

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHUHAI COSMX BATTERY CO., LTD.,
Petitioner

v.

NINGDE AMPEREX TECHNOLOGY LTD.,
Patent Owner

IPR2023-00587
Patent 10,964,987

PATENT OWNER'S PRELIMINARY RESPONSE

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TABLE OF EXHIBITS

Exhibit Number	Description
2001	Decl. of Dean R. Wheeler, Ph.D., in Supp. of Patent Owner's Prelim. Resp.
2002	Curriculum Vitae of Dean R. Wheeler, Ph.D.
2003	[RESERVED]
2004	Amir-Sina Hamed, Fezzeh Pouraghajan, Fei Sun, Mojdeh Nikpour, & Dean R. Wheeler, <i>Interplay of Electrode Heterogeneity and Lithium Plating</i> , 169 020551 J. Electrochem. Soc. (2022).
2005	Baichuan Liu, Kayci Prugue, M. Nikpour, K. Ward, B.A Mazzeo, D.R. Wheeler, <i>Heterogeneity in MacMullin Number of Li-Ion Battery Electrodes Studied by Means of an Aperture Probe</i> , 169 010517 J. Electrochem. Soc. (2022).
2006	M. Nikpour, B.A. Mazzeo, D.R. Wheeler, <i>A Model for Investigating Sources of Li-Ion Battery Electrode Heterogeneity: Part II. Active Material Size, Shape, Orientation, and Stiffness</i> , 168 120518 J. Electrochem. Soc. (2021).
2007	2016 Batteries Conference GRC, https://www.grc.org/batteries-conference/2016/ (last visited on June 26, 2023).
2008	Hubs – Department of Energy, https://www.energy.gov/hubs (last visited on June 26, 2023).
2009	DOE Energy Innovation Hubs, https://science.osti.gov/bes/Research/DOE-Energy-Innovation-Hubs (last visited on June 26, 2023).
2010	Patent Rule 4-3 Joint Claim Construction Chart and Prehearing Statement dated May 23, 2023 in <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co., Ltd.</i> , Civ. No. 2:22-cv-00232-JRG (E.D. Tex.) (Dkt. 93).
2011	Decl. of Dr. Seth Miller, May 23, 2023 in <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co., Ltd.</i> , Civ. No. 2:22-cv-00232-JRG (E.D. Tex.).
2012	An Overview of Micron-Ranged Particle Sizing Techniques, https://particletechlabs.com/ptl-press/an-overview-of-micron-ranged-particle-sizing-techniques/ (last visited on June 26, 2023).
2013	Caijuan Shi, Oliver L. G. Alderman, Diana Berman, Jincheng Du, Joerg Neuefeind, Anthony Tamalonis, J. K. Richard Weber,

	Jinglin You, & Chris J. Benmore, <i>The Structure of Amorphous and Deeply Supercooled Liquid Alumina</i> , <i>Frontiers in Materials</i> , 6 <i>Frontiers in Materials</i> (2019).
2014	M. D. Rothschild, <i>A Hand-Book of Precious Stones</i> (G.P Putnam's Sons, New York ,1890).
2015	R. Levkov, S. Kulkov, Structure and Properties of Porous Ceramics Obtained from Aluminum Hydroxide, <i>Physics of Cancer: Interdisciplinary Problems and Clinical Applications (PC'16)</i> , <i>AIP Conf. Proc.</i> 1760, 020042-1–020042-4.
2016	A high-performance meta-aramid that drive protection, https://www.teijinaramid.com/wp-content/uploads/2018/10/Product-brochure-Teijinconex.pdf (last visited on June 26, 2023).
2017	Mukhtar A. Khan, Effect of Wire Gauge, Web Speed, and Coating Solids on Leveling of Streaks in Rod Coating, (1997) (Master's Theses, Western Michigan University) (ScholarWorks).
2018	U.S. Pat. No. 6,855,374.
2019	Prosecution History of U.S. Pat. App. Pub. No. 2014/0248525 A1 (Iwai).

I. INTRODUCTION

Ningde Amperex Technology Ltd. (“ATL” or “Patent Owner”) respectfully submits this Preliminary Response to the Petition for *inter partes* review filed by Petitioner Zhuhai CosMX Battery Co., Ltd. (“Petitioner” or “CosMX”). Paper 1 (“Pet.”). The Petition seeks *inter partes* review (“IPR”) of claims 1-16 (the “Challenged Claims”) of U.S. Patent No. 10,964,987 (the “’987 Patent,” Ex. 1001). The Petition should be rejected and institution should be denied for numerous reasons.

First, in an attempt to remedy its admission that Nishikawa does not actually disclose the claimed *volume* particle size distribution Dv90 (a fact that is fatal to its anticipation case), Petitioner wrongly alleges that Nishikawa’s *weight* particle size distribution d90 is equivalent to the claimed Dv90 based on a simple mathematical relationship between volume and weight. As explained below, this assumption is improper because volume particle size distribution Dv90 must be experimentally measured and is routinely measured using one or more of the well-known and accepted methodologies for measuring volume particle size distribution.

In addition, Petitioner relies on Examples 4 and 5 of Nishikawa for anticipation but Examples 4 and 5 do not disclose a thickness of the porous layer *at all*. Instead, Petitioner e

rroneously relies on the thickness of distinct Example 1. Petitioner bases its improper reliance on Example 1 on a statement that the separators of Examples 4 and 5 are “produced in the same manner” as that of Example 1. First, the coating slurry materials and ingredients for the separators of Examples 4 and 5 are different from those of Example 1, which would result in different porous layer thicknesses (and would require an obviousness analysis that Petitioner has not performed). Next, confirming Petitioner’s error, Nishikawa’s separators for Examples 2 and 3, which likewise were “produced in the same manner” as that of Example 1, ***do not have the same thickness*** as Example 1. Finally, the two Mayer bars that Nishikawa uses to coat the dual porous layers of Example 1 do not result in uniform and reliable thicknesses. Altogether, there is not sufficient disclosure in Nishikawa to anticipate the claims.

Furthermore, the method claim 10 recites adding a “first solvent” into a mixture of a binder and inorganic particles and stirring to obtain a “uniform coating solution,” but each of Nishikawa’s Examples 4 and 5 that Petitioner points to mixes its mixture of resin and filler particles with a 50/50 mixed solvent comprising a polar solvent DMAc and a poor solvent TPG. In fact, Nishikawa explains that the use of a polar solvent together with a poor solvent is intentional, to “induce[] a microscopic phase separation structure to facilitate formation of pores.” Such a mixed solvent (of

polar and poor solvents) therefore does not constitute a “first solvent,” and separately cannot result in the “uniform coating solution” claimed in claim 10.

In addition, Petitioner’s other reference Iwai never discloses a Dv90 value. Petitioner makes various assumptions and derivations in an attempt to obtain a Dv90 value based on Iwai’s D90-D10 difference, but a POSA would have had no reason nor direction from Iwai to make such assumptions and derivations. Next, Iwai’s “thickness a” for Iwai’s adhesive porous layer is related to the thickness of Iwai’s PVDF resin. Finally, Iwai’s adhesive layer and its filler particles are intentionally highly irregular and non-uniform, rendering Iwai’s “thickness a” an inaccurate and unreliable measurement that is not equivalent to a measurement of the entire claimed porous layer.

Lastly, the Petition should be denied under § 314(a) based on the *Fintiv* factors because, in the remaining¹ district court case where the ’987 Patent is at issue, trial is scheduled to happen about eight months *before* the statutory final written decision deadline in this IPR, the parties will have expended significant effort by the expected institution decision date, no stipulation has been entered, and the Petition is weak.

¹ The district court case previously pending in N.D. Cal. has now been voluntarily dismissed, so only the E.D. Tex. case remains.

As such, the Board should deny institution because Petitioner has not met its burden of demonstrating that it is more likely than not that any claim of the '987 Patent is unpatentable and because denial is warranted in the interests of efficiency and fairness.

II. BACKGROUND²

A. Technology Overview

1. Separators in Lithium-Ion Batteries

The primary function of a lithium-ion battery separator is to provide a permeable barrier between the two electrodes of a battery to prevent electrical short circuits while allowing the flow of ions but not the flow of electrons between the electrodes. This requires that separators have a solid framework with sufficient mechanical rigidity to prevent the two electrodes from touching each other. It also requires that separators have interconnected pores that are filled with ion-containing liquid electrolyte, which allow ions to flow from one side of the separator to the other, that is, between the two electrodes.

² Dr. Wheeler provided a technology overview of separators in lithium-ion batteries and a summary of the '987 Patent, which are largely reproduced here for convenience. Ex. 2001, § IV, ¶¶ 37-50.

A common problem with separators is the lack of a sufficiently rigid mechanical framework to maintain separation of electrodes and support the pores within it, as the separator materials can heat up, swell, and compress the separator pores when the battery is in use, and separator materials can lose strength at high temperatures. Furthermore, in many commercially produced lithium-ion batteries such as cylindrical lithium-ion batteries, continued charging and discharging of the battery causes volume changes in the electrodes which can then create a gap between the electrode and the separator, resulting in a reduction of the cycle capacity and safety of the lithium-ion battery.

One way to address the above challenges and objectives is to provide a separator comprising multiple layers, each having different mechanical properties and materials, so that taken as a whole, the separator can satisfy various objectives, design challenges, and design criteria. However, using multiple separator layers necessarily introduces complexity in design and manufacturing as there are many possible choices in separator layer materials, geometry, and fabrication steps.

In multi-layer separators, many factors influence the stability, performance, lifespan, safety, and manufacturability of the separator itself and the battery as a whole. Such factors include, for example, the materials used to build the various separator layers, pore size, pore density, and thickness of each layer of the separator,

and fabrication steps and ingredients for manufacturing the separator, including the binder material, inorganic filler material, and solvent used to dissolve the binder.

In addition, a key problem in the manufacturing of battery materials is poor uniformity of electrode and separator layers. A lithium-ion battery is constructed as a “cell sandwich” in which there are two electrodes and a separator, each of which can itself be comprised of multiple thin layers. On the other hand, each “cell sandwich” layer has a large lateral area, in some cases more than a square meter in a single cell, that is rolled or folded to fit into a compact space. If there are defects in these thin layers, such as variations in layer thickness or pinholes, they can lead to failure of the entire cell even if such defects are relatively uncommon across the large lateral area.

As described above, there are many non-obvious tradeoffs between the various factors discussed above, and it can be very challenging to identify the optimal parameters for such factors to manufacture multi-layer separators that meet desired technical objectives and design criteria.

B. The '987 Patent Claims an Innovative Lithium-Ion Battery Separator

The '987 Patent discloses multilayer separators, energy storage devices including such separators, and methods of manufacturing such separators. Ex. 1001, Abstract, 1:38-3:3. In particular, the '987 Patent discloses an improved separator that

addresses, among other things, safety issues from the gapping that occurs between the separator and adjacent electrodes from poor or inadequate adhesion between the separator and electrodes, rate performance (how fast the battery can be charged or discharged), and cycle performance (how long the battery can function upon repeated charges and discharges). *Id.* 1:27-31, 2:59-3:3, 4:5-27, 5:26-35, 15:26-36.

The '987 Patent addresses such issues and objectives by providing a multi-layer separator comprising a porous substrate and a porous layer attached to the porous substrate, wherein the porous layer comprises inorganic particles and a binder, and where the ratio of Dv90 of the inorganic particles to the thickness of the porous layer is in a particular range that provides technical advantages in performance, adhesion and safety. *Id.* Table 1, Table 2, 1:38-3:3, 15:26-36. In particular, the '987 Patent describes that the ratio of the Dv90 of the inorganic particles to the porous layer ("Dv90/thickness"), is critical to achieving the advantages of the invention. *Id.* Table 1, Table 2, 15:26-36.

The '987 Patent teaches that a Dv90/thickness ratio that is within a particular range improves rate or cycle performance of the battery. *Id.* Table 1, Table 2, 1:38-46, 15:26-59. Specifically, the '987 Patent teaches that:

- If the Dv90/thickness ratio is too high, the pores are not uniform and the porous layer will not attach to the porous substrate with sufficient strength. *Id.* 5:50-54, 15:36-49. The POSA would have understood from this that the issues

with attachment could be a result of large particles protruding above the surface of the porous layer to reduce adhesion and uniformity of the porous layer to the porous substrate.

- If the Dv90/thickness ratio is too low, then pores may become plugged with small particles. *Id.* 5:54-61, 15:49-59. In addition, if that ratio is too low, the mechanical strength of the porous layer is sacrificed, which results in the porous layer's pores closing under mechanical compression. *Id.*

In view of these disclosures, a POSA would have understood that the '987 Patent indicates that there is a tradeoff between the Dv90 of the inorganic particles and thickness of the porous layer and the claims reflect this trade off ("ratio of Dv90 of the inorganic particles to the thickness of the porous layer is in a range from 0.3 to 3.0").

III. LEGAL STANDARDS

The Petition must establish, with particularity, the grounds and evidence that support invalidating the patented claims. 35 U.S.C. §312(a)(3). Petitioner "must 'specify where each element of the claim is found in the [relied upon] prior art patents.'" *In-Depth Geophysical, Inc. v. ConocoPhillips Co.*, IPR2019-00850, Paper 56, 2020 Pat. App. LEXIS, *27 (P.T.A.B. Sept. 3, 2020) (quoting 37 C.F.R. § 42.104(b)(4) (2018)). And, as here, Petitioner must demonstrate that each of Nishikawa and Iwai "discloses[] within the four corners of the document . . . all of

the limitations claimed,” and that disclosure must be “arranged or combined in the same way as recited in the claim.” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Petitioner cannot satisfy this burden by reliance on *Nishikawa and Iwai*.

In addition, the Board makes its determination regarding institution based on what the Petition *actually presents* and not what it could have reasonably contained had it been drafted differently. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (holding that the Board is *not* “free to adopt arguments on behalf of petitioners that could have been, but were not, raised by the petitioner during [a post-grant proceeding]”). The Board cannot “deviate from the grounds in the petition and raise its own” theories of invalidity. *Sirona Dental Sys. GmbH v. Institut Straumann AG*, 892 F.3d 1349, 1356 (Fed. Cir. 2018).

It is Petitioner’s burden to demonstrate unpatentability by a preponderance of the evidence. However, for the independent claims in the ’987 Patent, Petitioner only relies on references that do not actually disclose the claimed Dv90 value, do not specifically disclose the claimed porous layer thickness and, thus, do not sufficiently disclose the claimed Dv90/thickness range, and thus, must rely on unsupported and unscientific assumptions to attempt to demonstrate the presence of the claimed limitations that are simply ***not disclosed***. Petitioner thus fails to satisfy its burden. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir.

2015) (quoting 35 U.S.C. § 316(e)) (stating that “the burden of persuasion is on the petitioner to prove ‘unpatentability by a preponderance of the evidence’ . . . and that burden never shifts to the patentee”). The lack of sufficient disclosure within the four corners of Nishikawa and Iwai dooms Petitioner’s grounds in view of the unexpected benefits of the claimed range, including the improvement of rate or cycle performance of the battery. Ex. 1001, 15:26-36, Table 2.

IV. CLAIM CONSTRUCTION

A. Dv90

The term “Dv90” is recited in claims 1 and 10 of the ’987 Patent. The ’987 Patent, states: “[t]he Dv90 of the inorganic particles refers to a particle size which reaches 90% the cumulative volume from the side of small particle size in the granularity distribution on a volume basis.” Ex. 1001, 3:63-66 *see also* 1:53-56. The definition of Dv90 in the Petition is consistent with the plain and ordinary meaning of the term “Dv90” as would have been understood by the POSA. Ex. 2001, ¶ 52. This is also consistent with the interpretation of Dv90 by Dr. Gido, who acknowledges that “[t]he ’987 patent uses a cumulative volume distribution (hence the ‘v’ in ‘Dv90’),” and that the ’987 Patent “defin[es] ‘Dv90’ as ‘a particle size which reaches 90% the cumulative volume from the side of small particle size in the granularity distribution on a volume basis.’” Ex. 1003, 99.

Finally, the parties previously agreed that the term Dv90 should be construed to mean “a particle size which reaches 90% of the cumulative volume from the side of small particle size in the granularity distribution on a volume basis.” Ex. 2010 at 2. The Board may therefore adopt Patent Owner’s proposed construction.

V. LEVEL OF ORDINARY SKILL IN THE ART

For purposes of this Patent Owner’s Preliminary Response, Patent Owner adopts the definition proposed by Petitioner. *See* Pet. at 16-17. Patent Owner reserves the right to further address the level of ordinary skill in the art if this proceeding is instituted.

VI. THE BOARD SHOULD NOT INSTITUTE INTER PARTES REVIEW ON THE MERITS

A. Grounds 1 and 2: Nishikawa Does Not Anticipate Claims 1-2 and 4-9, and Does Not Render Obvious Claims 10-16

Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 1 and Ground 2 is unpatentable, for the reasons below.

1. Petitioner Fails to Show that Nishikawa Anticipates or Renders Obvious the Dv90 Value of Claims 1 and 10

The plain and ordinary meaning of the claimed Dv90, which the parties agreed on, is “a particle size which reaches 90% the cumulative volume from the side of small particle size in the granularity distribution *on a volume basis*.” Ex. 2010 at 2. Petitioner and Dr. Guido both admit that Nishikawa discloses weight-based particle

size distribution, not a volume-based one. Pet. at 22; Ex. 1003, ¶ 99. In addition, during prosecution of the '987 Patent, Applicant made clear the importance of measuring **both** the thickness of the porous layer **and** the Dv90 of the inorganic particles to provide the claimed ratio. Ex. 1002 at 276 (“Note, a person of ordinary skill in the art would not be able to provide the ratio from the parameter of Dv90 or thickness of the porous layer alone – ***one would need both parameters to provide the ratio.***”).³ As such, Petitioner’s case fails.

Specifically, Petitioner, points to the d90 values of 1.05 µm and 1.07 µm for Nishikawa’s Examples 4 and 5 in Table 2 of Nishikawa (reproduced below), and alleges that Nishikawa’s d90 is equivalent to the claimed Dv90. Pet. at 10-11, 22.

TABLE 2						
	d10	d50	d90	α	Sliding property	Coating property
Example 4	0.38	0.75	1.05	0.89	good	good
Example 5	0.50	1.02	1.07	0.56	good	good
Example 6	1.50	8.0	22.0	2.56	good	poor
Example 7	5.10	23.0	58.0	2.30	good	poor

³ In the related litigation, Petitioner’s expert interpreted this language from the prosecution history in terms of the Applicant “stress[ing] the importance of measuring both the thickness of the porous layer and the Dv90 of the inorganic particles to provide the claimed ratio.” Ex. 2010 at 44.

Ex. 1005, Table 2.

There is no dispute that Nishikawa's d90 values are d90 values of a weight-based particle size distribution, not a volume-based one. Both Petitioner and Dr. Gido admit this key distinction. Pet at 22; Ex. 1003, ¶ 99. Specifically, Petitioner acknowledges that Nishikawa "defines its D90 with reference to a *cumulative weight distribution*" but asserts that "a POSA would have recognized that where, as in Nishikawa's Examples 4 and 5, the inorganic filler is of a single material... a cumulative volume distribution and a cumulative weight distribution will have the same D90 value because volume is directly proportional to weight." Pet. at 22. Even after admitting that the d90 of Nishikawa is not the claimed Dv90, Petitioner asserts that such d90 values would result in the claimed Dv90/thickness ratio. Pet. at 10-11, 22. For the various reasons presented below, Petitioner's arguments fail.

a. Volume-Based Dv90 Must Be Experimentally Obtained, Not Derived From Weight-Based d90

The claimed Dv90 must be determined from an experimentally obtained volume particle size distribution, not derived from a weight-based d90 particle size distribution value, as done by Dr. Gido. As Dr. Wheeler explains, particle size distribution is an experimentally determined statistical distribution analysis method to approximate the particle size at which the particles of a material reach a certain volume or weight threshold or other characteristic property. Ex. 2001, ¶ 62. There

are various accepted methods and instruments for experimentally measuring and obtaining a particle size distribution, based on different measurements, such as weight, mass, and volume. Ex. 2001, ¶ 62; Ex. 2012 at 2-12. But the POSA would have understood that *each* of mass, weight, or volume is measured *individually* via an experiment.

A POSA would (and could) not have converted a particle size distribution determined from one type of measurement to a particle size distribution that would be determined by another type of measurement because particles rarely, if ever, have perfectly uniform shapes, perfectly uniform densities, perfectly uniform porosities, and perfectly uniform surface properties. *Id.* ¶¶ –63-66. For example, the particles of a powder can vary with respect to surface vs. interior composition, crystallinity vs. amorphous character, and internal porosity. *Id.* ¶ 66. Indeed, larger particles can be more porous than smaller particles due to the larger particles being aggregates of smaller particles, in which case the volume particle size distribution will not align with the weight particle size distribution. *Id.*

A POSA would have understood that particles *of the same material* can have irregular particle shapes, densities, and porosities, that can result in volume particle size distributions that differ significantly from weight particle size distributions. *Id.* ¶ 67. For example, two spherical particles of the same material may seemingly have

the same external shape and diameter, but different internal structures—one may be fully solid on the inside, while the other may be hollow. *Id.* ¶ 68.

In addition, as Dr. Wheeler explains, densities of single materials can change with crystal structure, including a lack of long-range structure leading to so-called amorphous or glassy materials. *Id.* ¶ 69. In amorphous alumina, for example, the density at room temperature can vary from 2.66 to 3.4 g/cm³. Ex. 2001, ¶ 69; Ex. 2013 at 6. In crystalline alumina derived from the mineral corundrum, the specific gravity (or density) can range from 3.9 to 4.1 g/cm³. Ex. 2001, ¶ 69; Ex. 2014 at 39. As such, when particles have irregular material densities, their volumes may appear to be the same when measured through a volume particle size distribution method, but their weights would be different when measured through a weight particle size distribution method. *Id.* 2001, ¶ 70. In addition, a POSA would have understood that certain particle size distribution measurement techniques rely on the assumption that the powder particles have certain uniform shapes. *Id.* ¶ 71. Indeed, a POSA would have understood that when the particles being examined do not have such uniform shapes, converting a particle size distribution value from one measured using a different technique, would result in inconsistencies due to incorrect assumptions regarding the particle shapes that carry over through the conversions. *Id.* ¶ 71.

Because volume and weight particle size distributions are measured by different methods that measure different properties of a powder, which can in turn

be affected differently by numerous factors, a POSA would have expected the two to provide different particle size distribution graphs, even for the same material sample.⁴ *Id.* ¶ 73. As such, a POSA would have understood that a volume particle size distribution value cannot be easily derived from just a weight particle size distribution value based on an allegedly simple mathematical relationship between weight and volume (as Dr. Gido does), but must be measured and obtained experimentally using a suitable volume particle size distribution method. *Id.* ¶¶ 72-74. This is especially true with respect to the particles disclosed by Nishikawa.

b. Deriving Dv90 From D90 Would Be Reasonable Only, if Ever, When All Particles Have Perfectly Uniform Shapes, Densities, and Porosities

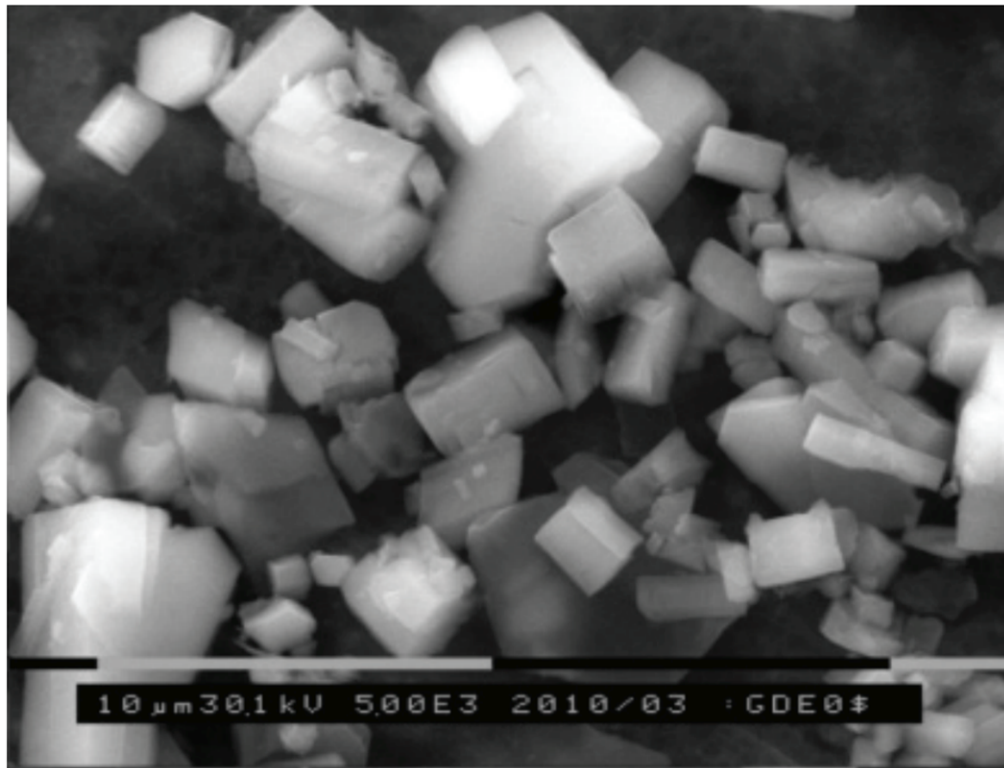
In violation of what a POSA would have understood (*see infra*), Dr. Gido makes a generalized assumption that when an inorganic filler is of a single material,

⁴ In contrast to its positions in this matter, Petitioner's expert in the district court indicated that "[a]n ordinary artisan would have understood that the measurement techniques disclosed for particle size distributions, including Dv90 measurements and those techniques discussed in section D below, have *significant variations in results between techniques and instruments*" and that "the same collection of particles may and often will yield *different PSD's coming from different measurement techniques*." Ex. 2011, ¶ 52.

a volume particle size distribution and weight particle size distribution will have the same D90 value simply based on an alleged direct mathematical relationship between volume and weight. Ex. 1003, ¶ 99 (“Where the inorganic filler is of a single material, the density relating each particle’s mass to each particle’s volume will be the same, such that Dm90 and Dv90 will have the same value.”). But the Dv90 value in Nishikawa must be determined from an experimentally obtained volume particle size distribution. Ex. 2001, ¶¶ 61-62, 65.

Even if it were reasonable to derive a volume particle size distribution Dv90 value based on Nishikawa’s weight particle size distribution d90 value (as Dr. Gido asserts), which it is not, such a conversion would only be scientifically sound in a theoretical, ideal world where all of Nishikawa’s inorganic filler particles, even if made from the same material, have perfectly or near-perfectly uniform shapes, densities, and porosities, and as a result, identical particle size distribution profiles. *Id.* ¶ 76. Here, however, the POSA would understand that the aluminum hydroxide filler particles of Nishikawa’s Examples 4 and 5 are crystalline, non-spherical particles, as shown in the exemplary image below showing a characteristic

distribution of aluminum hydroxide particle sizes and shapes, taken with a scanning electron microscope. *Id.* ¶ 78.⁵



Ex. 2015, 020042-1.

A POSA would have understood, as the image above shows, aluminum hydroxide particles are not spherical and have sharp edges that can result in anomalies even in a volume particle size distribution measurement, such as a laser

⁵ In the related litigation, Petitioner's expert confirms that commercially available magnesium hydroxide particles may exhibit a bimodal distribution with plate geometry and a Dv90 of 2 μm . *See* Ex. 2011 at 94, 98.

diffraction measurement (in this case the large angles cause the diffraction pattern to generate non-existing or ghost particles). *Id.* ¶ 78. However, as Dr. Wheeler explains, simply converting a weight particle size distribution value to a volume particle size distribution value based on the mathematical relationship between volume and weight, as Petitioner proposes, would not account for these anomalies. *Id.* ¶ 78.

As such, a POSA would have understood that particles, even of the same material (*e.g.*, aluminum hydroxide), would have significant variations in particle shapes, porosities, and densities, and, as such, would (and could) not have derived a volume particle size distribution Dv90 value from just a weight particle size distribution d90 value as Petitioner does. *Id.* ¶ 79. A POSA would have understood that a volume particle size distribution value would need to be experimentally obtained using a volume particle size distribution method. *Id.*

For the above reasons, Petitioner's argument that Nishikawa's weight particle size distribution d90 value is equal to a volume particle size distribution Dv90 value fails. The d90 values disclosed by Nishikawa are not the claim Dv90 values. As such, Petitioner cannot demonstrate that Nishikawa anticipates or renders obvious claims 1 and 10 and the claims that depend therefrom.

2. Petitioner Fails to Show that Nishikawa Anticipates or Renders Obvious the Porous Layer Thickness of Claims 1 and 10

In asserting that Nishikawa teaches the claimed Dv90/thickness range, Petitioner points to Examples 4 and 5 of Nishikawa and states “[i]n each of Nishikawa’s Example 4 and Example 5 separators, the heat resistant porous layer has a thickness of 3.15μm on each side of the microporous membrane (both sides totaling 6.3μm).” Pet. at 23. Examples 4 and 5 of Nishikawa do not disclose a thickness of the porous layer. This lack of disclosure alone results in the failure of Petitioner’s anticipation case. *See Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (for anticipation, Petitioner “must show ‘that the four corners of a single, prior art document describe every element of the claimed invention.’”).

Ignoring the lack of disclosure in Nishikawa regarding the thickness of the porous layer in Examples 4 and 5, Petitioner and Dr. Guido blindly allege that the thickness of the heat resistant porous layer of Example 1 **must** also be the thickness for both Examples 4 and 5. Ex. 1003, 100; Pet. at 23. Neither the Petition nor Dr. Guido provide any explanation or basis for why the total porous layer thicknesses of Examples 4 and 5 are assumed to be equivalent to the total porous layer thickness of Example 1, or why each porous layer thickness on each side of the substrate in Examples 1, 4, and 5 is assumed to be equal to exactly one half of the total porous

layer thickness of 6.3 μm in Example 1. Dr. Gido only states that “Example 1 ([] is, in this aspect, the same as Examples 4 and 5).” Ex. 1003, ¶ 100. Putting aside that Petitioner’s anticipation argument should fail because a lack of disclosure in Nishikawa and a lack of support for any assumptions made by Petitioner or its expert (which would require an obviousness analysis Petitioner has not performed), Petitioner’s reliance on Example 1 independently fails for at least the following reasons.

a. The Porous Layer Thicknesses of Examples 4 and 5 Are Not Equal to the Porous Layer Thickness of Example 1

Petitioner and Dr. Gido appear to rely on Example 1 of Nishikawa as noted in footnote 1 of Dr. Gido’s declaration:

Nishikawa’s Example 4 separator is “produced in the same manner as in Example 1, except that” the coating slurry is modified. *Nishikawa*, 22:37-40. *Nishikawa*’s Example 5 separator is “produced in the same manner as in Example 4 except that the inorganic filler was changed” from H-43M to H-42M, where H-42M and H-43M are both commercially available aluminum hydroxide organic fillers having different particle size distribution as shown in Table 2. *Nishikawa*, 22:26-33, 22:46-51. Accordingly, throughout my declaration, citations to discussions of Example 1 are provided where they apply equally to Example 4 and Example 5.

Ex. 1003, n.1; *see also* Pet., n.3.

But, as explained below, the porous layer thicknesses of Examples 4 and 5 are not equal to the porous layer thickness of Example 1.

(i) **“Produced in the Same Manner” Does Not Mean Having the Same Porous Layer Thickness**

Despite Nishikawa never disclosing thickness of the heat resistant porous layer of Examples 4 and 5, Petitioner imports the thickness of Example 1 based on a theory that the examples would have the same thickness because they were “produced in the same manner.” Ex. 1003, n. 1; Pet., n. 3. However, a POSA would have understood that using different coating slurries having different resin and inorganic fillers materials to produce the porous layers of Examples 1, 4, and 5 would result in porous layers having different properties and thicknesses. Ex. 2001, ¶ 83. Similarly, applying either butter, creamy peanut butter, or crunchy peanut butter to three pieces of toast “with a knife” produces three layers “in the same manner,” but with different layer thicknesses.

With respect to Example 4, Nishikawa states that “[a] separator for a nonaqueous secondary battery of the invention was *produced in the same manner* as in Example 1 *except that the aforementioned coating slurry was used.*” Ex. 1005, 22:37-40. (emphasis added). With respect to Example 5, Nishikawa states that “[a] separator for a nonaqueous secondary battery of the invention was *produced in the*

same manner as in Example 4 *except that the inorganic filler was changed to aluminum hydroxide (H-42M, produced by Showa Denko K.K.) having a particle size distribution of d90 of 1.07, d50 of 1.02 and d10 of 0.50 by laser diffraction.”* *Id.* 22:46-51 (emphasis added).

A POSA would have understood that the phrase “produced in the same manner,” in the context of Nishikawa’s Examples 1, 4, and 5, means using the same microporous membrane as that of Example 1, and using the same general fabrication steps and/or instruments, such as the same “Meyer bars”⁶ to coat the coating slurry onto the microporous membrane, but using different coating slurries made from different materials, which would not necessarily result in separators have the same properties, such as thickness. Ex. 2001, ¶ 84; Ex. 1005, 11:12-32, 15:49-16:44, 16:24-29, 22:8-54.

In fact, Nishikawa itself demonstrates that “in the same manner” does not result in the same thickness of the porous layer. For example, Examples 2 and 3 of Nishikawa are also described as having been “produced in the same manner” as Example 1 yet the porous layer thicknesses of these examples, which are actually based on a measured thickness of the separator (unlike the thicknesses for Examples

⁶ Nishikawa appears to misspell “Mayer bars” as “Meyer bars.” Ex. 2001 ¶ 84 n.4.

4 and 5 that Dr. Guido derives), are significantly different from that of Example 1: Example 2 lists 10.9 μm (for two layers) and Example 3 lists 8.5 μm (for one layer):

		Example 1	Example 2	Example 3
Coated surface		both surfaces	both surfaces	one surface
Weight per unit (g/m^2)		10.82	13.72	10.62
Coated amount (g/m^2)		3.83	6.73	3.63
Thickness Separator		17.8	22.4	20.0
(μm)	Polyethylene microporous membrane	11.5	11.5	11.5
	Heat resistant porous layer	6.3	10.9	8.5

Ex. 1005, Table 1.

A POSA would have understood that these measurements of layer thickness are made by measuring the overall thickness of the separator (as provided in Nishikawa's Table 1) and then subtracting the known 11.5 μm thickness of the microporous membrane substrate. Ex. 2001, ¶ 86. Thus, a POSA would have understood that one cannot separately determine the thicknesses of the individual layers in Examples 1 and 2, only a cumulative thickness of both layers. *Id.*

As Dr. Wheeler explains, the 10.9 μm thickness of the two layers of Example 2 is **73% larger** than the 6.3 μm thickness of the two layers of Example 1, despite the separator of Example 2 having been “*produced in the same manner as in Example 1* except that the aluminum hydroxide was changed to magnesium hydroxide having an average particle diameter of 0.8 μm .” Ex. 2001, ¶ 87; Ex. 1005, 16:48-49. Similarly, the 8.5 μm thickness of **one layer** of Example 3 is **35% larger** than the 6.3 μm thickness of **two layers** of Example 1, despite the separator of

Example 3 also having been “*produced in the same manner as in Example 1* except that the coating slurry was supplied from one side of the pair of Meyer bars to form a heat resistant porous layer on one surface of the polyethylene microporous membrane.” Ex. 2001, ¶ 87; Ex. 1005, 16:66-17:3. If the porous layer thickness of Example 3 were compared to the thickness of one porous layer of Example 1, which would presumably be *less* than the cumulative 6.5 μm for two combined porous layers (and which would be a more reasonable comparison), the difference would be even larger and more pronounced. Ex. 2001, ¶ 87.

As such, a POSA would have understood that the “produced in the same manner” language that Dr. Guido appears to rely on for his foundational assumption that the porous layer thicknesses of Examples 4 and 5 must be the same as that of Example 1, does not mean resulting in the same thickness (and that Nishikawa’s other examples suggest that the thicknesses would actually be different). Ex. 2001, ¶ 88. Further, because the coating slurries (including the resin material and inorganic filler material that are used for the porous layers) of Examples 4 and 5 differ from that used in Example 1, a POSA would have understood that the porous layer thicknesses of Examples 4 and 5, if measured, would be different from that of Example 1. *Id.* Lastly, a POSA would have understood that the only reliable way to measure the porous layer thicknesses of Examples 4 and 5, in the context of Nishikawa’s disclosure, would have been to directly measure them. *Id.* However,

Nishikawa does not provide such measurements. Without such measurements, the POSA would not have been able to derive the requisite thickness values to anticipate the claims and Petitioner's anticipation argument fails. *Id.*

b. Example 1, and Examples 4 and 5, Use Different Materials for the Coating Slurry

As explained above, a POSA would have understood that the types of filler material, binder, and solvent used to produce a porous layer can directly affect the structural and physical properties of the resulting porous layer, including thicknesses, as well as its performance characteristics. *Id.* ¶ 89.

As Dr. Wheeler explains, Nishikawa's Examples 4 and 5 use coating slurry materials that are *different* from those of Example 1, and thus a POSA would have expected the coating slurries of Examples 4 and 5 to result in porous layers that have physical, structural, and performance characteristics that are *different* from that of Example 1. *Id.* ¶ 91; Ex. 1005, 16:15-23. 22:10-43, 22:46-52.

In Table 1 below, Dr. Wheeler summarizes the different resin and inorganic filler materials used for the coating slurries of Examples 1, 4, and 5, based on Nishikawa's disclosure. Ex. 2001, ¶ 94; Ex. 1005, 16:15-23. 22:10-43, 22:46-52.

Nishikawa Example	Example 1	Example 4	Example 5
Resin Material	Conex (a meta-type wholly aromatic polyamide)	Poly-m-phenylene isophthalamide	Poly-m-phenylene isophthalamide
Inorganic Filler Material	Aluminum hydroxide (H-43M) having a particle size distribution of: d50 - 0.8	Aluminum hydroxide (H-43M) having a particle size distribution of: • d90 - 1.05 • d50 - 0.75 • d10 - 0.38	Aluminum hydroxide (H-42M) having a particle size distribution of: • d90 - 1.07 • d50 - 1.02 • d10 - 0.50

Table 1. Summary of Coating Slurry Materials of Nishikawa’s Examples 1, 4, and 5.⁷

As shown in Table 1 above, Nishikawa’s Examples 4 and 5 use poly-m-phenylene isophthalamide as a resin for the coating slurry, whereas Example 1 uses Conex, a commercial resin that is described as being a meta-type wholly aromatic polyamide, and Nishikawa presents these resin materials as distinct materials with different sources. Ex. 2001, ¶ 95. Nishikawa indicates that Example 1’s Conex “meta-type wholly aromatic polyamide” is a commercial product produced by Teijin Techno Products, without providing its manner of production, whereas the poly-m-phenylene isophthalamide of Examples 4 and 5 was produced by the inventors of

⁷ See Ex. 1003, 16:15-23, 22:10-43, 22:46-52.

Nishikawa themselves, describing its method of production. Ex. 2001, ¶ 95; Ex. 1005, 16:15-16, 22:10-26.

A POSA would have thus understood that the resin of Examples 4 and 5 is different from that of Example 1 by examining, for example, Example 8, which uses a resin made in the same exact manner as that of Example 4. Ex. 2001, ¶ 96. Example 8 is intended to contrast with Example 1 in that the only difference is the resin, and thus, any difference in outcomes between Example 8 and Example 1 in Nishikawa are indicated as being solely due to the different resins. Ex. 2001, ¶ 96; Ex. 1005, 15:49-16:44, 23:27-24:5. A POSA would thus conclude that Example 4, being made with the same resin as Example 8, would likewise depart from Example 1 in porous layer properties. Ex. 2001, ¶ 96; Ex. 1005, 22:10-26, 23:35-49. And in fact, the separator thickness of Example 8 has a total thickness of **20 μm** , while the separator thickness of Example 1 has a total thickness of **17.8 μm** (and also has substantially different air permeability and membrane resistance values from those of Example 1). Ex. 2001, ¶ 96; Ex. 1005, Table 1, 24:2-5. Again, this demonstrates that the thickness of Example 1 cannot be used for Examples 4 and 5.

In addition, a POSA would understand that the resins of Example 1 and Examples 4 and 5 would have different molecular weight distributions because they are from different polymer samples with different sources. Ex. 2001, ¶ 97. That is, as with weight-based particle size distributions that exist for powders based on the

different particle sizes in a powder sample, a polymer sample can also be characterized by its molecular weight distribution of polymer molecules having different molecular weights in that particular sample. *Id.* ¶ 97. As Dr. Wheeler explains, this occurs because when a polymer is produced, the number of repeat units in the polymer varies from one polymer molecule to the next, such that there is a distribution of the number of repeat units and molecular weights in any polymer sample. Furthermore, Nishikawa teaches that the distinct fraction of low-molecular-weight polymer (those with fewer repeat units such that molecular weight is less than 8000) in the resin is a significant indicator of outcomes. Ex. 1005, 8:20-25.

A POSA would have understood that a polymer sample's mechanical and thermal properties are sensitive to its molecular weight distribution. Ex. 2001, ¶ 98. Indeed, Nishikawa's Examples 8, 9 and 10 are intended to show the notable effect of changing the molecular weight distribution of poly-m-phenylene isophthalamide and to be compared to the effect of instead using Conex resin in Example 1. Ex. 1005, 23:27-25:14. The polymer sample's weight distribution in turn depends on how the polymer was prepared, including purity of raw materials, stoichiometric ratios of reactants, and reaction conditions such as temperature and time. Ex. 2001, ¶ 98. Thus, if any preparative steps for one resin differ from that of another resin, a POSA would necessarily conclude that the two resins have distinct behavior as adhesives and binders. *Id.* And because the resins of Example 1 and Examples 4 and

5 are different resin samples from different sources, a POSA would understand that they would have different properties. *Id.*

A POSA would have therefore understood that the resins of Example 1 and Examples 4 and 5 have different molecular weight distributions and that this translates into different slurry properties such as viscosity and different binding properties with solids. Ex. 2001, ¶ 100. A POSA would have understood that porous layers prepared using the different resins in Nishikawa would have different effective properties, including different thicknesses. *Id.*

(i) **Examples 1, and Examples 4 and 5, Use
Inorganic Filler Materials with Different D50
Values**

In addition, a POSA would have understood that although Nishikawa's inorganic filler materials for Examples 1, 4, and 5 all comprise aluminum hydroxide, they would result in different Dv90/thickness ratios because the three inorganic filler materials have different particle size distribution d50 values of 0.8, 0.75, and 1.02, respectively. Ex. 2001 ¶ 102, Table 1; Ex. 1005, 16:15-23, 22:10-43, 22:46-52.

A POSA would have understood from these observations that the porous layers of Examples 4 and 5 would not have the same thickness as the porous layer of Example 1.

c. The Dual Porous Layers of Example 1 Are Highly Non-Uniform and Uneven

Even assuming that the porous layers of Examples 4 and 5 were produced using the same coating slurry materials as those of Example 1, which is not the case, Petitioner's assumption and arguments fail because the thicknesses of the porous layers of Example 1 itself are highly non-uniform, uneven, and unreliable, as explained below.

(i) Mayer Bars Produce Highly Non-Uniform Coatings

Nishikawa explains, with respect to Example 1, that after the coating slurry is prepared, the coating slurry is placed on a pair of Mayer bars, and the microporous membrane is passed through the two Mayer bars:

A pair of Mayer bars (size number #6) were disposed to face each other with a gap of 20 μm . An appropriate amount of the coating slurry was placed on the Mayer bars, and the polyethylene microporous membrane was passed through the Mayer bars, thereby coating the coating slurry on both the surfaces of the polyethylene microporous membrane.

Ex. 1005, 16:24-29.

Nishikawa's Examples 4 and 5, which Dr. Gido points to as teaching the claimed Dv90/thickness range, had separators "produced in the same manner" as

that of Example 1. As such, a POSA would have understood that the porous layers of Examples 4 and 5 are also produced using the Mayer bars in the manner described above for Example 1. Ex. 2001, ¶ 105.

As Dr. Wheeler further explains, Mayer bars, although popular for their simplicity and efficiency, can result in substantial irregularities in the smoothness and thickness of the coatings. *Id.* ¶ 107. This is because a Mayer bar deposits a coating by rotation of its irregular outer surface adjacent to, and in some instances pressing against, a substrate, which necessarily leaves streaks or ribs in the coating. *Id.* Such nonuniformity is illustrated in the figure below, which shows the surface roughness (relative heights of peaks and valleys, relative to an arbitrary point of zero height) of an exemplary coating produced using a Mayer bar. *Id.*

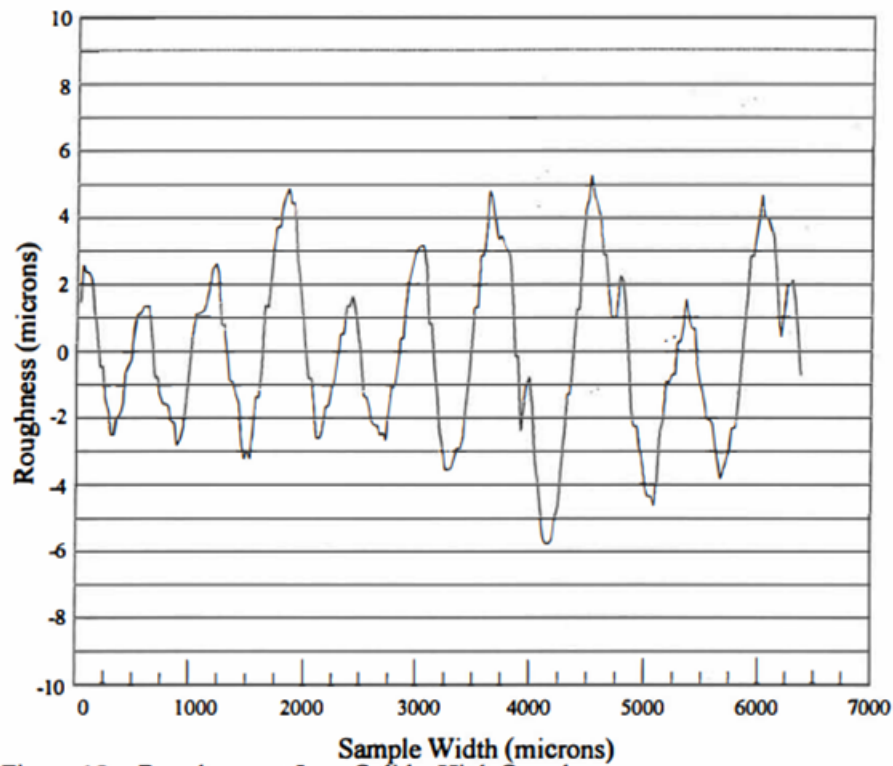


Figure 18. Roughness at Low Solids, High Speed.

Ex. 2017 at 68.

As Dr. Wheeler explains, the thinner the average coating thickness, the more pronounced the effect of the irregularities on the local properties of the coating. *Id.* ¶ 108. If the average coating thickness is low enough, the valleys shown in the figure above could represent regions with essentially *no* coating. *Id.* Dr. Guido’s declaration itself mentions that a POSA would avoid a procedure that would lead to a nonuniform coating with respect to the thickness of the coating. Ex. 1003, ¶ 128.

Nishikawa itself also states that Mayer bars should preferably be followed by “a pair of reverse rolls to scrape the excessive slurry” for improved coating uniformity. Ex. 1005, 11:22-32. But this modification to stand-alone Mayer bars was

not followed by Nishikawa. As such, a POSA would have understood that Nishikawa's porous layers are **not** uniformly coated.

(ii) **When Mayer Bars Are Used for Double Coating, the Non-Uniformity Is Even More Pronounced**

To obtain the alleged thickness of each porous layer in Examples 4 and 5, Dr. Gido subtracts the known thickness of the microporous membrane of Example 1, which is 11.5 μm , from the measured total thickness of the separator of Example 1, which is 17.8 μm , to obtain a total, combined thickness of the porous layer of 6.3 μm , which Dr. Gido takes as the “total thickness of the separator... which must account for a thickness of both heat resistant porous layers.” Ex. 1003, ¶100; Ex. 1005, Table 1. However, Dr. Gido then proceeds to make an unsupported and incorrect assumption that “[t]hus, each of both heat resistant porous layers has half that thickness, namely, 3.15 μm .” Ex. 1003, ¶ 100.

A POSA would not have made the assumption that Dr. Gido made because a POSA would have understood that when Mayer bars are used for double coating two surfaces of the same substrate, as Nishikawa does for Examples 1, 4, and 5, the thicknesses of the two porous layers will be inherently different from each other. Ex. 2001, ¶ 112-113. When Mayer bars are used for simultaneous coating of two surfaces of the same substrate, as Nishikawa does for Examples 1, 4, and 5, the unreliability and non-uniformity of the thicknesses of the dual porous layers will be

pronounced. *Id.* ¶ 113-115. As Dr. Wheeler explains, the unreliability is further amplified by the gap between Mayer bars of 20 μm and the 11.5 μm thickness of the microporous membrane leaving a substantial gap between the Mayer bars and the microporous membrane and resulting in a substantial variability in coating thicknesses. *Id.* ¶ 115.

As Dr. Wheeler explains, this view is reinforced by Nishikawa's own Example 3. Example 3 is intentionally made using the same exact resin material, the same exact aluminum hydroxide inorganic filler material having the same average particle diameter, and in a separator "produced in the same manner as in Example 1 except that the coating slurry was supplied from one side of the pair of Meyer bars to form a heat resistant porous layer on one surface of the polyethylene microporous membrane." Ex. 2001, ¶ 116; Ex. 1005, 16:66-17:3. A POSA would have observed that despite Example 3's separator being produced using the same resin and inorganic filler material as those of Example 1, with the only difference being that the porous layer is coated on one side as opposed to both sides of the substrate, Example 3 has a **single** porous layer thickness of 8.5 μm , which is 2.2 μm or **35% larger** than the combined thickness of 6.3 μm of the **dual** layers in Example 1, and 5.35 μm or **70% larger** than the alleged 3.15 μm thickness of each porous layer of Example 1 that is incorrectly derived by Dr. Guido. Ex. 1005, Table 1.

As such, a POSA would have understood that the top and bottom porous layers in Example 1 cannot be assumed to have the same thicknesses (as Dr. Guido assumes). *Id.* ¶ 117. Rather, a POSA would have understood that the only possible assumption that can be made regarding each individual porous layer, from the combined 6.3 μm thickness in Example 1, is that one of the two porous layers will have a thickness of between 0 and 6.3 μm , and the other porous layer will have a thickness equal to the difference between that first thickness and 6.3 μm . *Id.*

And even assuming that the weight particle size distribution d90 values of Examples 4 and 5 are equivalent to volume particle size distribution Dv90 values (as Dr. Guido incorrectly assumes, and which a POSA would know to be untrue), and that Examples 4 and 5 have the same combined total thickness for their porous layers of 6.3 μm (as Dr. Guido assumes without support, and which a POSA could not know to be true), the possible Dv90/thickness ranges in Nishikawa's Examples 4 and 5 still do not anticipate the claimed Dv90/thickness range of claim 1 because there are points within Nishikawa's ranges, even with such assumptions, that nevertheless fall outside of the claimed range. *Id.* ¶ 118. In Dr. Wheeler's Table 2 (reproduced below), he presents the results of his calculations of the porous layer thickness ranges in Examples 4 and 5 required to meet the claimed Dv90/thickness range using the d90 values disclosed in Nishikawa, and the possible porous layer thickness range of Example 4 and 5, which are broader than the former ranges required to meet the

claimed range. *Id.* The calculated thickness range required to meet the claimed range was obtained by inserting Nishikawa's d90 values for Examples 4 and 5 into the claimed Dv90/thickness range as follows:

Nishikawa's Example 4

$$0.3 < \text{Dv90/thickness} < 3$$

$$\text{and } d90 = 1.05$$

$$\text{therefore } 0.35 < \text{thickness} < 3.5$$

Nishikawa's Example 5

$$0.3 < \text{Dv90/thickness} < 3$$

$$\text{and } d90 = 1.07$$

$$\text{therefore } 0.36 < \text{thickness} < 3.6$$

Id.

Example	d90	Nishikawa's thickness value required to meet claimed Dv90/thickness range of 0.3 to 3	Nishikawa's possible thickness values
4	1.05	$0.35 < \text{thickness} < 3.5$	$0 < \text{thickness} < 6.3$
5	1.07	$0.36 < \text{thickness} < 3.6$	$0 < \text{thickness} < 6.3$

Table 2. Required and Actual Porous Layer Thickness Values of Examples 4 and 5 of Nishikawa.

Id. Table 2.

As shown above, even relying on the incorrect assumptions that Dr. Gido makes and taking all of Dr. Gido's assumptions to be true, there are a significant

number of possible thickness values of the porous layers of Examples 4 and 5 that fall outside of the thickness values required to meet the claimed range: 0-0.35 μm and 3.5-6.3 μm for Example 4, and 0-0.36 μm and 3.6-6.3 μm for Example 5. *Id.* ¶ 119. Without a showing of criticality, or any reason or indication why the thickness values would ***necessarily*** fall within the narrower, critical claimed range of the '987 Patent, which Nishikawa does not provide and which neither Petitioner nor Dr. Gido argued, Nishikawa cannot anticipate the thickness values required to meet the claimed Dv90/thickness range. *Atofina v. Great Lakes Chem. Corp.*, 441 F.3d 991, 999-1000 (Fed. Cir. 2006) (reversing a finding of anticipation because prior art's broad disclosure of temperature ranges of 100 to 500 °C and 150 to 350 °C did not anticipate the "critical" claimed narrower temperature range of 330 to 450 °C and finding that "no reasonable fact finder could conclude that the prior art describes the claimed range with sufficient specificity to anticipate this limitation of the claim").

The '987 Patent discloses multiple examples to demonstrate the importance of the disclosed and claimed range. Specifically, "[a]s can be seen from a comparison among examples 1-7 and comparative examples 1-2, the ratio of Dv90 of the inorganic particles to the thickness of the porous layer has an effect on the rate performance and cycle performance of the lithium-ion battery." Ex. 1001, 15:26-30. Comparative examples 1-2 have Dv90 to porous layer thickness ratio values of 0.2 and 3.2 (respectively), which are outside the claimed range of 0.3-3.0. Ex. 1001,

Table 1, Table 2; Ex. 2001, ¶ 120. The '987 patent further confirms that if “the ratio of Dv90 of the inorganic particles to the thickness of the porous layer is too high (for example, comparative example 2), the pore size distribution of the porous layer tends to be non-uniform, the surface of the porous layer is heterogeneous, the porous layer is easily detached from the surface of the porous substrate, and *defects are formed in the energy storage device (such as a lithium-ion battery)*” (Ex. 1001, 15:36-43) and “[i]f the ratio of Dv90 of the inorganic particles to the thickness of the porous layer is too low (for example, comparative example 1), the inorganic particles cannot be effectively exposed on the surface of the porous layer, which does not facilitate an exchange of the first solvent in the coating solution and the third solvent in the coagulating solution in the preparation process of the porous layer, cannot enhance diffusion, is not advantageous for the development of the pores, and *is also not advantageous for the improvement of the rate performance and cycle performance.*” Ex. 1001, 15:49-59.

For the reasons above, Petitioner has failed to show that Nishikawa's Examples 4 and 5 anticipate or render obvious the claimed Dv90/thickness range of claims 1 and 10.

3. Petitioner Fails to Show that Nishikawa Renders Obvious the Method Steps of Claim 10

Claim 10 of the '987 Patent recites:

10. A method for preparing the separator of claim 1,
wherein the method comprises steps of:

mixing inorganic particles with a binder to
generate a mixture;

adding a first solvent into the mixture;

stirring the mixture with the first solvent to
obtain a uniform coating solution; coating

the uniform coating solution onto a surface of
a porous substrate to form a wet film;

the coating solution is in a range from 7% to
25%; and

wherein a ratio of Dv90 of the inorganic
particles to the thickness of the porous layer
is in a range from 0.3 to 3.0.

Ex. 1001, Claim 10.

As shown above, the method steps of claim 10 recite: (1) mixing inorganic particles with a binder; then (2) adding *a first solvent* into the mixture; then (3) stirring the mixture with *the first solvent* to obtain a *uniform coating solution*.

Nishikawa does not disclose or render obvious a first solvent for the reasons below.

**a. Nishikawa Teaches Using a Mixed Solvent
Comprising DMAc and TPG, Not a Single DMAc
Solvent as Dr. Gido Alleges**

In addition to the above arguments regarding Claim 1, which apply equally to Claim 10, Claim 10 is not obvious in view of Nishikawa at least based on its recitation of the “first solvent.” Ex. 1001, Claim 10.

To allege that Nishikawa teaches the “first solvent” of claim 10, Dr. Gido states:

The solvent *Nishikawa* describes, dimethylacetamide, is one embodiment of the claimed “first solvent” described in the '987 patent. *Compare Nishikawa, 22:26-33 with '987 patent, 2:35-38.* A POSA would have understood this to teach adding a solvent, the dimethylacetamide, to the mixture of the inorganic filler containing aluminum hydroxide with the poly-m-phenylene isophthalamide resin..

Ex. 1003, ¶ 64.

Dr. Gido's citation to Nishikawa at Ex. 1005, 22:26-33, however, relies on Nishikawa's express teaching of mixing a poly-m-phenylene isophthalamide and inorganic filler mixture with a “*mixed solvent* containing *dimethylacetamide (DMAc)* and *tripropylene glycol (TPG)* at a *weight ratio of 50/50*” for Examples 4 and 5. Ex. 1005, 22:26-33, 22:46-51. In other words, Dr. Gido's citation confirms

that Nishikawa expressly discloses a mixed solvent comprising 50/50 DMAc/TPG and not simply dimethylacetamide (as alleged by Dr. Gido). Ex. 2001, ¶ 126. Yet without providing any reasoning or explanation, Dr. Gido asserts that a POSA would have understood from the express teaching of a 50/50 DMAc/TPG *mixed* solvent, that Nishikawa teaches using a single DMAc solvent. *Id.*

Nishikawa explains that a polar solvent such as the DMAc of Examples 4 and 5, and a poor solvent such as the TPG of Examples 4 and 5, are intentionally *used together* to “induce[] a microscopic phase separation structure to facilitate formation of pores upon providing the heat resistant porous layer.” Ex. 1005, 11:1-7. A POSA would have thus understood that Nishikawa’s express requirement of a mixed solvent comprising 50/50 DMAc/TPG in Examples 4 and 5 is intentional and is required by Nishikawa to achieve the solvent, coating slurry, and separator properties of Examples 4 and 5. *Id.* ¶ 127. A POSA would have understood that such properties can only be achieved by the complex chemical interactions that occur between Nishikawa’s mixed solvent comprising 50/50 DMAc/TPG, and Nishikawa’s resin. *Id.* A POSA would have thus understood that using just a DMAc solvent as Dr. Gido suggests, instead of the 50/50 DMAc/TPG mixed solvent that Nishikawa requires, would not result in the same or equivalent coating slurry, porous layer, and separator properties of Nishikawa’s Examples 4 and 5. *Id.*

As such, a POSA would have no reason and would not have used a single DMAc solvent instead of the 50/50 DMAc/TPG mixed solvent expressly disclosed in Examples 4 and 5 of Nishikawa. *Id.* ¶ 128.

**b. Nishikawa’s 50/50 DMAc/TPG Mixed Solvent
Teaches Away From Obtaining a Uniform Coating
Solution**

In addition, a POSA would not have considered the claimed “first solvent” to be obvious in view of Nishikawa’s 50/50 DMAc/TPG mixed solvent of Examples 4 and 5, because such a mixed solution would not result in the “uniform coating solution” recited in claim 10. Ex. 2001, ¶ 129; Ex. 1001, Claim 10. Specifically, claim 10 expressly recites that the “first solvent” is stirred with the mixture of inorganic particles and binder “to obtain a *uniform coating solution*.” Ex. 1001, claim 10. The ’987 Patent also emphasizes the importance of achieving a uniformly coated porous layer. *Id.* 5:43-49, 6:31-32. A POSA would have understood that a more uniform coating solution would result in a more uniformly coated porous layer and would have thus understood the importance of using the claimed “first solvent” to obtain the claimed “uniform coating solution.” Ex. 2001, ¶ 129.

Nishikawa’s 50/50 DMAc/TPG mixed solvent, on the other hand, comprises *an entire fifty percent by weight poor solvent*, namely TPG. A POSA would have interpreted Nishikawa’s “poor solvent” as a solvent in which Nishikawa’s resin is not completely soluble whereas a good solvent would dissolve the resin to a much

greater degree, if not completely. *Id.* ¶ 130. A POSA would have further understood that when a mixed solvent comprising a poor solvent and a good solvent is mixed with Nishikawa's resin, there would be competition between the good solvent's resin-dissolving behavior, and the poor solvent's poor resin-dissolving behavior. *Id.*

A POSA would understand from Nishikawa's own teachings that the presence of 50 percent by weight of poor solvent TPG in Nishikawa's 50/50 DMAc/TPG mixed solvent would result in an irregular phase structure and the formation of irregular pores with variable sizes and locations and not to the formation of a uniform coating solution as recited in claim 10. *Id.* ¶ 131-32. Indeed, Nishikawa states that "[t]he solvent may contain the polar solvent and additionally a poor solvent to the heat resistant resin, and the addition of the poor solvent induces a microscopic phase separation structure to facilitate formation of pores upon providing the heat resistant porous layer." Ex. 1005 11:1-5.

As such, a POSA would have understood that the claimed "first solvent" is a solvent that is able obtain a "uniform coating solution" as recited in claim 10, whereas Nishikawa's mixed solvent intentionally comprises fifty percent by weight of a poor solvent TPG, and thus cannot result in the claimed uniform coating solution. In addition, a POSA would have understood that Nishikawa's 50/50 DMAc/TPG mixed solvent would result in a significantly different morphology of pores in Nishikawa's coated layer from those of the claimed porous layer made using

the claimed “first solvent.” Ex. 2001, ¶ 133. Thus, a POSA would have no reason to use Nishikawa’s DMAc/TPG mixed solvent.

For the above reasons, a POSA would have found that Nishikawa does not render obvious the claimed “first solvent” of claim 10.

4. Claims 2, 4-9, and 11-17 Are Not Unpatentable

Claims 2, 4-9, and 11-17 are not unpatentable for the same reasons as discussed above with respect to claims 1 and 10. Petitioner does not rely on any other references to meet the limitations of the independent claims. Patent Owner reserves the right to address claims 2, 4-9, and 11-17 individually if this proceeding is instituted.

B. Ground 4: Iwai Does Not Anticipate Claims 1-2 and 4-9

1. Petitioner contends that Iwai anticipates claims 1-2 and 4-9 of the '987 Patent. These claims recite:

1. A separator, comprising: a porous substrate; and
a porous layer arranged on a surface of the porous substrate, wherein the porous layer comprises inorganic particles and a binder, and a ratio of Dv90 of the inorganic particles to the thickness of the porous layer is in a range from 0.3 to 3.0.
2. The separator according to claim 1, wherein the porous layer has a thickness of 0.2 μm to 10 μm .
4. The separator according to claim 1, wherein a volume ratio of the inorganic particles to the binder is in a range from 0.2 to 3.0.

5. The separator according to claim 1, wherein the porous layer has a porosity of 20% to 90%.

6. The separator according to claim 1, wherein the inorganic particles are one or more selected from the group consisting of alumina, silica, magnesia, titanium oxide, hafnium dioxide, tin oxide, zirconia, cerium dioxide, nickel oxide, zinc oxide, calcium oxide, boehmite, aluminum hydroxide, magnesium hydroxide, calcium hydroxide, and barium sulfate.

7. The separator according to claim 1, wherein the binder is one or more selected from the group consisting of polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylate, polyacrylic acid, polyacrylates, sodium carboxymethylcellulose, polyvinylpyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene and polyhexafluoropropylene.

8. An energy storage device, comprising the separator according to claim 1.

9. The energy storage device according to claim 8, wherein the energy storage device is a lithium-ion battery.

1. Petitioner Fails to Show that Iwai Anticipates Claim 1

Dr. Gido points to Iwai's Example 7 and Comparative Example 2, and argues, that based on the "thickness a" and an assumed D90 apparently derived from "D90-D10" values of these examples, Iwai anticipates claim 1. Ex. 1003, ¶¶ 156-175.

Specifically, Dr. Gido alleges that "*Iwai* defines 'volume average particle diameter' ["r"] as 'a particle diameter at 50% cumulative volume calculated from a smaller side in a volume particle size distribution'" and points to the r values of

Example 7 and Comparative Example 2. *Id.* ¶¶ 159, 167. Dr. Gido then notes that “*Iwai* defines D10 as ‘a particle diameter at which a cumulative volume of particles reaches 10% from a smaller side in a volume particle size distribution’” and assumes that “[a] POSA would have recognized that D10 for *Iwai*’s Example 7 separator must be greater than 0, because it would not be possible for particles at 10% of the inorganic filler volume to have a particle diameter of 0.” *Id.* ¶ 160. Dr. Gido then assumes that “a POSA would have recognized that D10 for *Iwai*’s Example 7 separator must be less than the volume average particle diameter of the inorganic filler for *Iwai*’s Example 7 separator, because it would not be possible for the particle diameter at 10% cumulative volume to be more than the particle diameter at 50% cumulative volume” and “[t]hus, a POSA would have recognized that D10 for *Iwai*’s Example 7 separator must be less than 1.2µm.” *Id.* Based on this assumption Dr. Gido then deduces that “[t]hus, a POSA would have recognized, D90 for *Iwai*’s Example 7 separator must be greater than 1.6µm and less than 2.8µm,” and that the Dv90/thickness ratio of Example 7 must be greater than 0.72 and less than 1.27. *Id.* ¶¶ 164-65. Dr. Gido then notes that based on similar calculations, a D90 value of Comparative Example 2 can be deduced to be between 1.1 µm and 1.9 µm, and a Dv90/thickness ratio of Comparative Example 2 can be deduced to be between 0.35 and 0.61. *Id.* ¶¶ 166-175.

A POSA would not have made the assumptions and deductions Dr. Gido made. Not only that, but even if a POSA wanted to deduce a Dv90 value from Iwai's D90-D10 value, they would not have been able to do so, because there is not enough information in Iwai to allow such derivations.

a. Iwai Does Not Disclose a Dv90 Value

Iwai does not disclose a Dv90 value, let alone a Dv90/thickness range. Petitioner admits as much and relies on a series of assumptions and calculations to derive a particular range of alleged Dv90 values. Pet. at 47-48. Instead, at best, Iwai discloses a D90 – D10 *difference*. In particular, Iwai discloses “a *difference* between *a particle diameter at 90% cumulative volume of the filler* and *a particle diameter at 10% cumulative volume* of the filler being 2 μm or less.” Ex. 1006, ¶ [0035]; *see also id.* abstract, [0021], [0041]-[0042], Table 1. Iwai never discloses that a specific Dv90 (or D90) value must be considered to achieve any of its advantages or benefits, as the '987 Patent does—the improvement of rate or cycle performance of the battery. Ex. 1001, 15:26-36, Table 2. Because Iwai does not expressly disclose the claimed Dv90, Dr. Gido appears to resort to various assumptions, calculations and derivations regarding D10, volume average particle diameter, and D90 values to provide a range of potential D90 values, as described above. Iwai, however, never suggests or directs a POSA to conduct an analysis to determine D90 and does not provide enough information for a POSA to make such a determination. A POSA

reading Iwai would have no reason to make such assumptions and perform the calculations and derivations that Dr. Gido makes and performs. Ex. 2001, ¶ 140-43.

b. Iwai Does Not Disclose the Porous Layer Thickness of Claim 1

Petitioner also fails to show that Iwai anticipates claim 1 because Iwai does not disclose the porous layer thickness of claim 1.

Dr. Gido points to Iwai's "Average thickness a (um) of adhesive porous layer" for Example 2 and Comparative Example 2 as a thickness that is equivalent to the claimed porous layer thickness. Ex. 1003, ¶¶ 165, 174. At best, Iwai describes "thickness a" as "an average thickness (um) of the adhesive porous layer on one of the sides of the porous substrate." Ex. 1006, ¶ [0037].

As described below, however, not only is the "thickness a" of Iwai's Example 7 and Comparative Example 2 that Petitioner points to a different measurement from that of the claimed porous layer thickness, but the thickness of Iwai's adhesive porous layer and separator is intentionally highly irregular. Ex. 1006, Table 2, ¶¶ [0037], [0043]-[0045], [0096], [0098], [0170]-[0171]. That is, it is Iwai's *objective* to provide filler particles that result in "*irregular* portions... on the surface of the adhesive porous layer." *Id.* [0096]; *see also id.* [0098]. This renders Iwai's thickness a unreliable and inaccurate as a measure of the claimed porous layer thickness. Ex. 2001, ¶ 145.

(i) **The Thickness “a” in Iwai Is the Thickness of the Resin Layer Without Accounting for the Filler Particles**

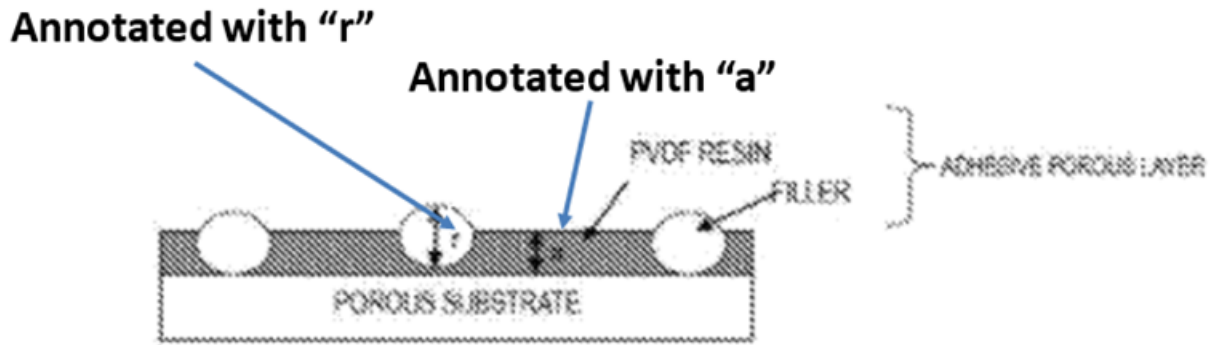
Petitioner points to Iwai’s “thickness a” from Iwai’s Table 1 as being equivalent to the porous layer thickness of claim 1. Ex. 1003, ¶¶ 165, 174; Ex. 1006, Table 1. Iwai’s “thickness a,” however, constitutes the thickness of only Iwai’s PVDF resin, without accounting for the “volume average particle diameter r” of the filler particles, which are intended to protrude above the adhesive, especially when their diameter r is greater than the thickness a of the resin layer. Ex. 1006, [0037], [0043]-[0045].

Iwai explains that the filler particle projecting, or protruding, from the surface of the adhesive porous layer, provides desirable advantages, noting that when the ratio “a/r” is between 0.5 to 3.0, “a state in which the filler is *projected at a proper height is formed on a surface of the adhesive porous layer* can be achieved,” which results in a separator with “favorable slidability” and “good handling property.” Ex. 1006, ¶ [0043]. Iwai then describes the disadvantages that occur when the filler particle does not protrude from the adhesive porous layer, noting that “in a case in which the ratio a/r exceeds 3.0, the filler is hardly projected from the surface of the adhesive porous layer, and slidability is hardly provided to the separator. As a result, a wrinkle is generated when conveying the separator, or a gauge band develops when

winding the separator. Therefore, the handling property of the separator is insufficient.” *Id.* ¶ [0045].

A POSA would have understood from these disclosures in Iwai, that unlike the porous layer thickness of the ’987 Patent which measures the combined thickness of the binder plus inorganic particles that make up the porous layer, Iwai’s “thickness a” is a measure of just the adhesive porous layer portion, without accounting for any contribution to thickness from the filler particles whose “diameter r” values are in fact desired to be sufficiently large that the particles protrude significantly from the background adhesive layer, thus rendering the “thickness a” unreliable as a measure of the entire porous layer. Ex. 2001, ¶ 148.

In fact, during prosecution of Iwai, Iwai confirmed what was meant by “thickness a.” Specifically, Iwai confirmed that “‘a’ represents an average thickness (um) of the adhesive porous layer” and “‘r’ represents a volume average particle diameter (um) of the filler contained in the adhesive porous layer,” providing the illustration below, which shows a volume average particle diameter “r” that is desirably larger than the thickness “a” of the adhesive porous layer:



Ex. 2019 at 30 (annotated with “a” and “r” annotations by Iwai during prosecution).

As clearly labeled in the illustration above, thickness a only accounts for the resin matrix and does not account for contributions to the overall layer thickness from protruding filler particles of diameter r . Ex. 2001, ¶ 150.

Iwai further confirmed that its advantages can be achieved when the thickness r of the filler and thickness a of the PVDF resin have a ratio such that the filler projects out from the adhesive porous layer, as shown in the excerpts from the prosecution history below:

The separator of the present invention achieves good adhesiveness to an electrode, along with exhibiting a good handling property derived from a favorable slidability caused by the projections of the filler by satisfying both of conditions (i) and (ii).

Ex. 2019 at 75.

... when the thickness of an adhesive layer containing a filler and particle sizing of the filler satisfies condition (ii),

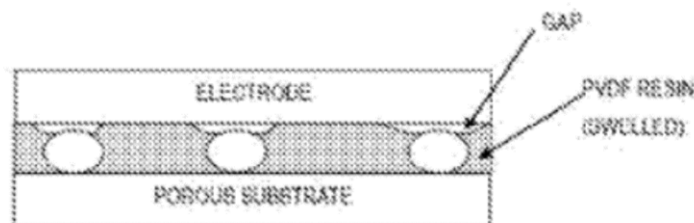
the filler is projected at a certain height on a surface of the adhesive layer. The projections of fillers form small gaps in an electrode/adhesive layer interface when a separator having the adhesive layer is stacked with an electrode in a battery.

Id.

In summary, the separator of the present invention uses filler particles having a uniform size and adjusts the relationship between an average thickness of the adhesive porous layer (a) and the filler particle size (r) so that the filler particles suitably project from a surface of the adhesive porous layer.

Id. at 30.

Furthermore, the prosecution history of Iwai indicates that in Iwai, the formation of gaps as a result of such filler particle protrusions when an electrode is stacked, is a desired characteristic, as such gaps improve the cycle characteristics of the battery. *Id.* The prosecution history of Iwai provides the following illustration to support these statements:



Id.

As shown above, Iwai's thickness *a* is a thickness of just the adhesive layer, and Iwai's diameter *r* of the filler particle is desired to protrude out from the adhesive layer so as to provide an inherently irregular surface, and so as to produce gaps between the electrode and separator when the electrode is stacked. A POSA would have understood that these are completely different technical aims from those of the '987 Patent, where the claimed thickness is a *uniform thickness of the porous layer that accounts for both the binder and inorganic particles*, and which desires to *eliminate gaps between the separator and electrode* through an appropriate porous layer thickness to prevent a reduction in the cycle capacity and safety performance of the lithium-ion battery. Ex. 2001, ¶ 153; Ex. 1001, 1:27-31, 5:1-12. In fact, the '987 Patent explains that a non-uniform porous layer surface is undesirable because it "makes the porous layer easy to detach from the surface of the porous substrate and forms defects in the energy storage device (such as a lithium-ion battery)." Ex. 1001, 5:46-49.

(ii) **Iwai's Surface Roughness Indicates that Its Adhesive Porous Layer Is Highly Non-Uniform**

Iwai discloses a non-uniform adhesive porous layer. Ex. 1006, ¶ [0068] ("In the invention, a surface roughness of the adhesive porous layer is preferably from 0.8 μm to 8.0 μm , more preferably from 0.9 μm to 6.0 μm , and still more preferably

from 1.0 μm to 3.0 μm , in terms of the ten-point mean roughness (Rz).”). Iwai quantifies the result of its intentionally irregular and non-uniform thickness by disclosing surface roughness values for the separators of its examples and comparative examples. Ex. 1006, Table 2, ¶¶ [0170]-[0171].

In Example 7, for example, the thickness *a* of the resin layer (i.e., adhesive porous layer) is **2.2 μm** , and the surface roughness of the separator is **1.7 μm** . *Id.* Table 1, Table 2. A POSA would have understood that such surface roughness indicates that the external surface of the porous layer, which is made up of the adhesive porous layer and protruding filler particles, will vary by at least half of such surface roughness, i.e., +/- 0.85 μm . Ex. 2001, ¶ 155. A POSA would have further understood, that such a surface roughness value, in view of the relative thickness *a* of 2.2 μm , indicates that the thickness *a* of Iwai’s Example 7 is **highly irregular**, not uniform, and is not a reliable thickness value. *Id.*

In Comparative Example 2, the thickness *a* of the resin layer (i.e., adhesive porous layer) is 3.1, while the surface roughness of the separator is 1.3. Ex. 1006, Table 1, Table 2. A POSA would have understood that such surface roughness indicates that the external surface of the porous layer, which is made up of the adhesive porous layer and protruding filler particles, will vary by at least half of such surface roughness, i.e., +/- 0.65 μm . Ex. 2001, ¶ 156. A POSA would have understood that such a surface roughness value, in view of the thickness *a* of 3.1 μm ,

indicates that the thickness *a* of Iwai's Comparative Example 2 is ***highly irregular***, not uniform, and is not a reliable thickness value. *Id.*

These effects and indications are even more pronounced in Iwai's other examples. In Example 2, for example, the thickness *a* is 1.1 μm , while the surface roughness is 2.8 μm . Ex. 1006, Table 1, Table 2. In Example 6, the thickness *a* is 3.0 μm , while the surface roughness is 4.2. *Id.* A POSA would have understood that such thickness *a* and surface roughness values strongly indicate that Iwai's adhesive layer and separator are not intended to be of uniform and regular thickness, but rather, of a highly irregular and rough surface and thickness. Ex. 2001, ¶ 157.

Iwai also discloses a difference of coating amounts on each side. For example: "In the invention, in a case in which the adhesive porous layer is provided on both sides of the porous substrate, a difference between the coating amount on one side and the coating amount of the other side is preferably 20% or less with respect to the total amount of the coating amounts on both sides." Ex. 1006, ¶ [0071]. A POSA would have understood that this further adds to the uncertainty of the thickness of Iwai's adhesive porous layer especially given the wide ranges proposed by Petitioner. Ex. 2001, ¶ 158. Again, this lack of specificity and the extreme variability in Iwai cannot support a case of anticipation.

For the above reasons, a POSA would have understood that Iwai's thickness *a* is not a reliable nor an accurate reflection of the claimed porous layer thickness,

and Petitioner has failed to show that Iwai anticipates the claimed Dv90/thickness range of claim 1.

2. Claims 2-9 Are Not Unpatentable

Claims 2-9 are not unpatentable for the same reasons as discussed above with respect to claim 1. Petitioner does not rely on any other references to meet the limitations of independent claim 1. Patent Owner reserves the right to address claims 2-9 individually if this proceeding is instituted.

VII. THE BOARD SHOULD NOT INSTITUTE INTER PARTES REVIEW UNDER § 314(A) BASED ON THE *FINTIV* FACTORS

In addition to the underlying failures of the Petition, the Board should deny institution under *Apple v. Fintiv, Inc.*, No. IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020) (precedential).

Factor 1 is neutral. In the Eastern District of Texas where Patent Owner is asserting the '987 Patent against Petitioner, a stay pending institution of this IPR has not been requested, and even if requested is unlikely to be granted. The Board should not infer the outcome of such a motion. *Sand Revolution II LLC v. Continental Intermodal Grp. – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (P.T.A.B. June 16, 2020) (informative).

Factor 2 weighs against institution because a trial date is already scheduled to occur in the district court on February 5, 2024, about eight months before the

September 29, 2024 statutory deadline for the Board to issue a final written decision in this IPR (assuming that the Board issues an institution decision on September 29, 2023). Ex. 1022. Even Petitioner agrees that trial will occur prior to final written decision when considering median time-to-trial. Pet. at 65. The Board has denied institution in view of similar or smaller gaps between the final written decision and trial. *See, e.g., EClinicalWorks, LLC v. Decapolis LLC*, IPR2022-00229, Paper 10 at 9 (P.T.A.B. Apr. 13, 2022) (finding this factor weighed in favor of discretionary denial and denying institution where “the beginning of the jury trial in the WDTX Cases is roughly one or two months before any final decision would have been due had *inter partes* review been instituted”); *Samsung Elecs. Co., Ltd. v. California Inst. of Tech.*, IPR2023-00130, Paper 10 at 16 (P.T.A.B. May 4, 2023) (finding this factor weighed in favor of discretionary denial and denying institution where trial in the underlying litigation would commence approximately eight months under the court’s scheduling order, or approximately five months under the time-to-trial statistics for the court, before the expected date of the final written decision); *Roku, Inc. v. IOENGINE, LLC*, IPR2022-01553, Paper 11 at 10-11 (P.T.A.B. May 5, 2023) (finding this factor weighed in favor of discretionary denial and denying institution where trial in the underlying litigation would commence approximately seven months under the court’s scheduling order, or approximately six months under the

time-to-trial statistics for the court, before the expected date of the final written decision).

Factor 3 also weighs against institution because there are significant ongoing efforts in the parallel litigation, and there will be significant efforts that will be expended by the expected institution decision date of September 29, 2023. For example, fact discovery has been ongoing since December 2022 and will close in mid-September 2023, before the expected institution decision date. Specifically, the parties expect to have taken six depositions of both fact and expert witnesses in June 2023 alone, on topics relating to claim construction, validity, conception, reduction to practice, inventorship, working examples, practicing products, and document retention, many of which are also topics under Fed. R. Civ. P. 30(b)(6). By late September, Patent Owner will have taken at least six additional depositions of CosMX witnesses. Most of these depositions have been (and will be) taking place in Hong Kong due to local laws, with dozens of witnesses and counsel flown from China and the U.S. each time. Meanwhile, the parties have already produced a combined total of over 200,000 documents (2,000,000+ pages) and are in the process of exchanging physical samples of relevant products shipped from their respective factories abroad. Third-party discovery is also ongoing, with over 15 third-parties having been subpoenaed to date. On expert discovery, the parties have disclosed at least seven expert witnesses, whose initial reports will have been completed by

September 18, 2023 (with rebuttal reports due shortly thereafter). The parties have also exchanged their respective infringement and invalidity contentions. By mid-August, claim construction will have been completed, and the parties will be working towards pretrial dispositive motions (due in October 2023). In short, the parallel district court litigation is *already* in an advanced stage and will be in an even more advanced stage by the time an institution decision is expected to issue.

Factor 4 also weighs strongly against institution because Nishikawa and U.S. Pat. No. 9,799,868, which is the issued patent of Iwai (Nishikawa and Iwai being the sole primary prior art references asserted in this IPR), are also being asserted by Petitioner in its Invalidity Contentions at the Eastern District of Texas (where trial will be long complete before any final written decision here). In addition, there is substantial overlap in how these references are being asserted at the district court, and in this IPR—for example, Petitioner points largely to the same disclosures in each prior art reference, in both the district court, and in this IPR. Petitioner has filed no stipulation.

Factor 5 also weighs against institution because the Petitioner is the accused infringer and defendant, while Patent Owner is the plaintiff, in the district court litigations. Ex. 1020, 1 (case caption); Ex. 1021 (case caption).

Factor 6 weighs against institution because the Petition is weak. It has numerous erroneous, unsupported, and inaccurate assumptions and arguments,

including the erroneous assumption that Nishikawa's weight particle size distribution d90 is equivalent to the claimed volume particle size distribution Dv90, the erroneous assumption that the porous layer thicknesses of Nishikawa's Examples 4 and 5 are exactly one half of the porous layer thickness of Example 1, the erroneous argument that Nishikawa's 50/50 DMAc/TPG "mixed solvent" reads on the claimed "first solvent" of claim 10 which requires a single solvent, the erroneous assumptions made in order to derive a Dv90 value from Iwai's D90-D10 difference, and the erroneous and unsupported argument that Iwai's "thickness a" is equivalent to the claimed porous layer thickness, let alone a uniform and reliable thickness value at that. To be clear, Petitioner did not and cannot fix the clear lack of disclosure in its asserted references. Given that these numerous deficiencies fail to meet the *likelihood of success* standard, they certainly fail to meet the higher *compelling* standard, which requires challenges "in which the evidence, if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence." *Commscope Techs. LLC v. Dali Wireless, Inc.*, IPR 2022-01242, Paper 23 at 3 (P.T.A.B. Feb. 27, 2023) (citing USPTO Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation at 4. (June 21, 2022) ("Guidance Memo").)

VIII. CONCLUSION

For the reasons noted above, Patent Owner respectfully submits that the Board should deny institution of all Grounds of the Petition.

Dated: June 29, 2023

Respectfully submitted,

By: / Christopher TL Douglas /

Christopher TL Douglas, Reg. No. 56,950

CERTIFICATION UNDER 37 C.F.R. §42.24

Pursuant to 37 C.F.R. §42.24(d), I certify that this reply complies with the type-volume limits of 37 C.F.R. §42.24(c)(1) because it contains 13,484 words, according to the word-processing system used to prepare this reply, excluding the parts of this reply that are exempted by 37 C.F.R. §42.24(c) (including the table of contents, a table of authorities, a listing of facts which are admitted, a certificate of service or this certificate word count, and appendix of exhibits).

Dated: June 29, 2023

By: / Christopher TL Douglas /
Christopher TL Douglas

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §42.6(e), the undersigned hereby certifies that a copy of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE** was served by filing this document through the PTAB's E2E Filing System as well as delivering a true and correct copy by electronic mail on Patent Owner's lead and backup counsel at the following email addresses (as agreed by counsel for Patent Owner):

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Dated: June 29, 2023

By: / Christopher TL Douglas /
Christopher TL Douglas