

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LG ENERGY SOLUTION, LTD.,
SAMSUNG ELECTRONICS CO., LTD., and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

MOLECULAR REBAR DESIGN, LLC,
Patent Owner

Case IPR2024-01012¹
U.S. Patent 10,608,282

PATENT OWNER'S SUR-REPLY

¹ Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc., which filed a petition in IPR2025-00358, have been joined as petitioners in this proceeding.

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I. CLAIM CONSTRUCTION

Petitioner argues that PO's proposed construction of "discrete carbon nanotubes" is "flawed" and unduly "narrow," while at the same time alleging "formal construction" is unnecessary. Petitioner Reply, 1-2. (Paper 23, "Reply"). Yet, Petitioner and its expert have already offered their own express construction—"lacking direct association with other nanotubes along substantially the length of the nanotubes." Patent Owner Response (Paper 18, "POR"), 16. Indeed, Dr. Gido unequivocally confirmed that this is his and Petitioner's construction of the term. MRD-2005, 7:16-8:9.

Petitioner and PO are thus in agreement that whether CNTs are attached is relevant to determining whether they are "discrete." The sole claim construction issue remaining is whether "discrete" precludes CNTs from being attached to one another (as proposed by PO) or whether it only prohibits a vague and subjective degree of attachment (as proposed by Petitioner). Not only does the intrinsic and extrinsic evidence overwhelming support PO's construction, it flatly contradicts the construction proffered by Petitioner.

A. Petitioner's Singular Focus on One Sentence from the Specification is Misplaced.

Petitioner argues that the specification teaches "'discrete' carbon nanotubes are 'alternatively termed *exfoliated* carbon nanotubes' and that they can be 'obtained

from as-made bundled carbon nanotubes,” and that this “says nothing about prohibiting discrete carbon nanotubes from being attached to one another.” Reply, 2 (citing LGES-1001,6:50-54). Petitioner’s argument is flawed for several reasons.²

First, the sentence *uses the term “discrete,”* which would be understood by a POSITA to carry the very meaning that Petitioner alleges the sentence “says nothing” about. Petitioner’s argument is thus premised on ignoring the fact that “discrete” itself is used in the sentence.

Second, obtaining separate and distinct CNTs (i.e., “discrete” CNTs) necessarily requires “exfoliating” them—a fact Petitioner does not dispute. POR, 14. Indeed, because exfoliation is a critical part of transforming “as-made bundled carbon nanotubes” into “discrete” CNTs, discrete CNTs are by definition also “exfoliated.” Given this, Petitioner’s reliance on Dr. Chung’s testimony as somehow supporting its claim construction is misplaced. Dr. Chung correctly testified that an exfoliated carbon nanotube “doesn’t imply that the nanotubes are not touching at

² Petitioner implicitly complains that PO did not apply an express construction for discrete in IPR2024-1006, IPR2024-01011, and IPR2025-01013. Reply, n.1. However, no express construction was required in those proceedings because Petitioner and its expert, Dr. Zhu, were applying the term consistent with PO’s express construction here.

all,” because exfoliated nanotubes are not required to be separate and distinct (i.e., “discrete”). LGES-1031, 103:13-25 (quoted by Reply, 3). Stated another way, while all “discrete” CNTs are necessarily “exfoliated,” “exfoliated” CNTs are not necessarily “discrete.”

Third, Petitioner’s flawed logic would be equally applicable to its claim construction position. For instance, the cited sentence also “says nothing about prohibiting discrete carbon nanotubes” from “lacking direct association with other nanotubes along substantially the length of the nanotubes.”

Fourth, Petitioner fails to address any of the portions of the specification that support PO’s claim construction. For example, Petitioner simply ignores the portions of the specification cited and discussed by PO. POR, 13-14 (citing LGES-1001, 4:18-21, 6:50-54, 11:61-12:32).

B. Petitioner Misunderstands the Plain Teachings of the Specification.

Petitioner contends that “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.” Reply, 4. However, Petitioner acknowledges that “CNTs that are not attached to one another can help provide electrical insulation” (*id.*), which is entirely consistent with the specification teaching that a “separator film comprising discrete carbon nanotubes of this

invention can improve ion transport yet still provide the necessary electrical **resistivity**. The degree of electrical conductivity **can be controlled** by the amount of discrete carbon nanotubes within the binder or separator film medium.” LGES-1001, 9:16-21. The patent itself makes clear that it is this control, derived from the characteristics of discrete carbon nanotubes (and their lack of interconnectivity), that the invention is using. And while it is true that “nanotubes coming together and making electrical contact” generates electrical conductivity useful in conductive structures such as binders (Reply, 4 (quoting LGES-1033, 36:18-37:5)), in non-conductive separators the “non-touching” nature of discrete carbon nanotubes increases strength and ionic conductivity while maintaining sufficient electrical **resistivity**. LGES-1001, 9:16-18. Not only were the inventors of the ’282 Patent deeply interested in non-touching nanotubes, their existence, characteristics, and concentration were deliberately sought and utilized.

Petitioner also argues that “discrete” CNTs must be attached to one another, because the specification teaches that increasing the amount of “discrete carbon nanotubes” can help achieve “low electrical resistivity.” Reply, 3 (citing LGES-1001, 9:18-29). This argument is premised entirely on the false notion that electrical conductivity requires physical contact between CNTs.

As Dr. Chung explained, “[i]n order for nanotube A and nanotube B to be in

electrical contact, they have to be ***extremely close*** to one another at the -- at that particular point.... I just mean ***not exactly contacting***, just a tiny bit ... a tiny little microscopic ***gap*** at the point of so called touching.” LGES-1031, 114:19-115:20 (“If the size of that gap is more than ... 10 angstroms, then there’s no electrical contact.”); see also *id.* at 122:24-123:9 (“[W]hen you come to that small [i.e., 10 angstroms] a distance, then there could be electrical interaction between the two....”). Consequently, discrete CNTs may provide electrical conductivity via electron tunneling even if they do not touch one another.

Dr. Chung also explained that CNT-based composites (e.g., CNT-PVDF composites) must be considered as “one unit” because it “is a composite material with the resin as the matrix and the nanotubes as a filler” such that the “electrical conductivity [of the composite] is much increased.” LGES-1033, 38:9-25; *id.*, 37:6-20, 39:2-40:20. In other words, the addition of sufficient amount of CNTs (i.e., highly conductive) to a composite material necessarily reduces resistance (i.e., increases conductivity) even if they are not interconnected.

Despite Dr. Chung’s unequivocal testimony, Petitioner resorts to an out-of-context quotation to portray her as agreeing that “*physical* contact” is required for improved electrical conductivity (i.e., reduced resistivity). Reply, 4 (quoting LGES-1033, 36:18-37:5). But as Petitioner is aware, Dr. Chung explained that the *physical*

term “touching” is sometimes loosely used to describe electrical contact between two points. For example, she explained that even if there is a “little microscopic gap at the point of so-called **touching**,” electrical conductivity would still exist. LGES-1031, 114:19-115:1, 47:4-10 (“That is forming a continuous electrical network because of **the touching** of one nanotube with another nanotube.”); *see also* LGES-1033, 36:24-35:5 (“[Y]ou need to have a plurality of nanotubes coming together and making electrical contact between one another -- that is, **touching** one another....”). She was thus consistent in testifying that conductivity may be increased (i.e., resistance reduced) even in the absence of physical contact.

C. Petitioner’s “Dictionary” Arguments are False and Misleading.

Petitioner argues that the specification mandates reliance on Webster’s Dictionary, 3rd Edition, 2009, which is further alleged to provide a definition that allows for attachment of CNTs. Reply, 3. Not so.

First, Petitioner omits critical context from the cited passage in the specification, which teaches:

While most of the terms used herein will be recognizable to those of ordinary skill in the art, it should be understood, however, that when not explicitly defined, terms should be interpreted as adopting a meaning presently accepted by those of ordinary skill in the art. In cases where the construction of a term **would render it meaningless or essentially meaningless**, the definition should be taken from Webster’s Dictionary, 3rd Edition, 2009.

LGES-1001, 6:39-46. Given that neither party proposes a construction that would render the term discrete “meaningless or essentially meaningless,” Petitioner’s position that claim construction is bounded by this particular dictionary is false.

Second, LGES-1034 *is not even the referenced dictionary*. While LGES-1034 is *a version* of a Webster’s dictionary, nothing in LGES-1034 indicates or suggests that it is the “3rd Edition.” If LGES-1034 was the “3rd Edition,” it would state as much on its cover page, just as LGES-1035 prominently states it is the “Eleventh Edition” and MRD-2008 prominently states that it is the “Fourth Edition.” Petitioner’s representation that LGES-1034 is the referenced dictionary is thus false.

Third, Petitioner argues PO’s construction is undermined by the fact that the words “not attached” do not appear in LGES-1034 and LGES-1035. Reply, 3. Yet, LGES-1035 defines “discrete” as “constituting a *separate* entity” and “consisting of distinct or *unconnected* elements.” LGES-1035, 3. In contrast, none of the definitions relied on by Petitioner support the construction it proposes, which vaguely and subjectively requires “a lack of direct association along a substantial length.”

Finally, the suggestion that PO cherry-picked the New World Dictionary (MRD-2014) is meritless. The Board routinely relies on this dictionary in rendering claim construction decisions. *See e.g., Micron Tech., Inc. v. Lone Star Silicon*

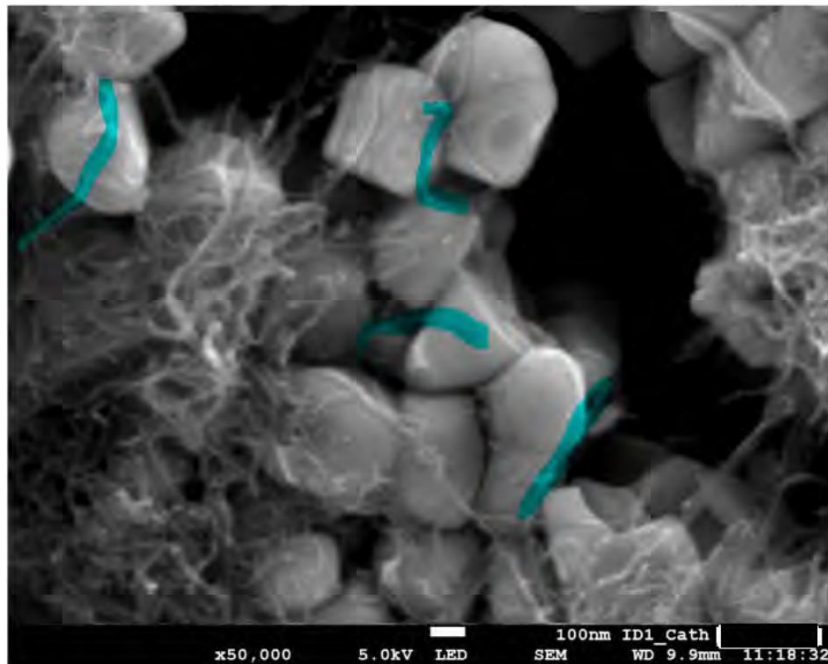
Innovations, LLC, IPR2017-01560, Paper 10 at 12 (PTAB Dec. 15, 2017). In fact, the Board has *sua sponte* relied on this edition of the New World Dictionary in numerous proceedings. See *e.g.*, *Los Angeles County Metropolitan Transport Authority v. Transport Techs., LLC*, IPR2016-01077, Paper 34 at 15 (PTAB Nov. 17, 2017); *Unified Patents Inc. v. Ruby Sands LLC*, IPR2016-00723, Paper 7 at 14 (PTAB Aug. 29, 2016).

D. The Notion that it is “Simply Not Feasible” to Create “Discrete” CNTs is Demonstrably False.

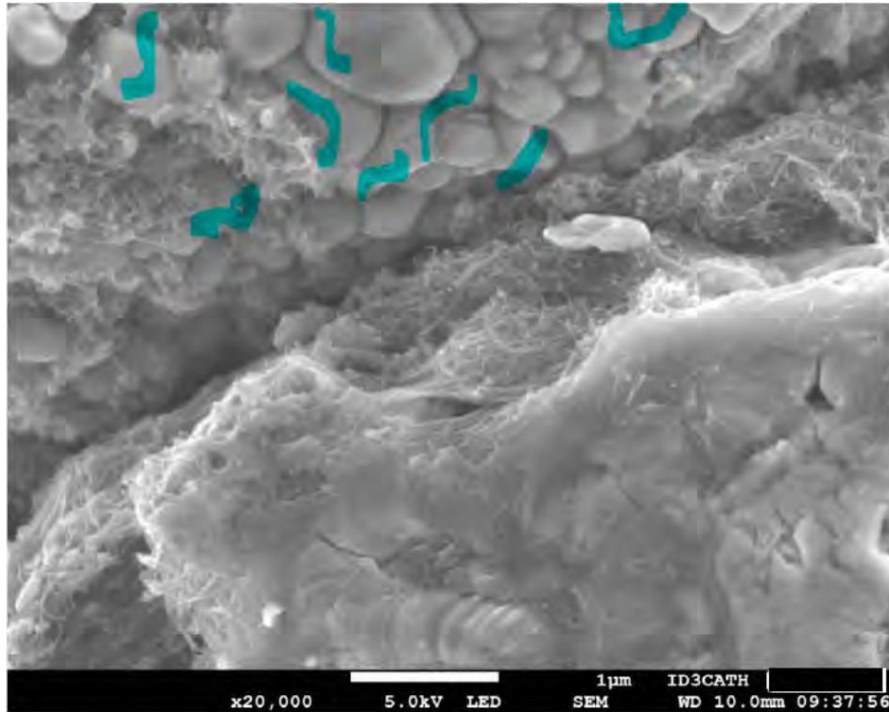
Petitioner states that “*as explained by Dr. Gido*, because of the high aspect ratio of carbon nanotubes, it is simply not feasible to have even a very small concentration of nanotubes without them crossing and contacting one another.” Reply, 4 (citing LGES-1030 ¶¶7-16). In making this conclusory assertion, Petitioner relies on 10 paragraphs of Dr. Gido’s declaration spanning 8 pages, which includes extensive explanation and analysis (including numerous figures) found nowhere in the Petition. LGES-1030 ¶¶7-16. This amounts to improper incorporation-by-reference and cannot fully be responded to by PO given the word-count limitations. See *Cisco Sys., Inc. v. C-Cation Techs.*, IPR2014-00454, Paper 12, 10 (Aug. 29, 2014) (designated precedential)).

In any event, Petitioner’s own accused products completely disprove Dr.

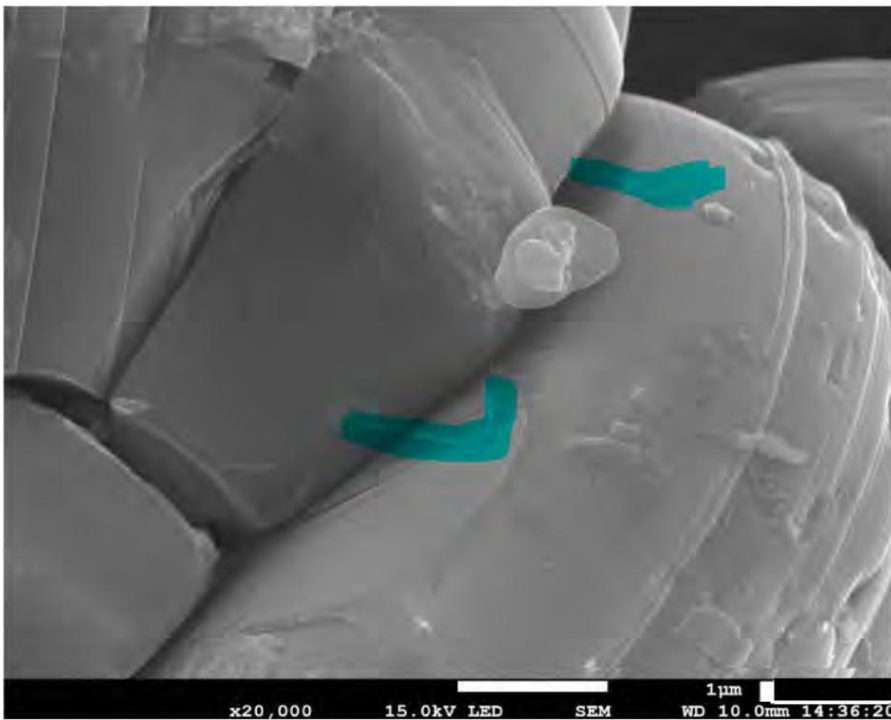
Gido's assertion that it is not possible to have discrete CNTs. As shown below, the accused products comprise countless (blue) CNTs that are not attached to any other CNTs (i.e., "discrete"):



LGES-1027, 36.

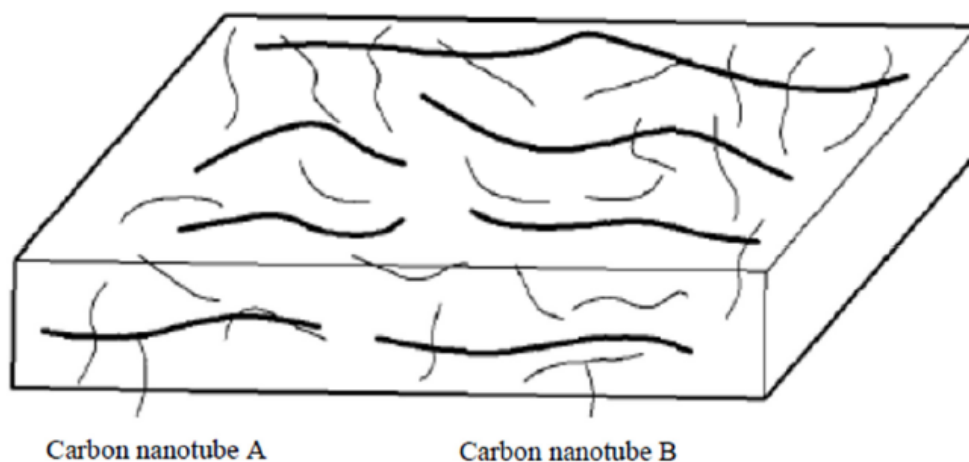


Id., 38.



Id., 39.

Dr. Guido's assertion is also flatly contradicted by other positions that he and Petitioner take in this proceeding. For example, Petitioner and Dr. Guido argue that Figure 1 of Son illustrates "discrete, individually dispersed carbon nanotubes" (Pet. 9-10), which allegedly "may, in fact, be present on entirely different planes and thus not in contact at all." Reply, 11 (citing MRD-2005, 36:9-37:5):



LGES-1008, FIG. 1.

Pet. 9. Thus, on one hand Dr. Guido alleges that achieving "discrete" CNTs as proposed by PO is "simply not possible," while on the other hand contradictorily arguing that the prior art was able to do so.

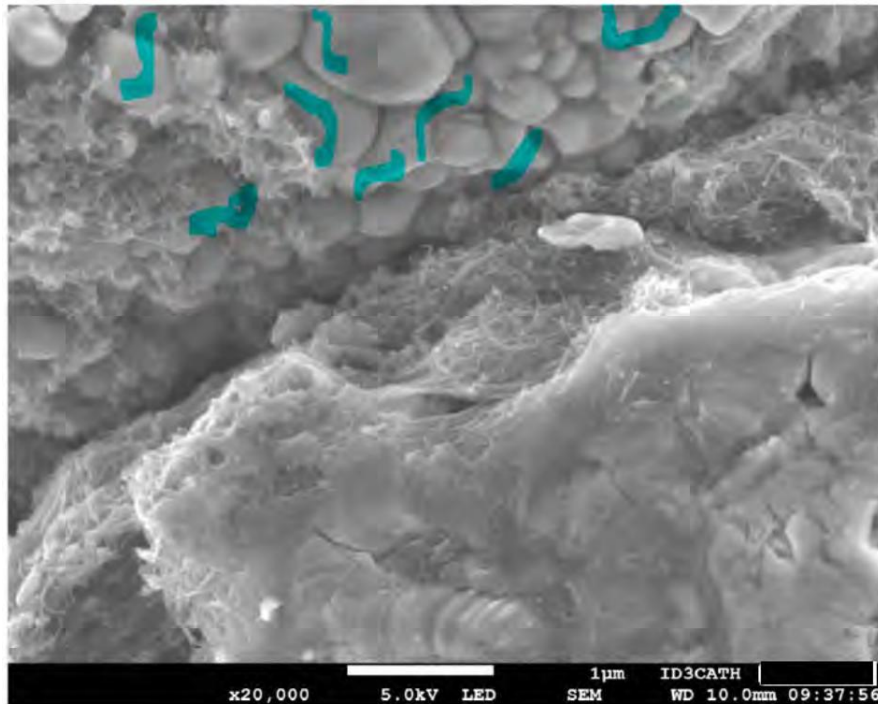
Given how demonstrably false Dr. Guido's position is, it is possible he may have *intended* to argue that it is not possible to create a dispersion that includes *only* discrete CNTs. But while the claims require a dispersion "comprising" discrete CNTs, that does not preclude the dispersion from also including CNTs that are not

discrete. Indeed, Petitioner's accused products includes many CNTs that are discrete and many that are not.

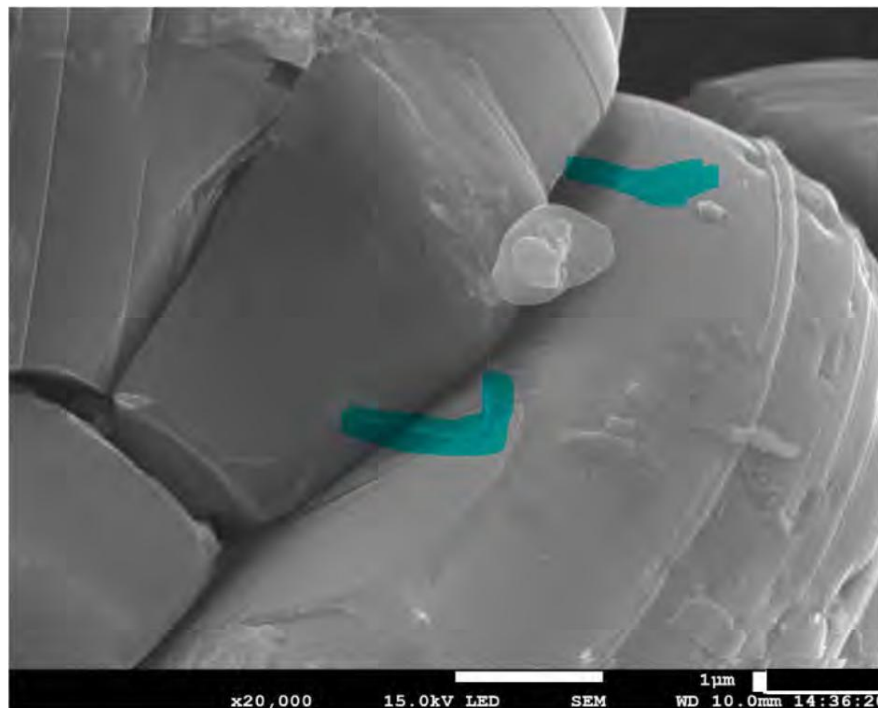
E. Petitioner Mischaracterizes the Infringement Contentions.

The reliance on PO's infringement contentions is misplaced and misleading. Reply, 5-6. As Dr. Chung explained, SEM images are two-dimensional images of *a three-dimensional space*, which means that in lower-magnification SEM images CNTs that *appear* to be attached because they overlap in an SEM are not necessarily attached or even touching. LGES-1031, 127:21-128:12. Counsel for Petitioner acknowledged this fact (*id.*, 128:3-9) and Petitioner relies on this "commonsense principle" (Reply, 11). Despite this, Petitioner disingenuously cherry-picks a couple of lower-level magnification SEM images from the dozens taken so that it can rely on an optical illusion to argue that PO is taking inconsistent positions.

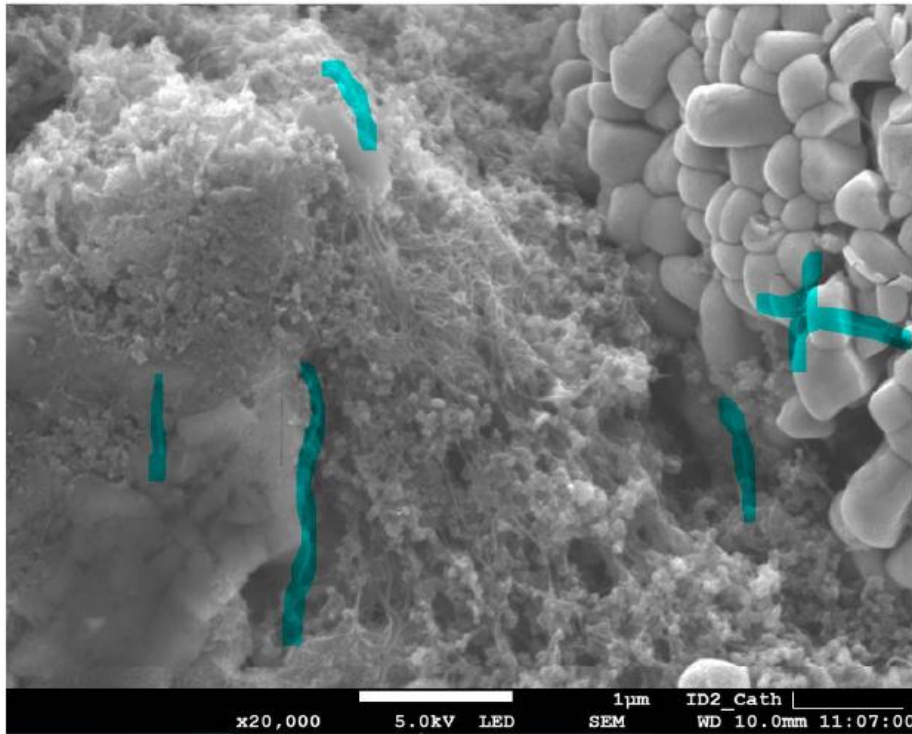
The other SEM images from the contentions show that PO consistently identified "discrete" CNTs (blue) consistent with the plain and ordinary meaning:



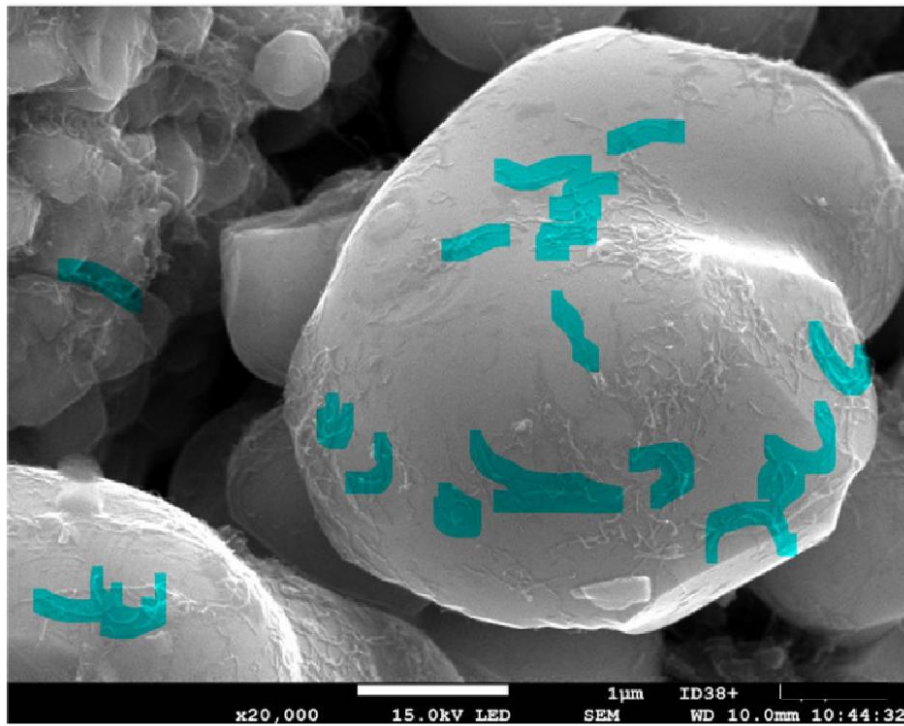
LGES-1027, 38



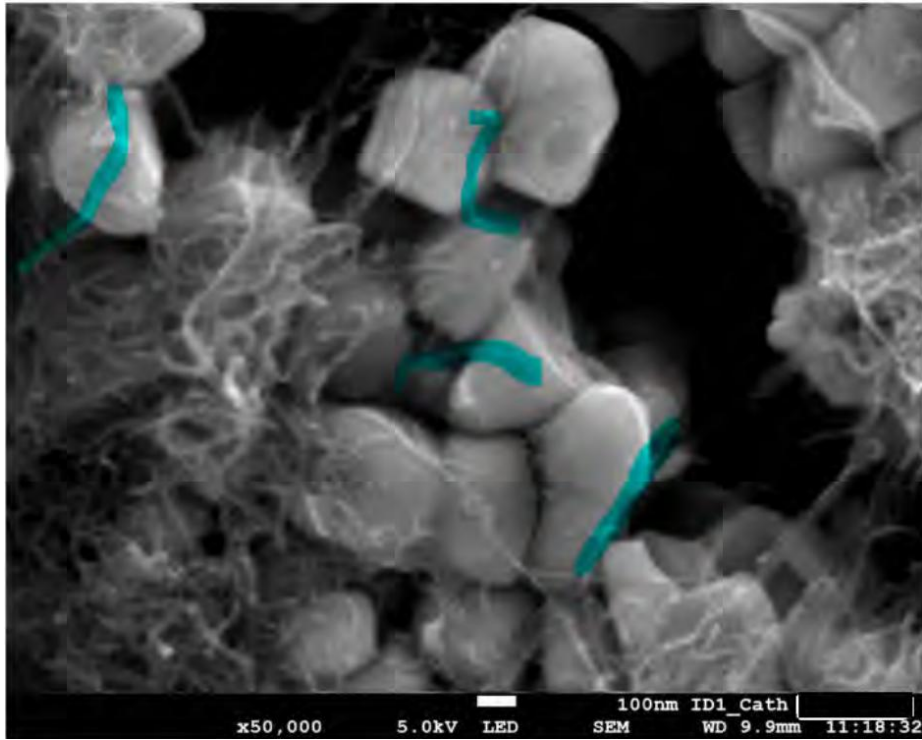
Id., 39.



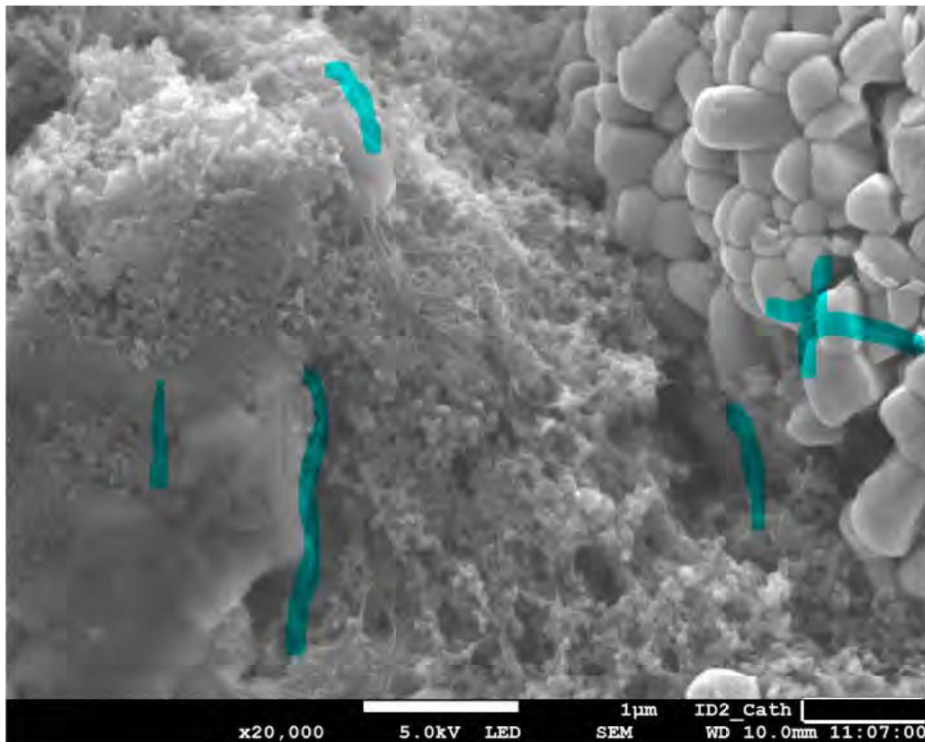
Id., 37.



Id., 42.



Id., 36



Id., 37.

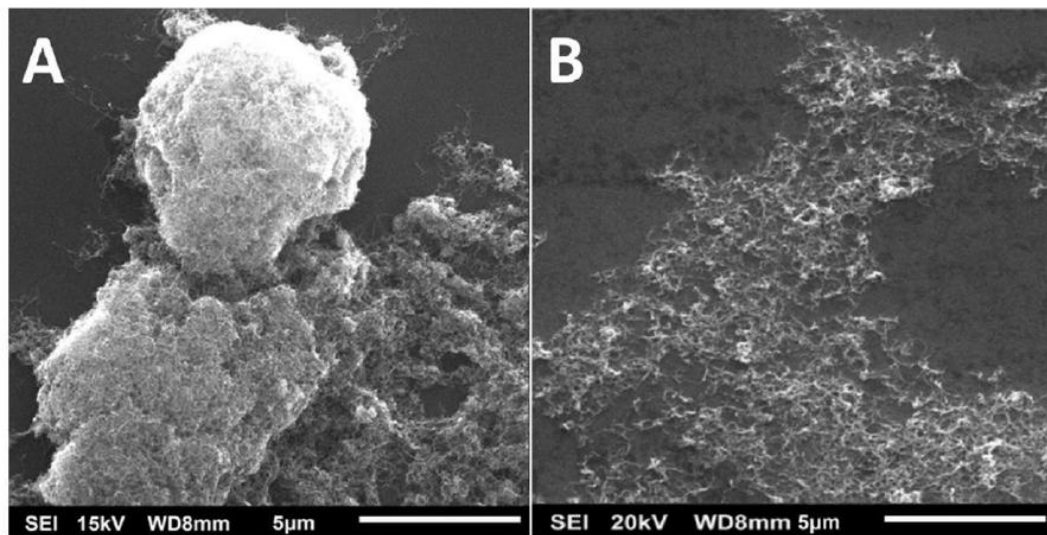
The Board should thus “decline to adopt Petitioner’s conclusory assumptions regarding what it purports to be Patent Owner’s applied construction” based on preliminary infringement contentions that when properly viewed contradict Petitioner’s assumption. *Globus Medical, Inc. v. Spinelogik, Inc.*, IPR2025-00226, Paper 9 at 11 (PTAB July 14, 2025).

F. Petitioner Mischaracterizes Swogger (LGES-1039).³

Petitioner argues that Swogger’s use of term “discrete” in reference to Figure 1B is a “clear indication” that discrete CNTs can “cross and contact one another.” Reply, 5. This argument is even more misleading than those based on the infringement contentions.

Figures 1A and 1B are another pair of lower-magnification SEMs selected by Petitioner, which Petitioner alleges depict “discrete” CNTs that are attached to one another. Petitioner’s presentation of those figures (*with Petitioner’s added text*) is reproduced below:

³ Swogger is not authored by Kurt Swogger, who is one of the two inventors named on the ’282 Patent. A different individual—Steven W. Swogger—is the author of Swogger.



Excerpt from Swogger, Fig. 1A-1B (showing “entangled tubes” at left, “discrete, untangled carbon nanotubes” at right)

Petitioner relies on the same optical illusion used to misrepresent the infringement contentions. Even worse, Petitioner’s presentation of these figures disingenuously omits the actual text underneath Figures 1A and 1B, which is highlighted in blue below:

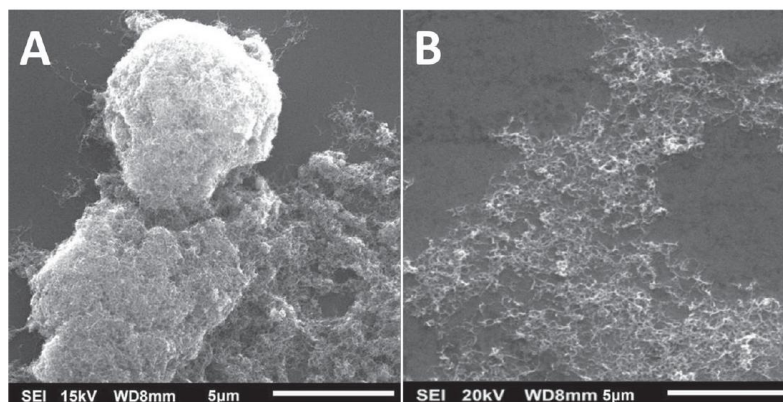
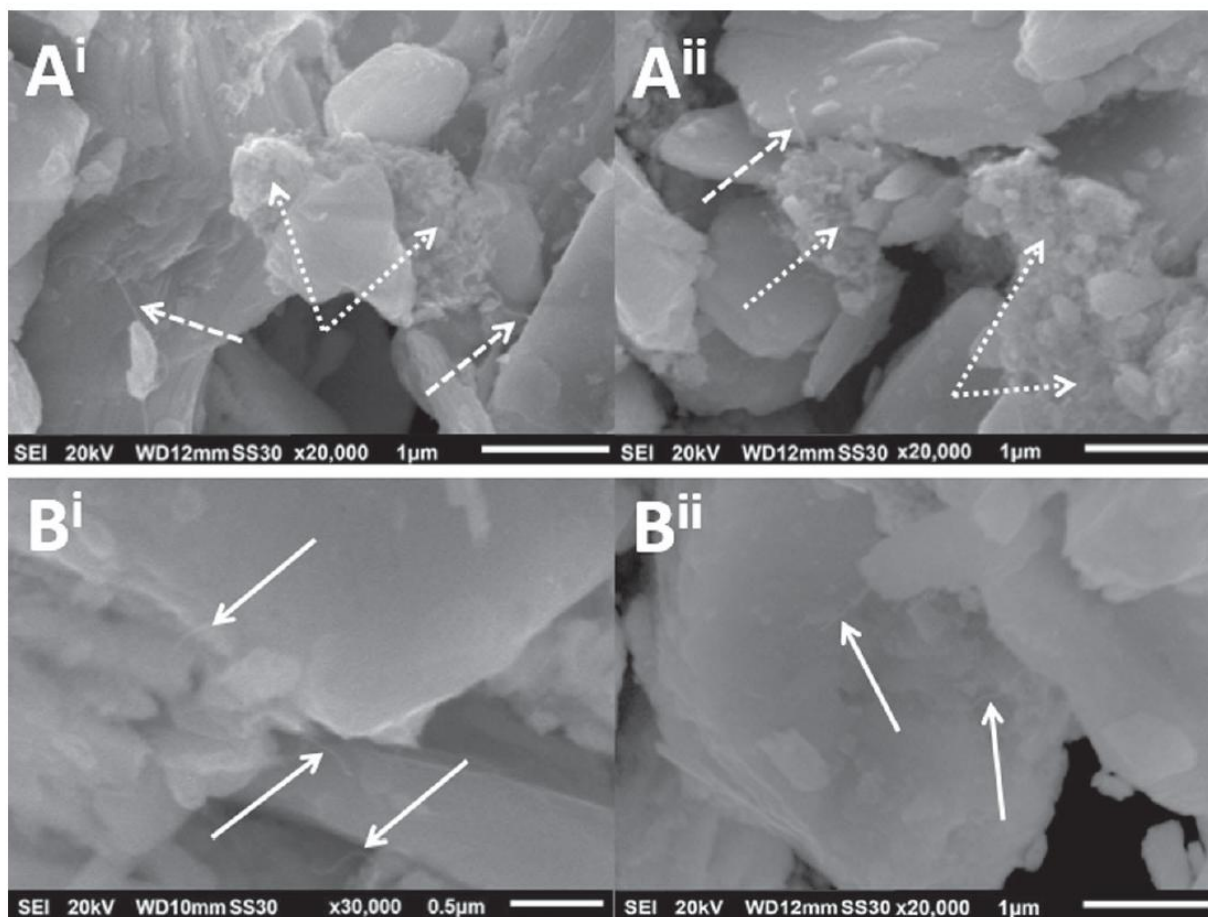


Fig. 1. SEM comparison of stock vs. discrete carbon nanotubes. A, Stock carbon nanotubes appear as bundles of entangled tubes whose aspect ratios (length/width) approach 1. B, dCNT are discrete, untangled carbon nanotubes with aspect ratios approaching 70 (typically 900×13 nm) appearing, here, as a thin mat due to an artifact of sample preparation. Images magnified 5000 $\times$.

LGES-1039, 3. That text plainly states that the “discrete, untangled carbon nanotubes” appear as “a thin mat *due to an artifact of sample preparation.*” *Id.* In other words, the appearance of the CNTs is misleading due to an effect of sample preparation. Indeed, the higher magnification SEM images in Figure 2 of Swogger show “show *discrete* nanotubes (solid arrows)” are those not attached to other CNTs, as opposed to “entangled balls of nanotubes (dotted arrows)”:



LGES-1039, 4. The CNTs identified by the solid arrows are clearly “discrete”

consistent with the plain and ordinary meaning proposed in this proceeding. Swogger thus not only contradicts Petitioner's representations, it fully supports "discrete" CNTs having the plain and ordinary meaning proposed by PO.

G. Dr. Zhu's Testimony in the Other Proceedings is Relevant Evidence as to the Understanding of a POSITA.

Dr. Zhu provided sworn testimony—both in a declaration and deposition—regarding carbon nanotubes pursuant to the same level of ordinary skill in the art applied in this proceeding. *Compare* LGES-1003 ¶19 *with* MRD-2009 ¶11. Despite this, Petitioner attempts to discard his testimony as irrelevant because it fundamentally undermines the ambiguous and subjective construction offered by Petitioner and Dr. Gido in these proceedings.

Petitioner vaguely argues that the "limited context" provided by PO somehow undermines Dr. Zhu's testimony. Petitioner fails to explain what additional "context" is needed, and PO provided ample context to determine that Dr. Zhu very clearly testified that "fully isolated" CNT are "discrete" and only identified fully isolated CNTs as "discrete." POR, 14-16. Dr. Zhu did not identify the CNTs that are depicted as disentangled but still touching, which would qualify as "discrete" under Dr. Gido's vague and subjective construction. *Id.*

Petitioner also does not dispute that Dr. Zhu offered clear, unequivocal testimony in his deposition that CNTs are discrete "because" they are "fully isolated

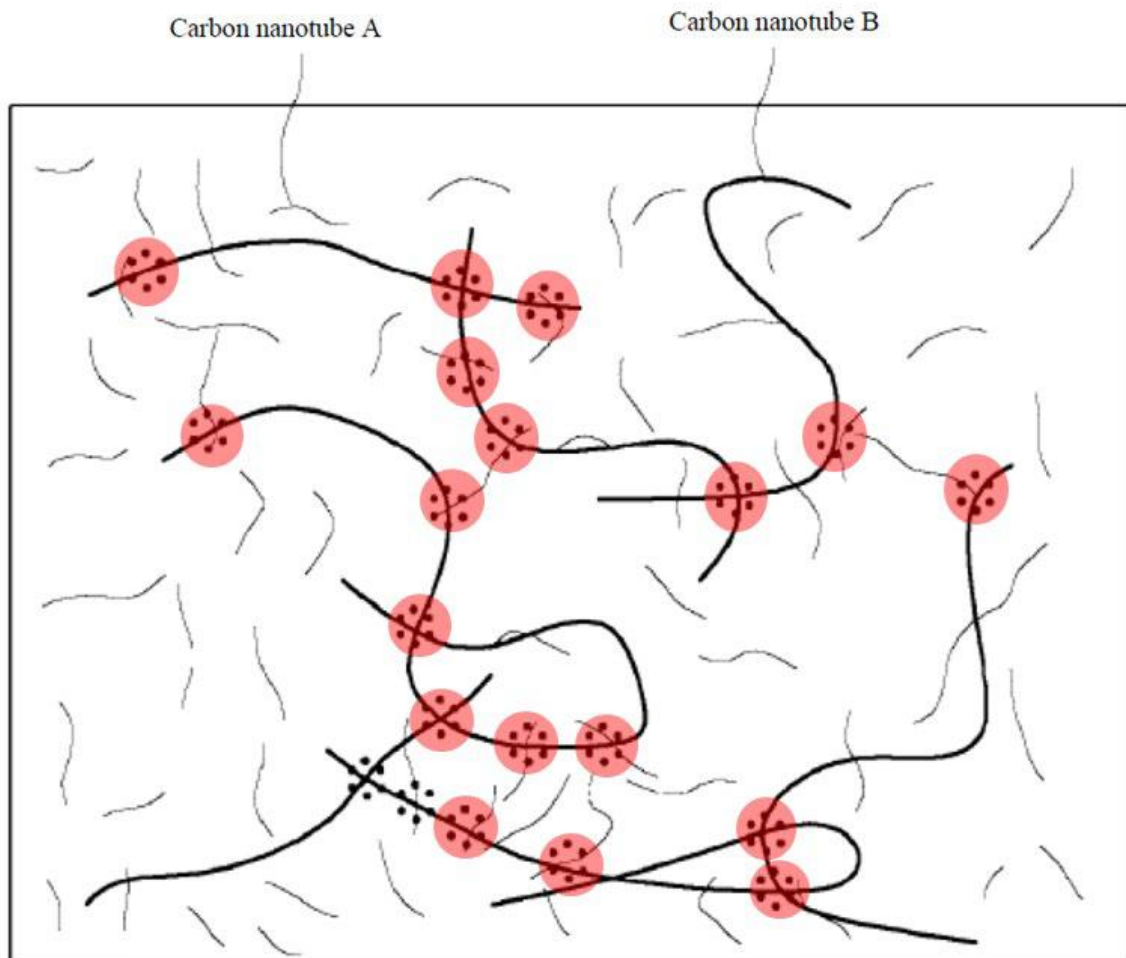
from other nanotubes” and “separate from each other.” *Id.* Petitioner instead tries to rewrite his testimony by alleging he said “fully isolated” CNTs “*can certainly be* discrete,” when in reality he testified that they “*are*” discrete “*because*” they are fully isolated. Reply, 7. Dr. Zhu was not quoted out of context—his testimony was unequivocal. The only reason Petitioner alleges otherwise is because that testimony supports PO’s construction while undermining Petitioner’s vague and subjective proposal.

II. GROUND 1A-1C: THE COMBINATIONS BASED ON BOSNYAK-392 AND SON DO NOT RENDER ANY CLAIM OBVIOUS.

The claims of the ’282 Patent require a bimodal, aspect ratio distribution of discrete CNTs in very specific number percent concentrations. LGES-1001, 14:2-13. Petitioner has relied on Son to provide the teachings of generating discrete carbon nanotubes in a bimodal, aspect ratio distribution having those concentrations. However, Son’s methodology does not claim to generate discrete carbon nanotubes in any aspect ratio range, and explicitly teaches the generation of non-discrete nanotubes in the upper aspect ratio range that Petitioner relies on. Further, it is impossible for Petitioner, its expert, or a POSITA to determine what number percent concentration of CNTs Son teaches. Son simply fails to provide the information necessary to convert its given weight percentages into number percentages.

A. The Combination of Boznyak-392 and Son Does Not Teach or Enable the Generation of a Bimodal Distribution of Discrete CNTs.

All of Son's Figures 1-3 are illustrations. They are not accurate depictions of actual CNTs in Son's embodiments, but are instead illustrative expansions of what Son **says** are present in its embodiments. Son itself makes no mention of discrete CNTs in either of the aspect ratio ranges it describes. And while Son remains silent about the lack of discreteness of the lower aspect ratio ranged CNTs from Figures 1-3, Son is explicit about the lack of discreteness of its upper range of CNTs. "As shown in FIG. 2 . . . the electrical **network** before injection [i.e. what is depicted in Figure 1] can be **maintained**." LGES-1008 ¶[0022]. Moreover, this electrical network is in the form of "electrical contact" between the CNTs of **both** ranges. *Id.* (referencing the dotted portions in Figure 3 below).

FIG. 3

LGES-1008, FIG. 3 (annotated by PO).

Petitioner (Reply, 10-11) attempts to elevate Figure 1 of Son over the express written text of Son, which teaches that the “network” and “contact” is “maintained” throughout the process. The written text is not only consistent with depiction of nanotubes contacting in Figure 3, but also with common sense. While physical contact is not required for there to be electrical connections between CNTs, it would

be impossible to “maintain” the contacts/network throughout the process if they were not physically connected. Indeed, if the larger aspect ratio CNTs were physically separate as Petitioner falsely alleges, then they would spread apart during the process and lose (rather than “maintain”) electrical connectivity.

Ultimately, Figures 1-3 alone cannot be viewed as definitive of what is and what is not actually present in Son’s polymer blocks, and a POSITA would not believe they could be. A POSITA would look to what Son itself **says**, and conclude that whatever else the illustration may appear to have, the author (the one who **drew** them) intended for the larger aspect ratio CNTs to be interconnected, providing a robust electrically conductive network throughout the composition.

But even if one was to assume that a POSITA would look at Son’s teachings and conclude “well there must be **at least some** discrete CNTs within the upper aspect ratio range,” how many would that be? What fraction of the CNTs are interconnected (as Son clearly intends them to be) and how many are not? As argued below (*Infra* II.B), Petitioner is already incapable of determining what number percentage of CNTs exist in any given aspect ratio range of Son, so how would a POSITA further refine that to determine what percentage fall into the presumed “at least some?” Vaguely alleging that “at least some” may be discrete is certainly insufficient to demonstrate by a preponderance of the evidence that “from 1% to

30%” are discrete.

It is Petitioner who must show what Son does and does not teach to carry its burden of proof. And it is Petitioner who has relied on Son for teaching an “aspect ratio distribution [that] covers the claimed aspect ratio distribution.” Pet. 20. The claimed distributions, however, have very specific aspect ratio ranges and number percentage concentrations of discrete carbon nanotube fibers. LGES-1001, 14:2-13. Son’s CNTs are interconnected by design, and even if one could argue that some percentage of Son’s CNTs would not be, there is no way of knowing what percentage or how that effects Petitioner’s already suspect conversion calculations.

B. Bosnyak-392 and Son Do Not Teach Discrete CNTs in the Claimed Concentrations.

The types of conversions (weight percentages to number percentages) Petitioner and Dr. Guido seek to make are simply not possible without specific CNT-parameter-data that Son does not provide. POR, 33-34 (citing MRD-2004 ¶¶94-95).

1. Petitioner cannot defend the assumptions it must make to justify its conversions.

Petitioner attempts to defend its conversions by deflecting—incorrectly accusing the ’282 Patent of “mak[ing] the same assumptions concerning CNT dimensions.” Reply, 13. In the ’282 Patent, Figure 1 is a graph described as depicting “carbon nanotubes of this invention with a bimodal **length** distribution.” LGES-

1001 6:18-19. This is a perfectly accurate description with no assumptions involved. And while Petitioner is correct that the '282 Patent expressly recognizes that aspect ratios can be varied by holding either the diameters or lengths constant while varying the other (Reply, 13 (citing LGES-1001 5:55-67)), this is a fact that neither Petitioner nor PO disagree with—and one that involves no assumptions at all. The assumptions made by Petitioner and its expert are that either: 1) Son used a CNT set that just happened to naturally contain a uniformity of diameter permitting Petitioner's conversion; or 2) Son went through the process of intentionally holding the diameters constant without mentioning or needing it. These are not assumptions that the '282 Patent makes, or that is any way reasonable for a POSITA to make. POR, 33-34; MRD-2004 ¶¶94-97.

PO is not demanding that the prior art teach more than the '282 Patent. Reply, 13-14. The point is that the '282 Patent and Son describe **different results**. The '282 Patent **expressly calls for number percentages of CNTs**. LGES-1001 14:9-13. Son does not. What is inappropriate is Petitioner's attempt to convert Son's results into the '282 Patent's results by making scientifically unsupportable assumptions. Again, no one disputes that a “desired aspect ratio distribution can be obtained by keeping the CNT diameters constant while varying the CNT lengths.” Reply, 14. But **Son never says that is what he did**, and no POSITA would reasonably just assume Son

had done so when such a laborious process is so highly impracticable, and unnecessary for Son's embodiments. POR 36-37; MRD-2004 ¶¶99.

Keeping the diameter constant from the beginning and varying the length (to control aspect ratio) is *technically* possible. But it takes extraordinary effort, and is decidedly **not** what would appear naturally. *Id.*, 34-35; MRD-2004 ¶¶96. Son never says it took this extreme step, and, further, had absolutely no reason to do so. Petitioner is retroactively trying to impose this unnatural, unnecessary restriction on the diameters of Son's nanotubes to try and make its math (Petitioner's math, not Son's) work.

2. Petitioner's conversions rely on inappropriate assumptions.

Petitioner's first methodology, a direct 1:1 conversion of weight percentage to number percentage, requires the unsupportable assumption that all of the CNTs in the sample have the same weight. POR, 39-41 (citing MRD-2004 ¶¶107-110). Because a POSITA knows that the aspect ratios **have to change** (it is an aspect ratio **distribution** after all), a POSITA knows this would require the CNTs to naturally occur in a miraculous set that carefully balances diameters and lengths to maintain a constant mass across all CNTs. *Id.* This is improbable.

Petitioner's second methodology expressly states that they assume "an essentially constant average tube diameter." Pet. 23. This is also improbable. POR,

41 (citing MRD-2004 ¶111).

In Petitioner’s third methodology, Dr. Gido expressly admits that he “assume[s] that the distribution of carbon nanotube diameters is similar across the range of aspect ratios (range of lengths),” because then, and only then, can Petitioner get away with dropping the “distribution” out of the equations. LGES-1003 ¶53. This is a continuation of the **same assumption**—assuming Son has used a CNT set with a highly specific, and highly improbable, distribution of characteristics.

Without making these improbable assumptions, Petitioner simply cannot carry its burden of demonstrating that Son teaches the specific CNT concentrations in the required aspect ratio ranges.

C. Bosnyak-392 and Son Do Not Teach Discrete CNTs in the Specific Claimed Range.

Petitioner contends that the *Genetics* logic (*Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc.*, 655 F. 3d 1291, 1304-07 (Fed. Cir. 2011)) should not apply because the “differences” amongst the CNTs within the range in question involve a “single structural parameter.” Reply, 16. First, aspect ratio (a CNT’s length divided by its diameter) involves three parameters (length, diameter, and the specific ratio between them) not one. Second, these are hugely important parameters governing CNT structure and behavior. POR, 45 (citing MRD-2004 ¶116).

In its Response, PO laid out detailed evidence of the structural and behavioral

differences amongst CNTs as they vary in aspect ratio. POR, 44-49 (citing MRD-2004 ¶¶116-124. Moreover, “[i]f the diameters and the lengths of the CNTs vary unknowably throughout the range of aspect ratios, as they almost certainly do in Son, the differences resulting from disparate lengths remain, such that they are scattered unpredictably across the entire range, making it even more difficult to account for their effects.” POR, 46 (citing MRD-2004 ¶117).

The upper range of the claims and the upper range of Son barely overlap—the claims recite 80-140 while Son teaches 130-10,000. Further Son’s upper range is essentially unbounded, capturing every possible combination of diameter and length resulting in an aspect ratio above 130. POR, 42-43. The immense variance in structure and behavior that CNTs exhibit through the unbounded upper range of Son is precisely the kind of variance-encompassing broad range the *Genetics* court determined insufficient to show obviousness, because it does not provide the ordinary motivation to optimize. *Genetics*, 655 F.3d at 1306-07.

III. Grounds 2A-2B: The Combinations Based on Bosnyak-129 Fail to Disclose the Aspect Ratio Distribution and Concentrations Required by the Claims.

Petitioner mistakenly contends that PO’s argument is that a bimodal distribution composed of, in part, “a single data point” is “somehow insufficient.” Reply, 17. This is not PO’s argument. The argument is that Petitioner is mistaken in

its insistence that “Albuerne discloses the claimed aspect ratio ranges” at all. POR, 50. The graph relied on by Petitioner does not show a bimodal aspect ratio within a given sample of Albuerne. Albuerne itself makes no claim or insinuation that it does, and no POSITA would believe it teaches one. *Id.* (citing MRD-2004 ¶126).

Petitioner’s reliance on the testimony of Dr. Chung is illustrative of why this is true. Reply, 18 (citing LGES-1029, 85:9-22). One cannot make a determination of an individually measured CNT’s contribution to a distribution without some basis for knowing what percentage of the total CNTs the measured CNT represents. In the hypothetical posed to Dr. Chung, this was made perfectly clear—“one [carbon nanotube] falls in the aspect range of 80 to 140,” from a very specific “hypothetical universe of . . . **ten** carbon nanotubes.” LGES-1029, 85:9-11. Thus, an unambiguous declaration that one, and only one in that sample of ten—i.e. 10%. This is fundamentally different from what is depicted in Figure 5(b) of Albuerne.

Petitioner insists that “Albuerne teaches that discrete carbon nanotubes that were obtained by similar processing conditions would have had a distribution of aspect ratios that meet the claimed percentage ranges.” Pet. 59. This is simply untrue. Albuerne never makes such a claim, and a POSITA would never read Figure 5(b) as implying that it does. MRD-2004 ¶¶134-137. The CNTs measured and displayed in the graph of Figure 5(b) are 100 CNTs out of the many billions of CNTs contained

in Albuerne's sample. **One** CNT was measured with the length 2000 nm, and Petitioner extrapolates this to contend that this provides some meaningful understanding of the aspect ratio ranges found in the *sample as a whole*. *Id.* ¶131 (citing Pet. 59). It does not. *Id.*, ¶133. That extrapolation is hyper-technical nonsense that no POSITA would reasonably make.

Figure 5(b) simply does not teach that carbon nanotubes obtained by Albuerne's processing conditions result in a distribution of aspect ratios in a sample that meets the '282 Patent's claimed percentage ranges. All Figure 5(b) shows is that when 100 CNTs were pulled from one sample of *many billions*, on that day, during that experiment, one of those 100 was approximately 200 nm long.

Dated: August 25, 2025

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

The undersigned certifies that this document complies with the type-volume limitations set forth in 37 C.F.R. § 42.24 *et seq.* This document, excluding those portions excluded under § 42.24(a)(1), contains 4,682 words as calculated by the program used in creating it.

/James A. Glenn/
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e)(4), the undersigned certifies that on August 25, 2025, the foregoing document was served via electronic mail on the following attorneys of record at the indicated e-mail address, which Petitioner has consented to electronic service for:

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