

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHUHAI COSMX BATTERY CO., LTD.,
Petitioner

v.

NINGDE AMPEREX TECHNOLOGY LIMITED,
Patent Owner

Case IPR2025-00432
U.S. Patent No. 11,575,148

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

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EXHIBIT LIST

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1001	U.S. Patent No. 11,575,148 (“the ’148 patent”)
1002	File history of Application No. 17/061,427 (now U.S. Patent No. 11,575,148)
1003	Declaration of Samuel Gido, Ph.D.
1004	<i>Curriculum Vitae</i> of Samuel Gido, Ph.D.
1005	U.S. Patent Application Publication No. 2017/0162849 A1 to Murakami et al. (“Murakami”)
1006	International Patent Application Publication No. WO 2015/178351 A1 to Honda et al (“Honda”)
1007	Certified Translation of International Patent Application Publication No. WO 2015/178351A1 to Honda et al. (“Honda”)
1008	Japan Patent Application No. 2017-137432 to Tanaka et al. (“Tanaka”)
1009	Certified English Translation of Japan Patent Application No. 2017-137432 to Tanaka et al. (“Tanaka”)
1010	U.S. Patent Application Publication No. 2012/0228214 A1 to Beard et al. (“Beard”)
1011	U.S. Patent Application Publication No. 2016/0013465 A1 to Akiike (“Akiike”)
1012	U.S. Patent Application Publication No. 2015/0280195 A1 to Schmitz, et al. (“Schmitz”)
1013	U.S. Patent Application Publication No. 2017/0194613 A1 to Murata et al. (“Murata”)
1014	File history of parent Application No. 16/000,764 (now U.S. Patent No. 10,833,355)

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1015	Complaint, <i>Ningde AmpereX Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , No. 2:24-cv-00728-JRG (E.D. Tex. Sept. 6, 2024), ECF 1.
1016	Unopposed Application for Extension of Time to Answer Complaint, <i>Ningde AmpereX Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , No. 2:24-cv-00728-JRG (E.D. Tex. Dec. 4, 2024), ECF 16.
1017	U.S. Patent No. 9,065,119 to Nishikawa (“Nishikawa”)
1018	Partial Stay Order, <i>STA Grp. LLC v. Motorola Sols., Inc.</i> , No. 2:23-cv-00030-JRG-RSP (E.D. Tex. Aug. 27, 2024), ECF 402.
1019	Order, <i>Stellar, LLC v. Motorola Sols., Inc.</i> , No. 4:23-cv-00750-SDJ (E.D. Tex. Apr. 21, 2025), ECF 170
1020	Order, <i>Cellspin Soft, Inc. v. ByteDance Ltd.</i> , No. 2:23-cv-00496-JRG-RSP (E.D. Tex. Jan. 27, 2025), ECF 106
1021	Order, <i>Intercurrency Software LLC v. Binance Holdings Ltd.</i> , No. 2:23-cv-00370-JRG (E.D. Tex. Aug. 29, 2024), ECF 86
1022	Order, <i>Netlist, Inc. v. Micron Tech., Inc.</i> , No. 2:22-cv-00203-JRG (E.D. Tex. Feb. 10, 2024), ECF 493
1023	Order, <i>BoxCast Inc. v. Resi Media LLC</i> , No. 2:21-cv-00217-JRG (E.D. Tex. May 25, 2022), ECF 163
1024	Order, <i>Datatrans Corp. v. Fiserv, Inc.</i> , No. 2:13-cv-00431-JRG-RSP (E.D. Tex. Aug. 14, 2014), ECF 616
1025	Docket Navigator Time to Trial for Eastern District of Texas District Judge Rodney Gilstrap
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1027	Declaration of John C. Evans in Support of Petitioner’s Response to Patent Owner’s Discretionary Denial Brief

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1030	Research Activities of the Wheeler Group, as downloaded on January 16, 2026, from https://www.et.byu.edu/~wheeler/research.html
1031	Dean R. Wheeler webpage, as downloaded on January 13, 2026, from https://www.et.byu.edu/~wheeler
1032	Wet Milling and Dispersing Device – Star Burst – Sugino Corp. webpage, as downloaded on January 30, 2026, from https://www.suginocorp.com/star-burst/
1033	Processing Battery Materials with Minimal Contamination webpage, as downloaded on January 30, 2026, from https://www.suginocorp.com/star-burst/battery-materials/#prev
1034	Processing Raw Materials – Chamber Types, downloaded on January 30, 2026, from https://suginocorp.com/blog/processing_raw_materials_chambers-for-different-applications/
1035	Wheeler Deposition Demonstrative
1036	Supplemental Declaration of Samuel Gido, Ph.D., dated March 4, 2026
1037	Deposition Transcript of Dean R Wheeler, Ph.D. and executed errata, dated January 30, 2026
1038	Deposition Transcript of Samuel Gido, Ph.D. and executed errata, dated November 13, 2025

Petitioner submits this Reply to Patent Owner's ("PO") Response to the Petition (Paper 21, "POR"). Nothing in the POR should dissuade the Board from extending its preliminary findings in the Institution Decision (Paper 10, "Decision") to a final determination that the Challenged Claims are unpatentable.

I. CLAIM CONSTRUCTION

Two terms are disputed. Petitioner contends each should be given its plain and ordinary meaning. Petition, 14; EX1003, ¶17. The Board agrees. Decision, 11. PO's unsupported—and contradictory—constructions should be rejected.

A. "Pores at least comprises a part of the inorganic particles"

The district court ordered this term be given its plain and ordinary meaning: the "inorganic particles are a part of the pores." EX2056, 32-33 (citing EX1001, 2:47-56, 3:24-51, 8:33-58) (presence of inorganic particles in the pore structure enhances pore stability, so particles are part of the pores). Petitioner agrees.

Moreover, the **pore** wall is part of the pore. The Board implicitly agreed. Decision, 19 (rejecting argument that inorganic particles within the pore wall do not comprise part of the pore). PO argues pores are solely "voids or interstitial spaces" and exclude pore walls. POR, 11-12; EX2034, ¶¶61-64. This construction should be rejected.

Claim terms are given their plain and ordinary meaning unless the patentee “acts as its own lexicographer” or “disavows the full scope of [the] claim term...in the specification or during prosecution.” *Kyocera Senco Indus. Tools Inc. v. Int’l Trade Comm’n*, 22 F.4th 1369, 1378 (Fed. Cir. 2022) (quotations, citations omitted). Neither exception applies, so “pores” should be given its plain and ordinary meaning, which includes pore walls. Without pore walls, there is no pore. Borrowing PO’s analogy, while one may not include the thickness of walls when measuring room dimensions, walls are nonetheless part of the room. Without walls, there is no room. Without pore walls, there is no pore—just undefined open space. EX1036, ¶13.

Dr. Guido’s testimony in an unrelated proceeding is irrelevant. Whether pores include pore walls was not at issue, so his testimony cannot support such a conclusion. Moreover, Dr. Guido’s statement—stretching “opens up voids or pores in the film”—is consistent with Petitioner’s construction. Stretching a porous structure “opens up” pores by expanding the pore walls, increasing the void space. EX1036, ¶14.

“Porosity” and “pore” are different terms—one does not define the other. EX1036, ¶¶15-16. Porosity is the fraction of the total volume of material that is void space. EX1037, 53:11-14. Void space is the numerator, total volume (including space occupied by physical matter) is the denominator. *Id.* Under PO’s “pore”

construction, porosity is pore volume divided by total volume. But the volume of particles that “comprise” or form part of the pores is “not [] part of the numerator” in the “porosity calculation.” *Id.*, 53:15-54:3. PO’s argument is self-defeating.

The ’148 Patent does not define “pore” as excluding pore walls. Describing how increasing “average wall thickness between adjacent pores” decreases average pore size does not redefine “pores” to mean “void space only.” Two adjacent rooms share a common wall, but that does not mean a room excludes its walls. The same applies to pores. EX1036, ¶17.

Defining “pores” as solely void contradicts the claim element “pores at least comprise[] a part of the inorganic particles.” If pores are just void space, how can a pore (i.e., void space) be comprised (i.e., made up of) of inorganic particles? It cannot. Dr. Wheeler confirmed “the particle is obviously not void,” it is “a solid.” EX1037, 51:6-7. PO argues annotated SEM images from the ’148 Patent prove the particles “extend[]...into [those] pore[s],” Dr. Wheeler admitted the identified particles are part of the pore wall. *Id.*, 21:17-22:2. This contradicts PO’s position that “a ‘pore’ and its ‘wall’ are distinct elements.” POR, 25; EX2034, ¶¶116-117. Dr. Wheeler admitted the identified particles “[has some effect]” on pore geometry. EX1037, 22:3-11. They must, as the particles are **not** part of the void space. EX1036, ¶¶18-19. Therefore, this claim element is only possible if “pores” include pore walls.

- **Indefiniteness position in district court**

PO argues institution should be vacated under *Tesla* because Petitioner made indefiniteness arguments in district court. POR, 4-5. But courts and the Board may “adjudicate a prior-art challenge” even if “some aspect of a claim renders the claim indefinite.” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 813 (Fed. Cir. 2021). Dr. Guido testified he determined the prior art was within the “boundaries” of the claims without needing to “fully understand the absolute metes and bounds” of the claim terms. EX2038, 29:3-22; EX1036, ¶20. This is sufficient. *Tesla, Inc. v. Intellectual Ventures II LLC*, No. IPR2025-00340, Paper 18 at 3-4 (PTAB Nov. 5, 2025). Moreover, the Petition demonstrates that Murakami and Beard meet this claim element under *any* reasonable construction because: (1) Beard has particles in the pores wall *and* extending into pore voids; and (2) if the ’148 Patent *specification* describes the claimed porous film, so does Murakami. Petition, 29-30, 52-54.

Petitioner raised an indefiniteness challenge before the district court on the ground that it is unclear whether each of the pores needs to comprise or contain the inorganic particles. Notwithstanding the alleged indefiniteness of the claim term, a POSITA would have understood the asserted art satisfies the claim limitation. For example, Figure 1 of Beard shows particles in all of the pores. So, while the objective metes and bounds of “the pores” are not reasonably certain, there is no dispute that a film that includes a particle in each of “the pores” meets this limitation. And, to

the extent the '148 patent describes the claimed porous film, so does Murakami. That is, Murakami (1) discloses the same kind of manufacturing process and (2) uses a slurry including even more particles than the '148 patent. *Id.*, ¶[0070]. So, if the '148 patent describes a porous film having “the pores” claimed in the '148 patent, Murakami does, too. Accordingly, the asserted prior art discloses the claimed subject matter even though the full metes and bounds of the claims cannot be ascertained with reasonable certainty.

Regardless, PO's *Tesla* argument is moot because the district court found the term not indefinite, (EX2056, 33), eliminating any risk of “detract[ing] from[] the Office's goal of providing greater predictability and certainty in the patent system.” Paper 18 at 4 (citation, quotation omitted).

B. Pores “formed by the binder”

Though not proposed for construction, the district court described this term as referring to how the binder forms the structure. EX2056, 32-33. Petitioner agrees this is the plain and ordinary meaning. EX1036, ¶21; EX1001, 1:45-47 (the porous film contains pores formed by the binder), 3:16-19 (the inorganic particles are fixed by the binder”). PO and Dr. Wheeler offer two narrower, and conflicting, constructions—both incorrect.

1. PO's construction is wrong

PO argues this term means pores must be “formed by the binder itself” and not “other components like inorganic particles.” POR, 6; EX2034, ¶¶44-50. PO contends the term requires the pores’ “outer geometry” to be “defined by binder” in the “same way that a circle’s perimeter defines the circle.” POR, 6-8; EX2034, ¶¶20-26, 44-52, 54. Combined with PO’s definition of “pores,” PO’s construction requires the void’s outer geometry be defined solely by binder. *See* EX2034, ¶98 (arguing Murakami’s pores are not formed by binder because there is “not enough binder...to surround the empty spaces...nor to fully surround the inorganic particles” and the claim requires “voids [be] formed between pore walls of binder.”). But neither the claims nor specification states pores are formed *entirely* or *exclusively* by binder. EX1036, ¶22.

PO points to SEM images from the ’148 Patent, but they show inorganic particles partly defining the void’s outer geometry. EX1037, 22:3-11; EX2034, ¶181; EX1036, ¶23. PO argues the ’148 Patent’s disclosure of the NIPS process supports its construction. PO’s expert disagrees. EX1037, 27:15-28:21 (“Q....the [NIPS] process doesn’t guarantee that the pores must be formed by binder, correct? A. Right.”). Further, the ’148 Patent does not require NIPS. NIPS is mentioned only once as part of “a method for preparing a porous film”— not the *only* method. EX1001, 5:61-62, 6:16-19 (emphasis added). Examples from the specification are

not imported into the claim language. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005).

PO argues the “high ratio of binder” disclosed by the ’148 Patent requires the outer geometry be defined solely by binder. But the claims do not recite this, and the ’148 Patent teaches using as low as 17vol% of binder (EX1001, 5:50-52), well below the 50vol% PO quotes from Dr. Gido. POR, 9-10. At 83vol%, the inorganic particles would form significant portions of the pore walls and the define the geometry of the pores. EX1036, ¶24.

PO’s argument regarding the claimed “average wall thickness” is meritless. “Average” is not “maximum.” Some walls will be thicker than average and thus could accommodate or be defined by larger particles. EX1037, 41:17-42:20. Moreover, the average claimed particle size (Dv50) range overlaps the claimed average wall thickness range. *Compare* Claim 1 (“Dv50...of 0.2 μm to 5 μm ”) with Claim 3 (“average wall thickness...of 20 nm to 500 nm”). Thus, a pore wall can be (or mostly be) an inorganic particle. EX1036, ¶25.

2. Dr. Wheeler’s new construction is incorrect

Dr. Wheeler initially agreed with PO’s construction in his Supplemental Declaration, but he changed his opinion when deposed. Instead of the void geometry being defined *solely* by binder, Dr. Wheeler testified the binder needs only be the *primary* definer—meaning inorganic particles can partially define the void’s

geometry. EX1037, 11:15-12:11. Again, the claims do not require pores be formed *primarily* by binder. For the same reasons PO’s arguments above fail, they fail here too. EX1036, ¶26.

Worse, Dr. Wheeler could not explain how a POSITA would know whether a void’s geometry is defined *primarily* by binder. EX1037, 12:15-15:14. Even where particles drastically alter void geometry, Dr. Wheeler denies it “in the context of the ’148 Patent specification and claims.” EX1037, 93:18-94:2 (discussing EX1035). Dr. Wheeler’s undefined, unsupported construction should not be adopted.

II. GROUND 1: MURAKAMI

A. “Pores Formed by the Binder”

1. PO’s claim construction is wrong

PO’s argument hinges on its incorrect construction requiring the outer geometry of the void to be defined by binder. PO argues Murakami’s voids are “gaps between filler particles.” POR, 20; EX2034, ¶¶81-89. Dr. Wheeler opines Murakami’s pore walls are only the particles themselves, with binder gluing them together. EX2034, ¶¶93, 117. Thus, under PO’s construction, particles—not binder—define Murakami’s void geometry. That construction is wrong. Section II.B.

Murakami—including Examples 1 and 2—discloses this element. Petition, 23-25. Murakami’s binder binds/glues the particles together in a porous structure,

“form[ing] the structure” as the district court characterized. *Id.* Without binder, the loose inorganic particles could not maintain a fixed porous structure. EX1036, ¶¶28-29.

2. Murakami discloses this limitation under PO’s construction

PO focuses on Murakami’s Examples 1 and 2, arguing particles at 93vol% must define the gaps/voids. POR, 21. But Dr. Wheeler admitted even at high-filler-volume percentages, binder may fully coat the particles, meaning the pores are “formed by the binder.” EX1037, 36:1-37:10. Dr. Wheeler stated SEM imaging would be required to confirm, so PO cannot dispute Murakami’s particles are coated by binder. *Id.*, 67:4-12; EX1036, ¶30.

Second, Murakami is not limited to two examples. Murakami states the “filler content is preferably 1 volume % to 99 volume %.” EX1005, ¶[0069]. Specific examples include as high as 62% binder by volume. EX1036, ¶¶31-33. At that amount, Murakami’s binder would primarily define the void geometry. *Id.* Comparatively, the ’148 Patent discloses up to 83vol% inorganic particles (i.e., 17%vol binder). EX1001, 5:50-52. If the ’148 Patent’s pores are formed by binder, so are Murakami’s. EX1036, ¶34.

PO stretches out-of-context quotes to improperly limit Murakami’s disclosure. While Murakami refers to “gaps formed by contacts of particles,” Murakami does not require all pores be formed by particle contacts. A POSITA

would understand this, as a porous layer with merely 1 or 5vol% filler particles would have pores formed by binder. EX1036, ¶35. In a preferred embodiment, Murakami states “filler dispersed in a resin...is not suitable,” EX1005, ¶[0070], but Murakami is not limited to preferred embodiments. *Merck & Co. v. Biocraft Lab ’ys, Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989). As explained, Murakami specifies as low as 1 or 5vol% filler, and specific embodiments with 38vol% filler, which would necessarily be dispersed in binder. EX1036, ¶¶35-36 (citing EX1005, ¶[0070]).

PO again relies on the ’148 Patent’s discussion of the optional NIPS process to differentiate Murakami. But the ’148 Patent does not require NIPS. EX1001, 5:61-62, 6:16-19. Regardless, Murakami discloses solvent substitution (EX1005, ¶[0087]), and Dr. Wheeler confirmed NIPS is a type of solvent substitution (EX1037, 86:6-8). He further agreed Murakami does not teach away from NIPS, and that NIPS could be used at high filler/low binder ratios. EX1037, 28:16-29:6, 86:9-87:6. Murakami’s process for coating the porous layer supports that this element is met. EX1036, ¶¶37-41.

B. “Pores at Least Comprises a Part of the Inorganic Particles”

PO’s argument hinges on “pore” excluding pore walls. POR, 42. PO argues Murakami’s particles form the pore walls and therefore cannot “extend” from the wall into the void. First, pore walls are part of the pore. Section II.A; EX1036, ¶43. Second, Murakami discloses a range of embodiments, including embodiments where

pore walls are predominantly binder. *See* Section II.A.2; EX1036, ¶44. Third, Dr. Wheeler admitted the '148 Patent's inorganic particles form part of the pore wall. EX1037, 55:4-11. Deciphering Dr. Wheeler's testimony, PO's position is that, when the pore wall is "primarily" binder, the binder defines some theoretical void shape, and particles in the pore wall that extend into that theoretical void shape are part of the void—not the pore wall. EX1037, 50:7-53:6. This has no basis in the '148 Patent or lithium-ion battery industry. EX1036, ¶45. This is pure attorney argument crafted to avoid invalidity. *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1384 (Fed. Cir. 2001).

C. Claimed Particle Size Distribution

Murakami discloses this claim element. Petition, 31-32. PO's only argument is Murakami's examples use a SUGINO Star Burst™ device for dispersion, which PO alleges pulverized the particles, drastically altering the particle size distribution. POR, 26-27; EX2034, ¶¶120-145. Wrong.

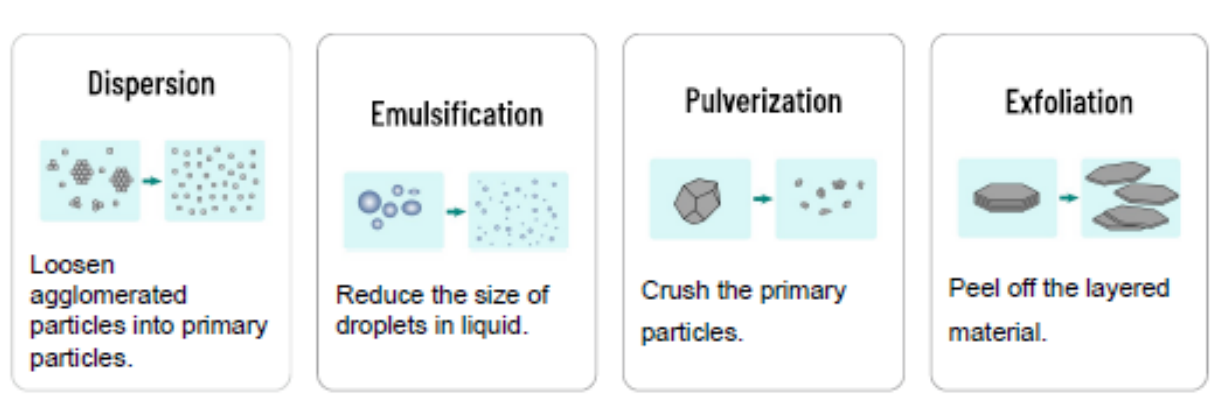
Murakami's disclosed particle size distributions apply to the particles in the finished porous layer. EX1005, ¶[0018]; EX1036, ¶47. Murakami discusses the benefits of using particles in these ranges, including "excellent in ion permeability" and "light weight." *Id.*, ¶[0066]. Outside these ranges, undesirable effects arise: if too small, "dispersibility tends to be decreased"; if too large, "filler is more likely to precipitate" and "ion permeability is [] decreased" while "weight per unit area is []

increased.” *Id.* These effects depend on the particle size distribution *in the porous layer*. EX1036, ¶47. The particles in Examples 1 and 2 fall within the prescribed ranges and thus provide the described benefits. EX1005, ¶¶[0140], [0161]. PO’s argument that the particle sizes in the porous layer are unknown contradicts Murakami’s disclosure. If the particles were pulverized to drastically smaller sizes, Murakami’s Examples would suffer from the issues Murakami says its invention avoids, which is illogical. EX1036, ¶47.

Nevertheless, PO argues the Star BurstTM machine significantly alters the prescribed particle size distributions. First, Murakami states the Star BurstTM machine “dispersed”—not pulverized—the inorganic particles. EX1005, ¶[0141]. In the context of batteries, “disperse” means to mix particles uniformly in solution, including loosening agglomerated particles into primary particles. while “pulverization” crushes primary particles into smaller particles by colliding them together.¹ EX1036, ¶48; EX1032, 6. SUGINO’s documentation shows the difference

¹ PO misleadingly cites Dr. Gido’s testimony to support “dispersion modes” would “smash” particles. POR, 29 (citing EX2033, 156:13-20). Dr. Gido meant “pulverization modes”—he misspoke in that instance. EX1036, ¶48 (citing EX1038, 128). He was clear throughout his deposition that “pulverization” changes particles size and “dispersion” does not. EX1038, 150:20-151:16, 154:13-18, 158:6-14.

between dispersion (what Murakami discloses) and pulverization (what PO alleges Murakami does):



EX1032, 6.

PO conflates Murakami's disclosure of a "wet grinding device" to obtain a desired particle size distribution with its separate disclosure of using the Star Burst™ machine for dispersion. POR, 27; EX2034, ¶127. Murakami first discloses "filler can be *dispersed* in the solvent...by the use of a conventionally known dispersing device such as...a *pressure type dispersing device*." EX1005, ¶[0073]. Star Burst™ is a pressure-type dispersing device. EX1037, 100:2-9. Murakami separately teaches using a "wet grinding device...to obtain a filler having an intended average particle diameter." EX1005, ¶[0073]. Thus, Murakami distinguishes between dispersion and methods for altering particle sizes and discloses using Star Burst™ solely for *dispersion*. EX1036, ¶53.

PO cites a SUGINO brochure (EX2029) to support that Star Burst™ pulverizes particles. POR, 28; EX2034, ¶¶129-130. But Star Burst™ has "many

chamber configurations” for different applications. EX2029, 2; EX1034, 2 (“Customization options include several chamber types that perform different functions.”); EX1036, ¶¶51-52. That brochure describes a Star Burst™ configured with an “Oblique collision type chamber” designed to “collide obliquely” particles “to achieve powerful pulverization.” EX2029, 4. The “Single nozzle chamber,” however, “disperse[s]” particles using “cavitation force” and does **not** pulverize. EX2029, 4 (“Pulverization” grayed out); EX1034, 5 (“Applications: Dispersion, exfoliation”). Because Murakami uses Star Burst™ for “dispersion,” a POSITA would understand the single nozzle chamber—designed for dispersion only—would be used. EX1036, ¶54.

PO argues a POSITA would use the oblique-type collision chamber to pulverize particles into uniformity—despite Murakami’s teaching to “disperse”—because Murakami prefers Dv90-Dv10 to be less than 1µm. POR, 28; EX2034, ¶¶129-130. But Dv90-Dv10 in Example 1 is already 0.81µm. EX1005, ¶[0140]. And other Murakami embodiments specify larger differences, up to 2.5µm. *Id.*, ¶[0066]. A POSITA would not assume the particle size distributions in Examples 1 and 2—which fall within the ranges Murakami states have beneficial effects—should be pulverized into smaller particles. Murakami teaches away from this. EX1005, ¶[0066]; EX1036, ¶55.

PO argues dispersion would break up agglomerated particles, altering particle size distribution. POR, 31; EX2034, ¶¶128, 144. Incorrect. First, agglomerated sizes are typically not specified or measured because they are random and of no practical interest. Thus, a POSITA would understand Murakami's particle size distributions to refer to primary particle sizes, not agglomerated sizes. EX1036, ¶57. Indeed, Murakami uses Star BurstTM to disperse and break up clumped particles in the slurry—ensuring the particle size distribution in the porous layer is as prescribed. *Id.* Second, agglomeration of particles occurs primarily in the slurry, not dry storage. EX1036, ¶58. Dry particles before going into the slurry—which PO argues Murakami's distributions describe—would typically not be agglomerated. *Id.* Third, PO alleges dispersing agglomerated particles would “significant[ly] shift” the particle size distribution, but this incorrectly assumes the distributions refer to agglomerated particles and not primary particles. POR, 31. Moreover, PO cites no support other than Dr. Wheeler's conclusory statement. *Id.*, 31 (citing EX2034, ¶144); EX1036, ¶59.

PO argues Murakami's authors either (1) believed it was easier to give a starting particle size distribution and specific instructions to reach some undisclosed particle size distribution that is actually beneficial; or (2) did not realize Star BurstTM pulverized the particles. POR, 32-34; EX2034, ¶¶129-132. Both fail. If Star BurstTM always pulverizes particles into narrow size distributions, then it is pointless to give

precise particle size distributions—much less different examples having different starting particle size distributions. One could start with any particle size distribution and pulverize it into uniformity. EX1036, ¶¶50, 60. And Murakami discloses other methods of dispersion that Dr. Wheeler confirmed would not necessarily pulverize. EX1005, ¶[0073]; EX1037, 98:6-100:1.

PO's second argument is unsupported conjecture. EX1036, ¶¶61-62 As discussed, Star BurstTM can disperse without pulverizing. Likewise, Murakami's other dispersion methods need not pulverize. EX1037, 98:6-100:1. Moreover, Murakami says "disperse," not "pulverize." EX1005, ¶¶[0073], [0141]; *Geo. M. Martin Co. v. All. Mach. Sys. Int'l LLC*, 618 F.3d 1294, 1302-1303 (Fed. Cir. 2010).

III. GROUND 2: MURAKAMI AND HONDA

A. Motivation to Combine

PO argues Murakami and Honda are incompatible because Murakami has particle walls—not binder walls like Honda. POR, 35; EX2034, ¶¶151-153. As explained, PO mischaracterizes Murakami. Section II.A. PO argues Murakami's particle sizes must be adjusted to fit Honda's pore wall thickness. Wrong. Honda discloses a thickness range of 0.1-2.0µm. EX1007, ¶[0045]. Murakami discloses a preferred D90 range of 0.8-2.5µm, and Example 1 has a D90 of 1.03µm. EX1005, ¶¶[0066], [0140]. Murakami's particles would fit in Honda's pore walls. Even if Murakami's particles were larger than Honda's pore walls, that does not render them

incompatible. EX1036, ¶¶64-65. Indeed, the '148 Patent claims using particles exceeding the thickness of its claimed pore walls. EX1001, Claims 1, 3. So does Honda, using particles as large as 10µm, over twice Murakami's maximum D90. EX1007, ¶[0058].

Moreover, Murakami's particle sizes and Honda's "thin pore walls" both fall within the '148 Patent's claimed ranges. EX1001, claims 1, 3. That is, PO argues the '148 Patent's claimed particle sizes and pore wall thicknesses are incompatible. The '148 Patent contradicts PO's contention.

PO argues Honda uses a surfactant to create its porous structure, whereas Murakami does not. Incorrect. EX1005, ¶[0073] ("The coating liquid can contain...a surfactant"); EX1036, ¶66-68. PO asserts undue experimentation would be required to confirm compatibility. Some experimentation is permissible as long as it is not unduly extensive. *PPG Indus., Inc. v. Guardian Indus. Corp.*, 75 F.3d 1558, 1564 (Fed. Cir. 1996). In fact, "a considerable amount of experimentation is permissible, if it is merely routine." *Id.* PO provides no support that unduly extensive, non-routine experimentation would be required. EX1036, ¶68. Bare citation to Dr. Wheeler is insufficient.

B. Reasonable Expectation of Success

PO argues that Murakami Examples 1 and 2 do not use phase separation but as explained above, that is immaterial and misrepresents Murakami. Section II.A.2.

PO argues Honda's wall thickness is incompatible with Murakami's particle sizes, and that "Murakami's large particle sizes could not be effectively held in place by the thin pore walls required by Honda and the claims." POR, 37; EX2034, ¶165. As explained, this is wrong. Section III.A; EX1036, ¶¶76-77.

IV. GROUND 3: MURAKAMI AND TANAKA

A. Motivation to Combine

PO argues Tanaka is non-analogous art because of its additional applications beyond batteries. POR, 38; EX2034, ¶170. But Tanaka teaches "[t]he polyolefin porous sintered compact...can be used as...*a separator for a lithium ion secondary cell.*" EX1009, ¶[0069]. Tanaka pertains to the same field of endeavor, so it is analogous art. *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004); EX1036, ¶79.

PO argues a POSITA would not have combined the references because Tanaka uses a polymer with no inorganic particles while Murakami's binder contains a high amount of inorganic particles. POR, 39; EX2034, ¶¶170-171. As explained, Murakami is not limited to high-particle loads and discloses particle loading as low as 1vol%. Section II.A.2; EX1036, ¶80. Regardless, PO provides no support for why Tanaka's pore size distribution coefficient is not compatible with Murakami other than Dr. Wheeler's conclusory statement that "it would not be clear to a POSITA." EX2034, ¶171; EX1036, ¶81. Statements about maintaining "pore sizes" or minimizing voidage conflate pore size, voidage, and pore size distribution

coefficients—all different metrics. EX1036, ¶81. Murakami does not “minimize voidage”—Murakami allows up to 90vol% voidage. EX1005, ¶[0093].

PO argues Tanaka’s use of sintering is incompatible with Murakami. POR, 40; EX2034, ¶172. Not so. Petitioner relies on Tanaka for its *pore size distribution coefficients* teachings and benefits thereof. Petition, 44-47. Sintering is not necessary to achieve the distribution coefficient, as evidenced by the ’148 Patent. EX1036, ¶82. A POSITA could obtain Tanaka’s distribution coefficient through well-known methods. *Id.*; Petition, 47-48.

B. Reasonable Expectation of Success

PO points to Tanaka’s pore size distribution coefficient pertaining to its porous substrate, not porous film. POR, 40; EX2034, ¶¶173-174. Irrelevant. Tanaka’s distribution coefficient balances membrane strength and permeability—that balance is desirable in the porous film and separator generally. Petition, 46-47; EX1003, ¶¶156-159; EX1036, ¶83. PO argues Murakami’s particle size distribution is incompatible with Tanaka’s “pore sizes” and distribution coefficient. Again, PO improperly conflates pore sizes with the distribution coefficient. EX1036, ¶¶84. Petitioner does not suggest using Tanaka’s pore sizes. If PO contends the distribution coefficient requires Tanaka’s pore sizes, that is wrong. *Id.* For example, the ’148 Patent achieves the distribution coefficient with larger pores. EX1001, Claims 2, 4.

V. GROUND 4: MURAKAMI AND BEARD

A. “Pores at Least Comprise a Part of the Inorganic Particles”

PO’s Murakami arguments hinge on its incorrect claim construction and thus should be rejected. Section II.A. But Beard satisfies PO’s construction because Beard discloses particles extending into the void space. Petition, 53-54; EX1003, ¶176. The Board agreed. Decision, 32.

PO argues the inorganic particles in Beard are encapsulated by binder and therefore are “only part of the pore walls—the particles do not contact or extend into the pores themselves.” POR, 41; EX2034, ¶¶179-194. PO argues encapsulation must occur because (1) Beard uses a high amount of binder, (2) Beard teaches away from filler blocking/interfering with pores, and (3) the particles in Figure 3 are encapsulated. POR, 42-46; EX2034, ¶¶187-188, 190-191. Each fail.

Dr. Wheeler agreed Beard has unincorporated filler particles that “are not encapsulated” by binder. EX1037, 135:2-137:5. While PO redirected Dr. Wheeler to explain that Beard does not teach a preference for unincorporated filler particles, that is irrelevant. Beard teaches, as part of its invention of packing particles into pore walls, some particles will not be fully incorporated or encapsulated. EX1010, ¶[0036]. This meets the claim element regardless of whether Beard identified any advantages. *Ex parte Obiaya*, 227 USPQ 58, 60 (BPAI 1985); EX1036, ¶88.

Beard teaches binder as low as 33vol%. EX1010, ¶[0029]. The '148 Patent discloses up to 83vol% binder. EX2015, ¶80 (citing EX1001, 5:50-52). Because the '148 Patent's particles are not encapsulated (under PO's claim construction), Beard's equal or lower binder amount likewise cannot guarantee encapsulation of all particles. EX1036, ¶89. Moreover, Beard explicitly states not all particles are encapsulated but "contained...**largely** within the pore walls." EX1010, ¶[0086] (emphasis added); EX1036, ¶89. This is illustrated in Beard's Figure 2, which is similar of Figure 2 of the '148 Patent. *Id.*, ¶91-93.

The particles in Figure 1 of Beard peeking into the void do not interfere with or block pore pathways. Beard states "[g]ood results may be achieved when the solid particles are contained...**largely** within the pore walls" (EX1010, ¶[0086])—confirming Beard achieves its goal even when particles extend into the void space. EX1036, ¶¶90-92. Moreover, whether binder encapsulates or exposes particles to the void does not meaningfully change porosity—a thin binder coating is volumetrically negligible. EX1036, ¶90.

PO points to Beard's Figure 3 embodiment but Petitioner does not rely on that embodiment. Petition, 52-54; EX1003, ¶¶169-172, 174-177; EX1036, ¶87. Moreover, Beard's teachings for Figure 3 do not negate those for Figure 1. *In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012).

PO dismisses Beard's embodiment including "larger fibrous particles" that "extend through, across or between the pores" claiming Petitioner did not rely on it. POR, 46; EX2034, ¶¶192-194. Incorrect. Petitioner cited Beard's optional inclusion of large fibrous particles. Petition, 54 (citing EX1010, ¶[0025]); EX1003, ¶176; Decision, 31.

B. Motivation to Combine

PO argues Beard requires extremely small particles—smaller than the maximum pore wall thickness. POR, 47-48; EX2034, ¶¶197-202. Not true. While Beard teaches particles largely within the pore walls produces satisfactory results, this does not require a specific particle size. Increasing pore wall thickness accommodates larger particles while preserving Beard's pore structure. EX1036, ¶96. PO disputes this but cites no support other than Dr. Wheeler's conclusory statement. POR, 50 (citing EX2034 ¶206 (citing nothing)). This should be given no weight. 37 C.F.R. §42.65(a). Further, Beard discloses using particles up to twice the size of its pore walls: 0.2µm particles and 0.1µm pore walls. EX1010, ¶¶[0021]-[0022]. Beard's pore wall thickness does not cap particle size. EX1036, ¶96.

PO argues Beard and Murakami have "vastly different binder ratios." POR, 47; EX2034, ¶198. Beard discloses 33%-67% binder by volume. EX2034, ¶207 (citing EX1010, ¶[0029]). Murakami discloses 1%-99% binder by volume, encompassing Beard's range. EX1036, ¶97; EX1005, ¶[0069].

PO argues “Murakami’s broader size distribution...would instead make a different type of pore structure that does not satisfy the claims” because Murakami’s particles are too large and would necessarily form “pores formed by gaps between inorganic particles.” POR, 51; EX2034, ¶¶203-205. But the ’148 Patent uses particles even larger than those disclosed in Murakami Examples 1 and 2 at the same binder volumes, yet claims its pores are “formed by the binder.” EX1001, Claims 1, 10; EX1036, ¶98.

PO argues Murakami teaches away from solvent substitution (which Beard uses). Not true—Murakami teaches solvent substitution may be used. Section III.A.2. A POSITA would have recognized that higher binder content—as in Beard—requires solvent substitution to remove the dispersion medium and form the porous structure. EX1036, ¶99.

PO argues Beard would increase voidage variability, which Murakami teaches against. POR, 53; EX2034, ¶212. Wrong. PO relies on Beard’s Figure 2, which the Board rejected as Petitioner does not rely on that embodiment. Decision, 33-34. Moreover, one cannot determine voidage variability from Figure 2. This requires aggregating measurements across many cross-sections of the separator—Figure 2 shows only a small sample, revealing nothing about the separator overall. EX1036, ¶¶100-102; EX1037, 143:9-144:3.

PO argues Murakami and Beard cannot be combined without altering Murakami's particle sizes. POR, 54; EX2034, ¶¶214-217. Beard's wall thickness could be increased to accommodate Murakami's particle sizes. EX1036, ¶103. PO argues thicker walls are not possible because this would require more binder than Murakami's preferred examples use. POR, 55; EX2034, ¶¶216-217. But Murakami discloses using up to 99 vol% of binder, and embodiments up to 62%. EX1036, ¶103; EX1005, ¶[0069]. PO argues walls thick enough to capture Murakami's particles would "likely [] swell" and "close the pores." POR, 55; EX2034, ¶216. Another conclusory statement contradicted by the '148 Patent, which discloses, and claims, pore walls no thicker than 0.5µm can capture 10µm particles . EX1001, Claims 1, 3; EX1036, ¶104.

VI. GROUND 5: MURAKAMI, BEARD, AND HONDA

PO argues the Petition fails to specify whether Ground 5 relies on the wall thickness of Beard or Honda. POR, 56; EX2034, ¶220. Incorrect. The Petition incorporates by reference Ground 2, which incorporates Honda's wall thickness. Petition, 48 (citing Section IX). Moreover, Beard and Honda pore wall thickness ranges overlap from 0.1-0.2µm. EX1010, ¶[0022]; EX1007, ¶[0045]. This falls within the claimed ranges. EX1036, ¶105.

VII. GROUND 6: MURAKAMI, BEARD, AND TANAKA

Petitioner incorporates by reference its arguments in Sections IV and V.

VIII. GROUND 7: BEARD AND AKIIKE

A. Particle Size Distribution

PO argues Akiike's disclosed distributions pertain to all particles in the slurry because Akiike mentions measurement by laser diffraction. POR, 57-58; EX2034, ¶¶226-229. But PO has no explanation for ignoring Akiike's plain disclosure: "particle size distribution of the non-conductive particles...are as follows: D10 is 0.2µm to 0.4µm; D50 is 0.5µm to 0.9µm; and D90 is 1.0µm to 3.0 m." EX1011, ¶¶[0010]-[0013]; *see also id.*, ¶¶[0033], [0036], [0037], [0048], [0049], [0194]. These paragraphs confirm Akiike's disclosed distributions pertain to non-conductive (i.e., inorganic) particles. Moreover, Akiike does not require laser diffraction—it is optional. EX1011, ¶[0036]. Akiike teaches the particles can be purchased commercially at the prescribed particle size distribution. *Id.*, ¶[0037]; *see also* EX1037, 148:1-7. If the POSITA makes the particles, Akiike explains the inorganic particles are crushed to the desired size and then measured to confirm. EX1011, ¶[0233]. Later, the inorganic particles are added to the slurry with other particles. *Id.*, [0239]. Thus, the inorganic particle size distribution is measured alone, without other particles. EX1036, ¶¶108-109.

Alternatively, PO argues Akiike's particle size distribution includes organic particles. POR, 59; EX2034, ¶¶242-243. Akiike discloses using either inorganic or

organic particles. EX1011, ¶[0038]. PO agrees. POR, 59. Therefore, the particle size distribution applies to the inorganic particles alone. EX1036, ¶110.

B. Motivation to Combine

PO argues Beard teaches a narrower distribution, defeating motivation to use Akiike's distribution. Beard teaches measuring particle size as a "maximum" or an "average or median particle size." EX1010, ¶[0022]. This is less precise than Akiike, which gives Dv10, Dv50, and Dv90 values. EX1036, ¶¶111-112. Moreover, Akiike discloses the benefits of its particle size distribution. Petition, 63-65 (citing EX1011, ¶¶[0031]-[0035]); EX1003, ¶¶202-204. Those benefits would have motivated a POSITA to incorporate Akiike's particle size distribution into Beard. *Id.*

PO argues Beard and Akiike have incompatible goals. But both seek to improve high temperature robustness and safety, mechanical strength, and porosity. *Compare* EX1005, ¶[0102] with EX1011, ¶¶[0017]-[0020]. Dr. Wheeler's statement that Akiike's "larger inorganic particles" would "likely block the pores" or decrease porosity is unsupported and false. EX1036, ¶113. PO again ignores the pore wall thickness could be adjusted to accommodate larger particles. Even if Akiike's particle sizes could have some negative effects, they would also impart the desirable benefits taught by Akiike. Petition, 63-65; EX1003, ¶¶202-204.

PO repeats that one cannot achieve Beard's pore structure with larger particle sizes. But the '148 Patent claims to. PO's position that achieving compatibility

would require either increasing wall thickness beyond the claimed range or reducing Akiike's particles sizes below the claimed range is untenable—the '148 Patent proves Akiike's particles are compatible with Beard's pore walls. EX1036, ¶114. If Beard's pore walls required increased thickness, Beard discloses a wide range of binder content (up to 67%) to accommodate this. EX1010, ¶[0029]. And PO offers no support that wall thickness would need to exceed 500nm—which equals Akiike's disclosed D50 of 0.5µm (EX1011, ¶[0032]). EX1036, ¶114.

IX. GROUND 8: BEARD, AKIIKE, AND TANAKA

Petitioner incorporates by reference its arguments above in Sections IV and VIII.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT (37 C.F.R. § 42.24(d))

This Petitioner's Reply to Patent Owner's Response to Petition complies with the type-volume limitation of 5,600 words, comprising 5,595 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

This Petitioner's Reply to Patent Owner's Response to Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word in 14-point Times New Roman font.

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CERTIFICATE OF SERVICE (37 C.F.R. §§ 42.6(e), 42.105(a))

I certify that the above-captioned **PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE TO PETITION and EXHIBITS EX1029-EX1038** were served in their entireties upon the Patent Owner on March 4, 2026, by email to the following addresses:

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