

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 IPR2024-01006¹
Patent 8,808,909

**PETITIONER'S REPLY TO
PATENT OWNER'S REHEARING RESPONSE**

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.

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I. Record Evidence Establishes That Ohata–Kavan Renders Obvious All Challenged Claims

Patent Owner’s Rehearing Response (“PORR”) fails to address the central error in the FWD: ***no evidence exists*** to support a finding that Ohata’s battery somehow works—radically different from all other batteries—***without any physical contact*** between its nanotubes and electrode active materials. The record contains no objective proof linking Ohata to PO’s undeveloped tunneling theory. Simply, PO advanced naked attorney arguments, stitched together based entirely on attorney interpretations of disparate references that are not relevant to Ohata, and it led the Board to misapprehend the record and find, without substantial evidence, that the “Ohata-Kavan composition conducts electricity by a mechanism materially different from the mechanism at play in Kavan and the ’909 patent” without “physical contact.” FWD, 21-22. The Board should grant rehearing and find all challenged claims unpatentable over Ohata-Kavan as the FWD’s misapprehension of Ohata’s teachings led to an outcome-determinative error. Rehearing Request’s (“RR”) key points are supported by the record, face no contrary evidence, and remain unrebutted.

First, “percolation” does not suggest “no contact”; rather, it ***requires contact***. RR, 9. PO not only failed to rebut this fact, in the PORR or otherwise, but PO admitted that percolation occurs when the CNTs are “continuous” and “touching.” POR, 12-13. Even PO’s expert Dr. Chung confirmed this: “In order to form a continuous conductive path ... the units ***must touch one another***. The phenomenon

in which the units ***touch one another*** to form continuous conductive path is known as ‘***percolation***.’” MRD-2006, ¶61. There is no conflation between “electrical” and “physical” contact. *Contra* PORR, 6. Percolation requires ***touching***, full stop.

Second, Petitioner’s evidence that Ohata does not work through tunneling within its electrode structure, RR, 8-9, is un rebutted, as Dr. Chung never addressed the point. Indeed, the ***only*** record evidence linking tunneling and Ohata is from Dr. Zhu, who testified tunneling has no practical relevance to lithium-battery electrodes of the type in Ohata. *Id.*; MRD-2044, 12:23–14:3; Petitioner’s Observations, 1.

Even Dr. Chung consistently acknowledged that CNTs must physically contact the active-material particles: “the conductive additive [*e.g.*, CNT] ***needs to be in physical contact with the active material*** so that the charges can come out or go in of this active material particle.” LGES-1054, 17:1–18:16; Pet. Reply, 6; MRD-2006, ¶61. Importantly, she was not describing any unusual or fundamentally different electrode architecture from Ohata when highlighting the importance of physical contact. Instead, she was referring to a battery electrode that, just like Ohata’s, contains a conductive additive like CNT, a PVDF binder, and an active material such as lithium cobalt oxide. LGES-1054, 10:2-13:22, 17:1-18:16; MRD-2006, ¶58-61, Pet. Reply, 6-7. Far from departing from the standard, contact-based architecture by which electrodes achieve conductivity, Ohata epitomizes it by seeking to eliminate “gaps in the conductive network” that reduce touch points while

pursuing an “electrode superior in conductivity.” POR, 56; MRD-2006, ¶152.

While PO claims that Dr. Chung “consistently testified ... that there is no physical contact” in Ohata (PORR, 6), Dr. Chung actually said Ohata achieves conductivity through “percolation” (LGES-1054, 36:3-16), which PO admits requires physical contact, as established above, and further that the CNT “***needs to be in physical contact with the active material*** so that the charges can come out or go in of this active material particle.” LGES-1054, 17:1–18:16; Pet. Reply, 5-7. The existence of physical contact in Ohata-Kavan is fully aligned with not only Ohata’s high-performance electrode, but also Kavan’s explicit teaching that the active materials are “anchor[ed]” to the nanotube surfaces. Pet., 23-25. There is no evidence in the proceedings, substantial or otherwise, that could lead a reasonable factfinder to conclude that Ohata somehow works using a “mechanism materially different” from every other known battery—*i.e.*, without physical contact.

PO’s inability to identify any meaningful connection between tunneling and Ohata is underscored by the only excerpts of Dr. Chung’s testimony on which PO relies: LGES-1055, 114:19–115:20, and 122:24–123:9. PORR, 7; Sur-Reply at 15. These excerpts merely reflect Dr. Chung’s acknowledgment that tunneling is a general physical phenomenon that can occur at atomic distances; she never even theorized that tunneling could occur in batteries. RR, 8–9. Contrary to PORR’s suggestion that the “lousy” conductivity associated with tunneling occurs only at

“greater distances,” Dr. Chung made clear that “***even at 10 angstroms*** [*i.e.*, 1 nanometer] ... the quality of the electrical contact is ***lousy***.” PORR, 8; LGES-1055, 125:10-19. Moreover, the cited testimony comes from Dr. Chung’s deposition in IPR2024-01005 concerning the ’649 patent, which PO has since disclaimed. That proceeding did not involve Ohata and thus shows ***no connection between tunneling and Ohata***. Similarly, MRD-2010—which PO initially cited (in the POR) to show electrons can travel from one tube to another “when touching” but later cited (in Sur-Reply) for its passing mention of “tunneling”—makes clear that **electrons cannot pass through a polymer**. MRD-2010 (“If there is not a CNT-CNT contact, once electrons travel from one end of the tube to another end [] it will find ***huge resistance of the polymer so that it will not cross the barrier***.”).

Third, PO cannot rebut Ohata’s clear teachings that its “masterbatch was ***easily dissolved***” in NMP. RR, 4, 10-12 (citing to LGES-1004, [0032]). PO likewise offers no evidence to rebut Petitioner’s showing that PVDF concentrations disclosed in Ohata are known to be readily dissolvable in NMP. RR, 10–11; LGES-1056 ¶14. Indeed, NMP is a widely used, highly effective solvent for dissolving PVDF in batteries, just as in Ohata: “[PVDF] is soluble in NMP,” LGES-1061, [0004]; “PVdF...is used as the binder...NMP...acts as the solvent,” LGES-1062, 2. Pet. Reply, 6-8; *see also* MRD-2020, 1.

To the extent PO contends that all the PVDF in Ohata must be “fully

dissolved,” that argument mischaracterizes Petitioner’s position. PORR, 3. Petitioner has consistently explained that NMP sufficiently dissolves PVDF for the process at issue, not that PVDF must be “fully” dissolved by NMP every time. RR, 12; Pet. Reply, 5–9; FWD, 24. All alleged “[o]bjective evidence” PO identifies (PORR, 2) to show that CNTs *can* be coated by PVDF is irrelevant as none relates to the use CNTs in batteries (*e.g.*, MRD-2020) and, further, none refutes the well-established notion that a CNT that is completely “embedded within PVDF to the point of being isolated from the active material ... would lack the necessary conductivity to function as an electrode.” Pet. Reply, 8-10.

Fourth, PO concedes that “gaps” in Ohata’s electrode structure would be inconsistent with Ohata’s express objective of producing an “electrode superior in conductivity.” PORR, 5, 9. As improved conductivity depends on physical contact—not “tunneling” across gaps (RR, 6, 9)—PO now attempts to cabin its argument by claiming it meant only “gaps in the electrically conductive network of CNTs,” not gaps “between the CNTs and active material.” PORR, 5. PO’s selective line-drawing is arbitrary and inconsistent with “conventional wisdom.” POR, 56. Ohata’s goal is to enhance electrical conductivity throughout the electrode as a whole, and that objective cannot be squared with allowing conductivity-killing “gaps” to exist. *Id.*

Ohata’s desire to eliminate gaps is also fully consistent with Petitioner’s position as to claim 6. Specifically, Petitioner’s explanation that Ohata’s nanotubes

are dispersed “without clustering on a dimension scale less than 1 micrometer” does not require, as PO suggests, “no physical contact” and all nanotubes spaced apart by at least 1 micrometer. PORR, 9; *see also* Pet., 33-35; Pet. Reply, 18-20.

The Board’s determination that Ohata achieves electrical conductivity “by a materially different mechanism” through “electron tunneling” and the “percolation threshold” rests on a technical impossibility advanced solely through PO’s attorney argument. FWD, 21–24. This finding not only lacks substantial evidence, it is affirmatively contradicted by the record, including testimony from both experts.

Having established that Ohata-Kavan unequivocally discloses and indeed requires physical contact between its nanotubes and active materials—in particular with Ohata’s process explicitly providing a blending step where NMP is added to the masterbatch to easily dissolve away portions of the PVDF to promote active material attachment—all remaining PO criticism of the Ohata–Kavan combination collapses. RR, 3-4. Ohata-Kavan together discloses oxidized nanotubes (Pet., 28-30), and further renders obvious the attachment of electrode active materials to oxidized CNT surfaces via ionic or covalent bonding. Pet., 23–25; LGES-1003, ¶¶90-98; LGES-1005, 2 (“[S]urface oxidation of carbon nanotubes...improve the anchoring of [active materials]...for optimum attachment”). PO offers no evidence capable of disturbing this straightforward conclusion.

Lastly, PO’s contention that “discrete” nanotubes must be those that are “not

attached to any other nanotubes” is inconsistent with the finding of this same panel in the FWD for the related IPR2024-01012 case for the ’282 patent, where the Board “**disagree[d]** that ‘discrete’ must mean ‘not attached to other nanotubes.’” IPR2024-01012, Paper 41 (FWD) at 21 (P.T.A.B. Jan. 15, 2025).

II. Lee-Wepasnick Renders All Challenged Claims Obvious

PO’s misleading complaints that Petitioner’s clarifying explanations regarding Lee’s structure presented at the oral hearing gave it “no opportunity to respond to in its briefing” (PORR, 10) ignore that PO had ample opportunity to respond, including in its Sur-Reply, to this very same issue as earlier addressed in Petitioner’s Reply. *See* Pet. Reply, 21-22. *See Chamberlain Grp., Inc. v. One World Techs., Inc.*, 944 F.3d 919, 925 (Fed. Cir. 2019) (confirming that at oral hearing “[p]arties are not barred from elaborating on their arguments on issues previously raised” and permitting “clarification of [a] prior position in response to the arguments raised in [PO’s] reply”). Critically, both the Reply and subsequent explanations at oral hearing remained consistent with the Petition’s demonstration that the Lee-Wepasnick nanotubes are discrete because (1) Lee discloses agglomeration of nanoparticles (that include discrete nanotubes), not the nanotubes themselves (*see* Pet., 38, 42-43; Reply, 21-22), and (2) the oxidation of the nanotubes further promotes their discreteness (*see* Pet., 54; Reply, 26). It was an error for the Board to ignore Petitioner’s clarifying and directly responsive arguments.

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4) and 42.205(b), the undersigned certifies that on February 12, 2026, a complete and entire copy of this Petitioner's Reply to Patent Owner's Rehearing Response was provided by email to the Patent Owner by serving the correspondence email address of record as follows:

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