CNTs in FIG. 1 (below) to determine the 3-D orientation and configuration of CNTs (including both smaller and larger aspect ratio nanotubes that are clearly not in contact with any other nanotube), PO argues that the two-dimensional (2-D) depiction is more accurate in showing how the nanotubes interact with one another in 3-D space.



Petition, 9 (showing LGES-1008, FIG. 1)

However, in a two-dimensional projection of a three-dimensional sample, as in Son's FIG. 3, nanotubes that appear to cross in 2-D may, in fact, be present on entirely different planes and thus not in contact at all. MRD-2005, 36:9-37:5.

PO's own expert concedes the commonsense principle that the discreteness of nanotubes cannot be determined from a two-dimensional projection. Indeed, when the following schematic diagram was presented at Dr. Chung's deposition where she was asked whether the two carbon nanotubes as shown are discrete, she responded that "[t]here's a third dimension that's not shown, you know. If you just look at two-dimensional view, it looks like that they are in physical contact. But if one looks at the third dimension as well, they might not be." LGES-1031, 127:16-128:1.



Thus, PO's reliance on FIG. 3 of Son for the notion that every single one of Son's larger aspect ratio CNTs are touching each other is fundamentally flawed. MRD-2005, 36:9-37:5. Rather, while it's conceivable (and perhaps even likely) that some of Son's larger aspect ratio tubes may indeed be touching each other, FIG. 1 clearly shows that there are at least *some* nanotubes that do not touch each other—and thus “discrete” even under PO's strained construction. *Id.*; see *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016) (“[C]ombinations of prior art that sometimes meet the claim elements are sufficient to show obviousness.”); see also *Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1326 (Fed. Cir. 2003) (“[A] prior art product that sometimes, but not always, embodies a claimed method nonetheless teaches that aspect of the invention.”).

B. The CNTs in Bosnyak-392-Son Satisfy the Claimed Concentrations

As thoroughly explained in the Petition, Dr. Gido provided three different conversion approaches, each more mathematically precise and rigorous than the previous, to confirm that Son's broad disclosure of its aspect ratio distribution (given as a weight ratio) covers the claimed aspect ratio distribution in the '282 Patent (given as a number ratio). Petition, 19-20; LGES-1003, ¶¶51-80.

While PO and its expert agree that these types of conversions are technically feasible and further that Dr. Guido's approaches are mathematically correct (LGES-1029, 72:15-20, 75:7-12), PO wrongly contends that "Petitioner tries to sidestep this insurmountable problem in each of its expert's methods by assuming that the diameter of all of the CNTs in Son are *the same*." POR, 34 (emphasis original). PO argues that such an assumption is implausible, particularly because "[c]ommercially available CNTs" are often provided based on an "*average diameter*." *Id.* PO's arguments here are critically flawed for several reasons.

First, the '282 Patent itself makes the same assumptions concerning CNT dimensions that PO criticizes. Petition, 5; LGES-1003, ¶24. For example, FIG. 1 of the '282 Patent, which allegedly "shows discrete carbon nanotubes of this invention," indicates *only the lengths* of the carbon nanotubes. LGES-1001, 6:18-24; Petition, 5; LGES-1003, ¶24. This figure correspond to the related description from the '282 Patent that each of "diameters" or "lengths" (or both) of discrete carbon nanotubes can be varied to create the desired distribution of aspect ratios. LGES-1001, 5:55-67. That is, the '282 Patent specifically recognizes that, for instance, the "diameters" of its nanotubes can be kept constant while their "lengths" are varied—and vice versa—to achieve the desired aspect ratio distribution. Petition, 22-23; LGES-1003, ¶55. It is inappropriate for PO to be entitled to a claim to a result that requires more to achieve than what is taught, and

by extension, PO cannot demand more of the art than what is described by the '282 Patent with respect to the recited distribution of nanotube aspect ratios. *See In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994).

Dr. Chung similarly recognizes this basic concept, explaining that “[f]or a particular CNT diameter,” the “aspect ratios of the CNTs ... can thus be adjusted accordingly to suit the particular function of the composition[.]” MRD-2004, ¶65. That is, Dr. Chung recognizes—like the '282 Patent—that the desired aspect ratio distribution can be obtained by keeping the CNT diameters constant while varying the CNT lengths. *Id.*

Second, PO’s allegation that “Petitioner tries to sidestep this insurmountable problem in each of its expert’s methods by assuming that the diameter of all of the CNTs in Son are *the same*” grossly mischaracterizes and misunderstands Dr. Guido’s careful approach. POR, 34 (emphasis original). Specifically, in his third approach, Dr. Guido provided “a more mathematically rigorous approach to more precisely go from Son’s weight distribution domain to the number distribution domain of the '282 Patent” in a manner that bypasses PO’s unfounded criticism. Petition, 24; LGES-1003, ¶¶58-80.

Specifically, Dr. Guido provided a more rigorous conversion approach in which the nanotube diameters, instead of being assumed to be constant as per the '282 Patent, were taken to have a distribution of diameters characterized by an

average diameter $\langle d \rangle$. *See* Petition, 26-27 (citing LGES-1003, ¶63 (“Also, there will be likely be a distribution of carbon nanotubes diameters, d , in a population of nanotubes ... One way to characterize this carbon nanotube diameter distribution is by its average $\langle d \rangle$.”). Indeed, Dr. Chung acknowledged that when you “buy a sample of carbon nanotubes, it’s not all the same diameter” but rather that “the vendor often gives you the average diameter[.]” Working through Dr. Gido’s math in his declaration at ¶¶62-67, which Dr. Chung acknowledged is correct, it can be seen that nanotube diameters $\langle d \rangle$ ultimately drop out of the conversion calculation and yield the following two formulas for converting conversion of a known number distribution (n/N) into the corresponding weight distribution (m/M), or a known weight distribution into a number distribution:

$$\left(\frac{m}{M}\right) = \left(\frac{n}{N}\right) A \frac{\int_0^\infty n(A) dA}{\int_0^\infty n(A) A dA}$$
$$\left(\frac{n}{N}\right) = \left(\frac{m}{M}\right) \left(\frac{1}{A}\right) \frac{\int_0^\infty m(A) dA}{\int_0^\infty \left(\frac{m(A)}{A}\right) dA}.$$

Petition 27 citing to LGES-1003, ¶¶64-67; *see also* LGES-1003, ¶64 (“The carbon nanotube diameter distribution, as represented by its average, will be seen to cancel out of the calculation.”). Here, it’s worth noting that the conversion in no way assumes all the nanotubes as having the same diameter but rather a distribution of

nanotube diameters based on an average diameter. Petition, 24-28; LGES-1003, ¶¶58-80.

Lastly, Patent Owner's contention that Son's broad disclosure of aspect ratio range is somehow insufficient to show *prima facie* obviousness because "the *structure* associated with the broad range [of Son] is different from the *structure* [] associated with the narrower range [of the '282 Patent]" based on *Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc.*, 655 F. 3d 1291, 1304-07 (Fed. Cir. 2011) is unavailing. POR, 43. Among other things, the facts in *Genetics* involved "68,000 truncated variants of a protein made up of 2,332 amino acids, and the allegedly interfering inventions ***differ in terms of the size of the permitted amino acid deletions, the location of those deletions, and the degree of allowable amino acid substitutions.***" *Genetics*, 655 F.3d at 1306. In contrast to such vast structural differences noted by the court in *Genetics*, the sole difference between Son and the '282 Patent relate to numerical optimization within an overlapping numeric range for a single structural parameter (*i.e.*, aspect ratio), thus making *Genetics* readily distinguishable and not applicable to the present case. Indeed, the adjustment of aspect ratios of CNTs was a well-known and exceedingly common technique with predictable results. See LGES-1003, ¶38; MRD-2004, ¶70 ("[A]spect ratios of the CNTs...can thus be adjusted accordingly[.]"); *In re Aller*, 220 F.2d 454, 456 (C.C.P.A. 1955) ("where the general conditions of a claim are disclosed in the prior

art, it is not inventive to discover the optimum or workable ranges by routine experimentation”).

IV. GROUNDS BASED ON BOSNYAK-129 AND ALBUERNE RENDER OBVIOUS CLAIMS 1-16

As described in the Petition, in the grounds based on the Bosnyak-129-Albuerne combination, Bosnyak-129 discloses most of the claimed features—including “discrete carbon nanotube fibers” (LGES-1006, [0011])—but stops short of expressly disclosing the specific percentage and aspect ratio ranges as claimed. To this end, Albuerne teaches that discrete carbon nanotubes that are obtained by similar processing conditions as in Bosnyak-129 would have had a distribution of aspect ratios that meet the claimed percentage ranges. Petition, 59; LGES-1003, ¶130.

Patent Owner’s main argument against the Bosnyak-129-Albuerne combination’s showing of the claimed aspect ratio distribution of discrete carbon nanotubes seems to be that Albuerne’s bimodal distribution ratio comes from a “single data point” and that such a “blip” is somehow insufficient. POR, 56-57.

However, regardless of whether the relevant disclosure from Albuerne comes from a “blip,” a clump, a blob, or something else, it nevertheless remains that a reference is prior art for all that it discloses: Albuerne discloses the claimed aspect ratio ranges. *See In re Snow*, 471 F.2d 1400, 1403 (Ct. Cust. & Pat. App. 1973) (“All the disclosure in a reference, not just the specific examples, must be

evaluated for what it fairly teaches those of ordinary skill in the art.”); *In re Boe*, 355 F.2d 961, 964 (Ct. Cust. & Pat. App. 1966) (“All of the disclosure in a reference must be evaluated for what they fairly teach one of ordinary skill in the art.”).

Indeed, during deposition, Dr. Chung confirmed that even a single nanotube that falls within the claimed aspect range would be sufficient to satisfy the claim. *See* LGES-1029, 85:9-22 (Dr. Chung acknowledging that just “one [carbon nanotube that] falls in the aspect range of 80 to 140” would be sufficient to cover the claim limitation).

V. CONCLUSION

Patent Owner fails to rebut the invalidity grounds and prior art mappings in the Petition. Accordingly, the Board is requested to find all the Challenged Claims of the '282 patent invalid.

Respectfully submitted,

Date: July 14, 2025

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioners' Reply to Patent Owner's Response totals 3,257, which is less than the 5,600 allowed under 37 CFR § 42.24.

Respectfully submitted,

Date: July 14, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e), the undersigned certifies that on July 14, 2025 a complete and entire copy of the Petitioner's Reply to Patent Owner's Response and Accompanying Exhibits were provided by email to the Patent Owner by serving the correspondence addresses of record as follows:

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