

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.,
Petitioners

v.

MOLECULAR REBAR DESIGN, LLC,
Patent Owner

Case IPR2024-01006¹

U.S. Patent 8,808,909

PATENT OWNER'S RESPONSE TO REQUEST FOR REHEARING²

¹ Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. were joined as parties to this proceeding via a Motion for Joinder in IPR2025-00356.

² This filing was authorized by the Board. Paper 43.

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I. OHATA-KAVAN

LG failed to account for Ohata-Kavan's unique process, which embeds its CNT-network in PVDF to create a *conductive* binder ("masterbatch") that prevents the claimed "attachment." POR, 20-44; FWD, 19-26. This was established by "compelling objective proof" and Dr. Chung's "well-reasoned and well-supported testimony." FWD, 19, 20 n.11, 23. Unable to counter this, LG's Reply advanced the *new* contrived theory that CNTs cannot be coated because "physical contact" is required between CNTs/active material. Reply, 5-10. PO's Sur-Reply ("SR") disproved this too with *objective* proof, showing Ohata-Kavan's binder achieves conductivity with active material via the percolation threshold and electron tunneling. SR, 14-22; FWD, 21-23. This was not an "eleventh-hour, attorney-driven pivot" but a response to LG's new theory. The Board did not overlook or misapprehend anything by crediting PO's evidence-driven positions over LG's unproven theory. Recognizing this, LG misstates the law, quotes out-of-context, mischaracterizes prior arguments, and ignores evidence.

A. The Board Did Not Misapply the Law

LG argues that the Board erroneously required it to prove that Ohata-Kavan "necessarily achieves" the claimed "attachment," alleging it only needs to show motivation to combine and reasonable expectation of success. Rehearing Request ("RR"), 2. This misstates the law. Even if there were motivation and a reasonable

expectation of success, Ohata-Kavan must satisfy *all* claim limitations. “[T]he obviousness inquiry centers on whether ‘the claimed invention *as a whole*’ would have been obvious,” not *part* of the invention. *Rambus Inc. v. Rea*, 731 F.3d 1248, 1257 (Fed. Cir. 2013). Thus, LG’s failure to show “attachment” was fatal. FWD, 20.

B. NMP Would Not Remove the CNT’s PVDF-Coating

PO proved that Ohata-Kavan’s goal is to create a conductive glue-like binder (“masterbatch”) by embedding its network of CNTs within the PVDF and then dispersing the binder as globules with a “dispersion medium” (NMP). POR, 20-27. PO further proved that mixing at the proportions of Ohata-Kavan would fully coat the CNTs with PVDF, which more strongly bonds to oxidized CNTs. *Id.*, 28-35. This was supported by objective proof describing and depicting this coating. *Id.* (citing MRD-2006 to 2018; MRD-2028; LGES-1014). PO also proved that Ohata-Kavan’s next step—blending the masterbatch with a “dispersion medium” (NMP) and active material—would not remove the molecular layer of PVDF coating, but instead disperses the binder as globules throughout the composition to act as “glue.” *Id.*, 36-44; SR, 19-24 (disproving LG’s NMP theory). Objective evidence showed this, including Dr. Chung and numerous SEMs *visually* depicting such coatings. POR, 36-44 (citing MRD-2006; MRD-2014 to 2018; MRD-2020; MRD-2024). Notably, LG *never addressed* MRD-2020. FWD, 23 (citing Dr. Chung’s discussion of MRD-2020 (MRD-2006 ¶¶125-126)). Thus, the Board properly credited Dr.

Chung's testimony that it is "scientifically impossible" for the claimed attachment to occur. *Id.* Given this overwhelming proof, LG resorts to misleading arguments.

First, LG contends the Board misunderstood it to argue that Ohata-Kavan's CNTs become available for attachment "during the earlier masterbatch step" (before NMP is added). RR, 4. But LG ignores *pages of detailed analysis rejecting LG's argument* that NMP "expose[s] the surfaces of the" CNTs during blending. FWD, 22-25. LG also argues the Board misrelied on Ohata's Figure 1 to support that the CNTs are "plainly" embedded in PVDF. RR, 4-5. Yet, Ohata itself expressly *states* the depicted CNTs are *blended in "resin"* (LGES-1004 ¶¶[0013], [0016]), objective references show that they would "plainly" be embedded in resin (POR, 30-34), and LG admits Fig. 1(b) shows CNTs and "a resin." Pet., 18. Thus, LG's discussion of "circles" in Figure 1 is a ploy to persuade the Board it erred.

Second, PO showed that Ohata-Kavan's masterbatch process *always* fully coats the CNTs (POR, 29-44), not merely in "*certain circumstances.*" (RR, 10).

Third, Ohata's statement that "the masterbatch was easily dissolved in [NMP]" does not mean it is "*fully* dissolved." RR, 4, 11. PO demonstrated with evidence, credited by the Board, that Ohata describes NMP as a "*dispersion* medium" and that the statement refers to dissolving PVDF-domains *to disperse them as globules*. SR, 19 (citing POR, 36-44; MRD-2006 ¶¶118-126); FWD, 24-25.

Fourth, LG cites Dr. Zhu's testimony about Ohata seeking to "form an

excellent conductive path in an electrode” and that such “path could not occur if the CNTs” are embedded in “*nonconductive* PVDF binder” and not “able to contact the *active material particles*.” RR, 10. First, Ohata-Kavan’s binder *is conductive*. Second, Ohata never suggests the “excellent conductive path” relates to physical contact with *active material*. Ohata teaches “unraveling” CNTs to improve the “conductive path” in the *binder*, not physically contact active material. POR, 20-23 (citing MRD-2006 ¶¶74-84), 30-31 (citing MRD-2010). This renders the binder conductive, eliminating the need for physical contact. *Id.* 21-23; SR, 14-16.

Fifth, LG contends that PVDF is “fully dissolvable in NMP,” Ohata’s PVDF concentration was “within the known range for full PVDF dissolution,” and “solvent capable of dissolving [] PVDF ... *can* ... remove it from the CNT surface.” RR, 10-11. However, these assertions by LG and Dr. Zhu are unsubstantiated and rely on Ohata and other references that merely teach that PVDF is *soluble* by NMP—not that NMP “fully” dissolves PVDF at the Ohata-Kavan proportions. SR, 20-22 (explaining Dr. Zhu’s evidence provides no support for his opinions); FWD, 23-26. Dr. Zhu himself acknowledges that PVDF remains “inside the mixture” even after mixing with NMP. MRD-2024, 41:5-25. LG cites to Zhu’s declaration ¶¶14-20, but it was improperly incorporated-by-reference and shown to be unsubstantiated. SR, 20-22. Contrary to LG’s assertion that PO “offers no evidence,” objective proof demonstrates that CNTs remain coated with a molecular layer of PVDF *even after*

mixing with NMP. POR, 36-44; SR, 19-24. LG also never explains how the binder can serve its binding function if the PVDF is *fully* dissolved. SR, 21.

C. The “Physical Contact” Theory Was Contrived

LG declares that the FWD turns on a “technical impossibility” and that it is “common sense” that “physical contact” between the CNTs/active material is required. RR, 1, 3. PO disproved this contrived theory with objective evidence and testimony proving the “masterbatch” binder is rendered electrically conductive due to the presence of billions of CNTs via the percolation threshold and electron tunneling. SR, 15-16. The Board appropriately rejected LG’s theory. FWD, 19-23. LG’s attempt to undo this is premised on mischaracterizations.

First, LG misleadingly quotes PO’s statement about “gaps.” RR, 1. PO never argued that “gaps” between *the CNTs and active material* was “contrary to Ohata’s express goal.” *Id.* PO was referring to gaps in the *electrically conductive network of CNTs*. Ohata’s goal is to create a *conductive* binder comprising a well-dispersed *electrically conductive CNT network*, which involves “unraveling” the CNTs to disperse the CNT-network apart like unraveling a “wound spiderweb.” POR, 11 (showing “highly entangled” raw CNTs), 56 (citing MRD-2006 ¶153); FWD, 21. Ohata “*wants* the CNTs to be interconnected to form a continuous network” to render its *binder* conductive. RR, 5. It is because the *binder itself becomes conductive* that “physical contact” between CNTs/active material is not needed. SR, 15-16.

Second, contrary to LG’s assertion (RR, 6-7), PO did not rely on Liu-009 as evidence that conductivity is achieved without physical contact. SR, 23. PO also disproved LG’s argument that Liu-009 itself “makes clear” that its conductivity improvements come from *physical* “contact” between the active material and carbon black. *Id.*, 23-24. PO further demonstrated that Liu-009 actually undermines LG’s “physical contact” theory. *Id.* Moreover, Liu-009 “uses *significantly smaller* ratios of PVDF:conductive-filler” than Ohata-Kavan, so even if it did rely on physical contact, this does not evidence that the same occurs in Ohata-Kavan. *Id.*

Third, LG’s reliance on Dr. Chung’s testimony (LGES-1054, 17:1-18:16) is highly misleading. RR, 7. She was questioned about a hypothetical *without conductive binder* (i.e., pure polymer)—not Ohata-Kavan’s *electrically conductive binder* (i.e., PVDF-CNTs). LGES-1054, 10:2-18:16. She consistently testified that the Ohata-Kavan’s *CNT-PVDF binder* would be conductive and that there is no physical contact due to the PVDF coating. SR, 15-17 (citing LGES-1055, 114:19-115:20, 122:24-123:9; LGES-1054, 37:6-20, 38:9-40:20). Objective evidence proves the binder exhibits “metal-like behavior” due to the embedded CNTs. *Id.*

Fourth, Dr. Zhu’s testimony that physical contact is required (LGES-1056 ¶ 10), and LG’s arguments based on MRD-2017 and other exhibits, improperly conflates “electrical” contact and conductivity (e.g., “electrical bridges”) with *physical* contact. SR, 17-19, 22-23; FWD, 22-23. Additionally, *none* of those

references rely on the uniquely high PVDF:conductive-agent ratios of Ohata-Kavan. Recognizing this, LG argues that because Kavan and the '483 Patent achieve electrical conductivity through “physical contact between the ... nanotubes and an electrode active material,” Ohata-Kavan must work the same way. RR, 8 (quoting FWD, 21). However, as the Board recognized, Kavan and the '483 Patent are fundamentally different than Ohata—they mix **“naked”** CNTs with active material to attach CNTs to the active material surface, whereas Ohata **first** embeds CNTs in PVDF to make its binder conductive, which **eliminates the need for physical contact between CNTs/active material and prevents such contact**. POR, 26-27.

Fifth, LG argues that “electron tunneling” has “no practical relevance” and is a product of “attorney argument.” RR, 8. Yet both experts testified that electrical conductivity occurs across small gaps. MRD-2043, 14:8-16; LGES-1055, 114:19-115:20, 122:24-123:9. And objective references prove that electron tunneling occurs between CNTs embedded in PVDF—like Ohata’s PVDF-CNT masterbatch. SR, 14-15 (discussing MRD-2010, 12 (explaining that electrons “can **easily** travel from one tube to another tube without any obstacle (**through tunneling**)” when “CNTs are touching each other **or very close**”); MRD-2012, 5). Dr. Zhu’s unsubstantiated and unexplained statements (MRD-2044, 12:23-14:3) on redirect that “**I don’t think**” tunneling plays a role or is “important” cannot rebut this clear evidence.

Sixth, LG misrepresents that Dr. Chung testified that conductivity via

tunneling would be “lousy” and “far from reality.” RR, 8. She *actually* testified that the conductivity is “lousy” at *greater distances (10 $\geq$ angstroms)* but that the smaller the gap “*the better ... the electrical contact quality.*” LGES-1055, 125:14-126:4. Also, the “far from reality” quote was not about conductivity, but the magnification capability of microscopy. *Id.*, 126:5-18. Indeed, she unequivocally testified that conductivity occurs across sufficiently small gaps between CNTs. SR, 15 (citing LGES-1055, 114:19-115:20, 122:24-123:9). Thus, nothing substantiates the meritless assertion that tunneling does not occur. FWD, 22-24.

Seventh, LG falsely asserts that “no record evidence supports a conclusion that a POSITA would have applied the theory of ‘percolation’” (RR, 9), despite *numerous objective references* showing that the percolation threshold is reached “by very small amounts of CNT in PVDF” (<3-5% CNT, *i.e.*, even less than Ohata’s *minimum* 5% CNT) at which point the binder exhibits “metal-like behavior.” SR, 15-16 (discussing MRD-2018; MRD-2014; MRD-2011; MRD-2012; MRD-2019). LG not only ignores this evidence, but *both experts* acknowledge the percolation threshold—Dr. Chung testified that Ohata-Kavan’s binder provides conductivity via this principle. LGES-1054, 38:9-25, 37:6-20, 39:2-40:20. Indeed, Liu-009 teaches a “*conductive* glue” created by mixing PVDF/carbon black, similar to how Ohata-Kavan creates “*conductive* glue” but with CNTs/PVDF. POR, 22-23.

Eighth, LG’s single-paragraph assertion that the percolation threshold is

inapplicable is unsubstantiated. RR, 9. First, even Dr. Zhu did not support this. MRD-2044, 8:15-9:18. Second, LG ignores that the CNTs embedded in the masterbatch would be *interconnected*. POR, 55-58 (citing MRD-2006 ¶¶151-55 (explaining disentangling CNTs is like spreading apart a spider web)). Both parties agree Ohata seeks an improved “network of *interconnected* [CNTs]” (FWD, 21) not that the CNTs are physically isolated from one another in the electrode composition. Even if *some* CNTs were, LG cannot dispute the vast majority remain interconnected after detangling. Third, tunneling provides conductivity across small gaps. SR, 14-15. Fourth, LG’s “physical contact” theory is contradicted by its claim 6 argument (Pet., 35), which argues a POSITA was motivated to space Ohata-Kavan’s CNTs apart “by at least 1 micrometer” (no physical contact) despite LG now arguing physical contact is required for Ohata’s “improved conductivity.”

In short, the Board correctly determined LG failed to carry its burden (FWD, 21-26). PO proved Ohata-Kavan’s *binder* provides conductivity with active material, not physical contact with CNTs like the ’483 Patent and Kavan.

II. LEE-WESPASNICK

The Board correctly found “that the information presented in the Petition is inadequate to make out the challenges based on Lee,” LG failed to identify “with particularity ... the evidence that supports” this ground, and that it is impermissible and unfair for LG to “backfill” with information first raised in Reply. FWD, 31-34.

LG's assertion that the Board "misapprehended" Lee is nothing more than a second attempt to backfill with pages of "clarification" that not only mirrors but far exceeds the belated "particularity" from LG's Reply. *Compare* Reply, 21-22 with RR, 12-15. Despite already trying to "shift blame" for its failure (FWD, 33), LG tries to shift blame again by alleging that the Board "overlooked [LG's] subsequent clarifying remarks that should have remedied the Board's misunderstanding," including "clarifying remarks" first raised *at the hearing*. RR, 14. In other words, LG's arguments on Lee-Wespasnick were apparently so inadequate that it was unable to clearly convey it during multiple rounds of briefing—it needed to add more "clarity" *at the hearing*. Belated "clarity" that PO had no opportunity to respond to in its briefing. Regardless, that both the Board and PO allegedly "misunderstood" LG's application of Lee conclusively shows that LG failed to explain its evidence.

LG also ignores that the Board *expressly addressed all* of LG's Lee arguments from the Reply. FWD, 34. The Board determined the Lee grounds failed and *each* argument was "persuasively countered," including by showing each thick squiggly-line 1 in Figure 1 represents intertwined CNTs (*i.e.*, "agglomerated" CNTs). *Id.* (citing SR, 32-39). PO thus proved that that Lee's "agglomeration" teachings refer to nanoparticles including *intertwined* CNTs. Given that LG fails to identify anything "overlooked or misapprehended" in determining that PO countered LG's "clarified" interpretation of Lee, the RR should be denied for this reason as well.

PO Response to Rehearing Request

Case IPR2024-01006
U.S. Patent No. 8,808,909

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Respectfully,

/Stephen Zinda/

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e)(4), the undersigned certifies that on February 5, 2026, 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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