

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

IPR2025-00432
Patent 11,575,148

PATENT OWNER'S PRELIMINARY RESPONSE

TABLE OF CONTENTS

I.	INTRODUCTION	7
II.	BACKGROUND	11
A.	Technology Overview	11
B.	The '148 Patent	12
III.	LEGAL STANDARDS.....	13
IV.	LEVEL OF ORDINARY SKILL IN THE ART	14
V.	CLAIM CONSTRUCTION.....	14
VI.	THE BOARD SHOULD NOT INSTITUTE <i>INTER PARTES</i> REVIEW.....	15
A.	Ground 1: Murakami Does Not Render Obvious Claims 1, 2, 5- 11, and 14-19.....	15
1.	The Petition Fails to Show that Murakami Discloses or Renders Obvious Pores “Formed by the Binder” as Recited in Claim Elements [1.3] and [10.8]	15
a.	The Plain Meaning of “Pores Formed By a Binder”	16
b.	Murakami Fails to Disclose Any Imaging Showing that a Binder Defines the Structure of Pores	18
c.	If anything, Murakami Discloses Pores Formed by Inorganic Particles, Not a Binder	20
(i)	Paragraph 70 of Murakami Teaches Away From Using a Binder to Form Pores	20
(ii)	Murakami Teaches that the Pores Are Formed By Inorganic Particles, Not a Binder.....	21
d.	Murakami’s Process of Making Its Porous Layer Does Not Create “Pores Formed by the Binder”	23

2.	The Petition Fails to Show that Murakami Discloses or Renders Obvious “Pores At Least Comprise[] a Part of the Inorganic Particles” as Recited in Claim Elements [1.4] and [10.9].....	25
3.	The Petition Fails to Show That Murakami Discloses or Renders Obvious the Claimed Particle Size Distributions of the Inorganic Particles <i>In</i> the Porous Layer as Required by Claim Elements [1.5]-[1.9] and [10.10]-[10.14]	27
a.	The Plain Meaning of the Claims Require the Dv10, Dv50, and Dv90 Values to Be Satisfied By the Particles <i>In</i> the Porous Film.....	27
b.	Murakami Does Not Provide Particle Sizes of Inorganic Particles When Those Particles are Part of a Porous Film.....	29
4.	The Petition Fails to Show that Murakami Discloses or Render Obvious the “Ratio of Dv90 to Dv10” as Recited in Claim Elements [1.10] and 10.15].....	32
B.	Ground 2: Murakami and Honda Do Not Render Obvious Claims 3 and 12.....	34
C.	Ground 3: Murakami and Tanaka Do Not Render Obvious Claims 4 and 13	35
D.	Ground 4: Murakami and Beard Do Not Render Obvious Claims 1, 2, 5-11, and 14-19.....	35
1.	Neither Beard Nor Murakami Disclose or Render Obvious Pores that “At Least Comprise[] a Part of the Inorganic Particles”.....	36
a.	“Pores . . . At Least Comprise a Part of the Inorganic Particles” Requires At Least Some of the Inorganic Particles to Extend Into the Pores	37

b.	The Particles In Beard’s Preferred Embodiment Are, At Best, Part of the Walls that Define the Pores and Not Part of the Pores Themselves.....	38
c.	The Particles In Beard’s Alternative Embodiment Define the Pore Structure, Such that Beard’s Alternative Disclosure Lacks “Pores Formed by the Binder”	41
2.	Petitioner Fails to Show That a POSITA Would have Combined Beard with Murakami to Arrive at the Claimed Invention.....	43
3.	Even if Combined, Petitioner’s Ground Fails.....	48
E.	Ground 5: Murakami, Beard, and Honda Do Not Render Obvious Claims 3 and 12	50
F.	Ground 6: Murakami, Beard, and Tanaka Do Not Render Obvious Claims 4 and 13	51
G.	Ground 7: Beard and Akiike Do Not Render Obvious Claims 1- 3, 5-12, and 14-19.....	51
1.	Neither Beard nor Akiike Disclose or Render Obvious “The Pores At Least Comprise[] a Part of the Inorganic Particles”	51
2.	Petitioner Fails to Show That a POSITA Would have Combined Akiike with Beard to Arrive at the Claimed Invention	52
3.	Even if Combined, Petitioner’s Ground Fails.....	57
H.	Ground 8: Beard, Akiike, and Tanaka Do Not Render Obvious Claims 4 and 13	59
VII.	CONCLUSION	59

TABLE OF AUTHORITIES

	Page(s)
CASES	
<i>Apple Inc. v. Carbyne Biometrics, LLC</i> , IPR No. 2024-00334, Paper 26 (P.T.A.B. May 22, 2025)	16
<i>Chevron Oronite Co. v. Infieum USA LP</i> , IPR2018-00923, Paper 9 (P.T.A.B. Nov. 7, 2018) (informative)	59
<i>E Ink Corporation v. Research Frontiers Incorporated</i> , IPR2014-00422, Paper 6 (P.T.A.B. Aug. 14, 2014).....	33
<i>E.I. du Pont de Nemours & Co. v. Synvina C.V.</i> , 904 F.3d 996 (Fed. Cir. 2018)	33
<i>Hockerson-Halberstadt, Inc. v. Avia Group Int’l</i> , 222 F.3d 951 (Fed. Cir. 2000)	38
<i>In re Magnum Oil Tools Int’l, Ltd.</i> , 829 F.3d 1364 (Fed. Cir. 2016)	14
<i>Microsoft Corp. v. Secure Web Conf. Corp.</i> , IPR2014-00745, Paper 12 (P.T.A.B. Sept. 29, 2014).....	14
<i>Phillips v. AWH Corp.</i> , 415 F.3d 1303 (Fed. Cir. 2005) (en banc)	16
<i>Sirona Dental Sys. GmbH v. Institut Straumann AG</i> , 892 F.3d 1349 (Fed. Cir. 2018)	14
<i>Synopsys, Inc. v. Mentor Graphics Corp.</i> , IPR2012-00041, Paper 16 (P.T.A.B. Feb. 22, 2013).....	13
<i>Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.</i> , 97 F.4th 882 (Fed. Cir. 2024)	41

TABLE OF EXHIBITS

Exhibit Number	Description
2001	Second Amended Complaint, <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , Case No. 2:24-cv-00728-JRG, ECF No. 23 (E.D. Tex. Jan. 28, 2025)
2002	Scheduling Order, <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , Case No. 2:24-cv-00728-JRG, ECF No. 27 (E.D. Tex. Feb. 6, 2025)
2003	CosMX Invalidity Contentions Cover Pleading, <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , Case No. 2:24-cv-00728-JRG (E.D. Tex. Jan. 7, 2025)
2004	Summons to attend oral proceedings in German Case No. 3 Ni 12/23 (EP) (“Germany Order 1”)
2005	Summons to attend oral proceedings in German Case No. 3 Ni 12/24 (EP) (“Germany Order 2”)
2006	Docket Navigator Statistics for Judge Rodney Gilstrap (accessed May 5, 2025)
2007	Docket, <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , Case No. 2:22-cv-00232 (E.D. Tex.)
2008	Joint Motion for Entry of Protective Order, <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , No. 2:24-cv-00728-JRG, ECF No. 30 (E.D. Tex. Feb. 11, 2025)
2009	Amended Final Judgment, <i>Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , Case No. 2:22-cv-00232, ECF No. 427 (E.D. Tex.)

Exhibit Number	Description
2010	Article, <i>Lithium battery manufacturer ATL won injunction against its Chinese rival COSMX in German Court</i> , China IP Today (April 6, 2024)
2011	Reserved
2012	Reserved
2013	Reserved
2014	Reserved
2015	Declaration of Dean R. Wheeler, Ph.D.
2016	<i>Curriculum Vitae</i> of Dean R. Wheeler, Ph.D.
2017	Reserved
2018	Reserved
2019	Reserved
2020	Reserved
2021	Reserved
2022	Reserved
2023	Reserved
2024	Reserved
2025	<i>2016 Batteries Conference GRC</i> , https://www.grc.org/batteries-conference/2016/ (accessed on May 12, 2025)
2026	<i>Hubs – Department of Energy</i> , https://www.energy.gov/hubs (accessed on May 12, 2025)
2027	<i>DOE Energy Innovation Hubs</i> , https://science.osti.gov/bes/Research/DOE-Energy-Innovation-Hubs (accessed on May 12, 2025)
2028	Salvatore Luiso & Peter Fedkiw, <i>Lithium-ion battery separators: Recent developments and state of art</i> , 20 Current Opinion in Electrochemistry 99–107 (2020).
2029	Sugino Machine Ltd., <i>StarBurst® P2218E 102501 AS</i> (Sugino Machine Ltd. 2025)

I. INTRODUCTION

Ningde Amperex Technology Ltd. (“ATL” or “Patent Owner”) respectfully submits this Preliminary Response (“POPR”) to the Petition (“Petition”) filed by Zhuhai CosMX Battery Co., Ltd. (“Petitioner” or “CosMX”). Paper 3 (“Pet.”). The Petition seeks *inter partes* review (“IPR”) of claims 1-19 (the “Challenged Claims”) of U.S. Patent No. 11,575,148 (the “’148 Patent,” Ex. 1001).

The Petition sets forth three grounds (out of eight) that relate to independent claims, Claims 1 and 10. These grounds rely on obviousness over Murakami, obviousness over Murakami in view of Beard, and obviousness over Beard in view of Akiike. Petitioner fails to show that *any* of its references—alone or in combination—disclose or render obvious the Challenged Claims.

Among other failures, none of Petitioner’s references disclose or render obvious the claim requirements that the pores (1) are formed by the binder and (2) at least comprise a part of the inorganic particles. Attempting to remedy the numerous individual failings of its references, Petitioner relies on its expert’s unjustified, incorrect, and improper assumptions to extrapolate from its references, as well as meritless motivations to combine these references. As explained below, these assumptions and the lack of disclosure in the references undercut Petitioner’s ability to meet its burden for at least the following reasons.

First, the **Murakami** reference does not disclose (1) “pores formed by the binder,” (2) “pores . . . at least comprise[] a part of the inorganic particles,” or (3) the claimed Dv10, Dv50, and Dv90 values of inorganic particles in the finished porous film.

For the (1) “pores formed by the binder” and (2) “pores . . . at least comprise[] a part of the inorganic particles” limitations, Petitioner relies solely on unsupported expert testimony to extrapolate from Murakami that this limitation is met. *See, e.g.*, Pet. at 23-30. Murakami is silent with respect to its pore structure. Unlike the ’148 Patent, the Murakami reference has no SEM images (or any other kind of images) to show the pore structure or how they are formed. Given this plain deficiency, Petitioner’s expert *assumes* that the pores in Murakami must be formed by the binder because (a) Murakami discloses that “the filler is bound by the binder resin” and (b) they claim that Murakami’s process for coating the porous layer onto its porous film is “comparable” to the ’148 Patent’s process. Ex. 1003 ¶¶ 90-95. But Petitioner and its expert are wrong—Murakami discloses that pores are *not* and cannot be formed by the binder. Instead, Murakami discloses that its pores are “gaps formed by contacts of particles of the filler” (i.e., the pores are formed by inorganic particles). Ex. 1005 ¶ [0069]. Thus, none of Murakami’s pores comprise any of the inorganic particles because the inorganic particles are themselves what define Murakami’s

pore walls—they do not extend into pores defined by a binder, as required by these two limitations in the claims.

For the claimed (3) Dv10, Dv50, and Dv90 values, Petitioner and its expert overlook key disclosures in Murakami that make clear the D10, D50, and D90 values reported in Murakami are unreliable and are not the actual sizes of the inorganic particles in the *finished* porous film. For example, they ignore the fact that Murakami disperses its filler in the porous layer using a high-pressure dispersing device that would have (by design) substantially changed the D10, D50, and D90 values of the particles in the final porous layer. For at least these reasons, Murakami is fundamentally different from the '148 Patent.

Second, to solve the deficiencies of Murakami, Petitioner attempts to cherry pick disclosures from **Beard** and fill in the remaining gaps with its expert's testimony. Petitioner relies on what appears to be a handwritten and not-to-scale conceptual figure in Beard that assumes what its pores and particles might look like. But even if the conceptual or notional drawing were an accurate depiction of Beard's pores, it shows that Beard does not meet the other requirement of the independent claims that the "pores at least comprise[] a part of the inorganic particles." Instead, Beard teaches that its inorganic particles are preferably packed exclusively in the *walls* and are not extending into the pores themselves.

Moreover, even if Beard were to disclose the required pore structure limitations, a POSITA would not have been motivated to combine Murakami and Beard with any reasonable expectation of success because the two references have (a) incompatible particle sizes (and distributions) and (b) incompatible bonding and dispersing forms. Because of these incompatibilities, if a POSITA were to combine Murakami and Beard as Petitioner suggests, the POSITA would be forced to choose between using the (larger) particle size of Murakami to allegedly meet some limitations of the claims (particle sizes and distributions) or using a different (smaller) particle size of Beard to allegedly meet other limitations of the claims (pores formed by the binder and pores at least comprising a part of the inorganic particles). Either way, Petitioner's argument fails because no disclosed particles in either reference would meet all of the claim recitations, and Murakami and Beard's very different particle sizes are incompatible with each other's disclosures.

Third, the particle sizes (and distributions) of Beard and Akiike are also incompatible. That is, like Murakami, Akiike discloses much larger particle sizes than Beard. Ex. 1011 ¶¶ [0011]-[0013]. Consequently, if a POSITA were to combine Beard and Akiike as Petitioner suggests, the POSITA would be forced to choose between using the particle sizes of Beard to allegedly meet some limitations of the claims (pores formed by the binder and pores at least comprising a part of the inorganic particles) and using a different particle size of Akiike to allegedly meet

other limitations of the claims (particle sizes and distributions). Again, Petitioner's argument fails either way because no disclosed particles in either reference would meet all of the claim recitations.

For at least these reasons, the Board should deny institution.

II. BACKGROUND¹

A. Technology Overview

Lithium-ion batteries are commonly used in portable electronic devices like laptops and cellphones, as well as in electric vehicles. Ex. 2015 ¶ 41. Lithium-ion batteries have an anode, a cathode, an electrolyte, and a separator. *Id.* ¶ 42. When charging the battery, lithium ions move through the electrolyte from the cathode to the anode and are stored at the anode. *Id.* When discharging the battery (i.e. when the battery is being used), lithium ions move back through the electrolyte to the cathode. *Id.* It is the movement of lithium ions from the anode to the cathode that releases energy that powers whatever device is connected to the battery. *Id.*

The separator is a membrane located between the cathode and the anode that prevents direct contact between electrodes, while still allowing lithium ions to pass through between electrodes. *Id.* ¶ 43. It is important to prevent direct contact

¹ Patent Owner's expert provided a technology overview and a summary of the '148 Patent. Ex. 2015, § IV.A-B, ¶¶ 41-66.

between electrodes because contact between the cathode and anode can cause a short circuit, and a short circuit could result in a fire or explosion. *Id.* Given the safety function of the separator, a separator must be strong enough to withstand outside forces that could puncture the separator and lead to contact between electrodes. *Id.* At the same time, the separator must permit effective ion flow between the electrodes (i.e. high ionic conductivity), and the separator must not react to the electrolyte solution in a way that negatively impacts ionic conductivity. *Id.* ¶ 44.

These various design considerations for separators require a delicate balance related to the composition of the separator and its components. *Id.* ¶ 45. This balance is something experts in the field have been working on for decades. *Id.* One problem faced by experts trying to achieve this balance is the creation of a gap between the electrode and the separator during the cycle process (i.e. charging and discharging of the battery). *Id.* ¶ 48. The gap formed between the separator and the electrode reduces the cycle capacity of the lithium-ion battery and shortens the battery's service life. *Id.*

B. The '148 Patent

The '148 Patent recognized the gap problem and identified “an urgent need for a technical solution to solve the problem of the gap issue between the separator and the electrode so as to improve the service life of the lithium-ion battery.” Ex. 1001, 1:29-37. To solve this problem, the '148 Patent describes and claims a novel

porous film that prevents or limits gap formation while still allowing for high ionic conductivity. *Id.* at 2:47-56.

The '148 Patent describes both the composition and the structure of the pores in its porous film. For example, the patent explains that the porous film includes “a binder and inorganic particles of different particle sizes,” wherein “the inorganic particles are fixed by the binder.” *Id.*, 3:17-19. The '148 Patent describes the importance of using enough binder to form the pores of the porous film, while not using so much that it results in poor adhesion. *Id.*, 5:50-60. The '148 Patent also describes specific size distributions that should be achieved for peak performance. To describe the size distributions of the inorganic particles, the '148 Patent uses Dv10, Dv50, and Dv90. In addition to specifying particle size distributions for the inorganic particles, the '148 Patent also describes a specific ratio of Dv90 to Dv10 that is critical for the claimed invention: $Dv90/Dv10=2$ to 100. *Id.*, 4:54-56.

III. LEGAL STANDARDS

The Petition must both “clearly point out the differences between the claimed invention and [the prior art]” and “explain why a person of ordinary skill in the art would have found the claimed subject matter obvious in spite of those differences.” *Synopsys, Inc. v. Mentor Graphics Corp.*, IPR2012-00041, Paper 16, 14 (P.T.A.B. Feb. 22, 2013). Petitioner must recite where the challenged limitation is found in the reference(s) and explain why a POSITA would have modified the primary reference

with the recited limitation from the secondary reference(s). *Microsoft Corp. v. Secure Web Conf. Corp.*, IPR2014-00745, Paper 12, 11-13 (P.T.A.B. Sept. 29, 2014).

In addition, the Board institutes based on what the Petition *actually presents* and not what it could have reasonably contained. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016). 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).

IV. LEVEL OF ORDINARY SKILL IN THE ART

Each of the arguments below should be considered from the standpoint of a person of ordinary skill in the art (“POSITA”) in the field of the ’148 Patent. For purposes of this POPR, ATL adopts the definition proposed by Petitioner. Pet., 14; *see also* Ex. 2015 ¶¶ 67-69. ATL reserves all rights to challenge Petitioner’s definition and/or further address the level of ordinary skill in the art if this proceeding is instituted.

V. CLAIM CONSTRUCTION

Petitioner contends that “[n]o claim terms require express construction for purposes of granting the Petition.” Pet., 15.² The failure of the Petition to render

² ATL reserves the right to address construction if this proceeding is instituted.

obvious the Challenged Claims is clear in view of the arguments below without construing any specific claim term or phrase.

VI. THE BOARD SHOULD NOT INSTITUTE *INTER PARTES* REVIEW

A. Ground 1: Murakami Does Not Render Obvious Claims 1, 2, 5-11, and 14-19

Petitioner contends that Murakami renders obvious Claims 1, 2, 5-11, and 14-19 of the '148 Patent. Pet., 19-41. However, Murakami fails to teach, suggest, disclose, or otherwise render obvious at least elements [1.3]-[1.10] and [10.8]-[10.15].

1. The Petition Fails to Show that Murakami Discloses or Renders Obvious Pores “Formed by the Binder” as Recited in Claim Elements [1.3] and [10.8]

This ground fails because Murakami does not disclose or suggest “pores formed by a binder.” The Petition does not address the plain and ordinary meaning of this claim language, which requires the pore geometry be defined by the boundaries of the binder. Ex. 2015 ¶ 78. Instead, Petitioner asserts that Murakami discloses “wherein the porous film comprises pores formed by the binder” for two primary reasons: (1) Murakami states that it has a porous layer in which “the filler is bound by the binder resin” (Pet., 23 (quoting Ex. 1005 ¶ [0070])); and (2) “Murakami forms those pores through a process like that described in the '148 Patent” (Pet., 24). These arguments lack merit.

a. The Plain Meaning of “Pores Formed By a Binder”

There is no dispute that the Board should apply the plain and ordinary meaning of all claim terms for purposes of this inter partes review. Pet. at 14-15. Yet the Petition never explains what the plain and ordinary meaning of “pores formed by a binder” actually is. “Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence.” *Apple Inc. v. Carbyne Biometrics, LLC*, IPR No. 2024-00334, Paper 26 at 12 (P.T.A.B. May 22, 2025) (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-17 (Fed. Cir. 2005) (en banc)). “Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term.” *Id.* (citing *Phillips*, 415 F.3d at 1315).

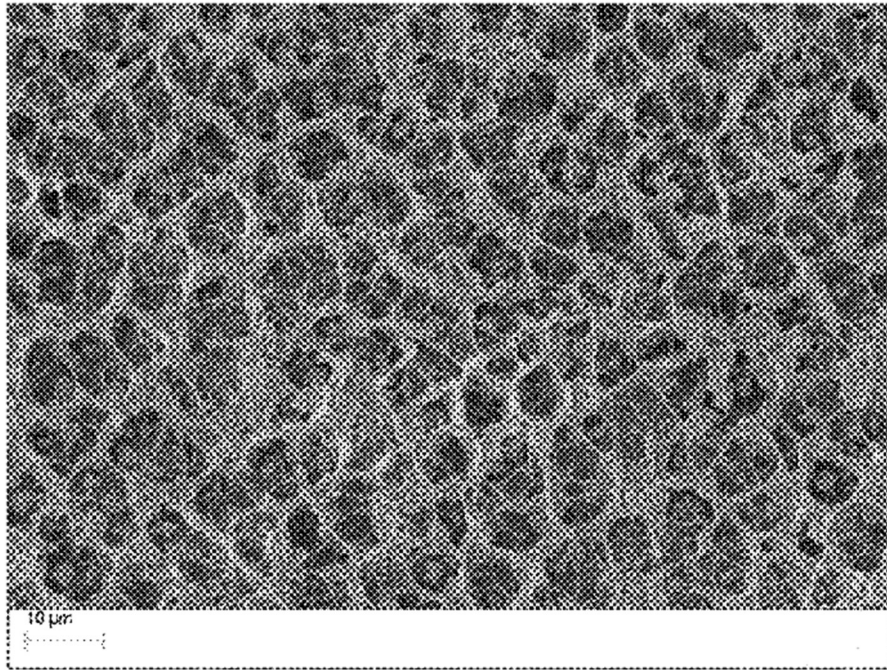
Here, a POSITA would have understood the plain meaning of “pores formed by a binder” requires the pore geometry to be defined by the boundaries of the binder. Ex. 2015 ¶ 78. This meaning is dictated by the claim language itself, which explicitly includes the phrase “formed by the binder.” *Id.* This language indicates to a POSITA that it the binder itself acts as the boundary that defines the structure of the pores and thus “forms” the pores. *Id.*

This plain meaning is also clear from the specification, which states that “the binder in the coating solution is coagulated and separated out, *thus forming a porous*

film.” Ex. 1001, 6:26-32 (emphasis added). In this process, the binder is initially dissolved in a first solvent and then separated out of the solvent when a coagulation solution is added. Ex. 2015 ¶ 79. This means that “the binder forms its own solid phase with interconnected threads like a spider web, forming the pores.” *Id.*

The ’148 Patent further explains that the amount of binder is important for the formation of the pores. *Id.* ¶ 80. It discloses that there is anywhere from 25 volume % to 83 volume % binder in the porous layer and, if there is more than 83 volume % binder, “the average pore size of the porous film is reduced, the porosity is decreased, and the rate performance of the lithium-ion battery is deteriorated drastically.” Ex. 1001, 5:52-55 (“the volume ratio of the inorganic particles to the binder in the porous film is in a range of 0.2 to 3.0”); Ex. 2015 ¶ 80; n.4 (explaining conversion of a 0.2-3.0 volume ratio range to a volume percentage of binder). As Dr. Wheeler explains in his declaration, a POSITA would have understood this to mean that the amount of binder influences pore size and that it is therefore the binder that dictates how the pores are formed. Ex. 2015 ¶ 80.

The ’148 Patent further confirms this plain meaning of the claim language by providing scanning electron microscope (“SEM”) images of its porous film that show that the pores are formed by the binder. *Id.* ¶ 81; *see also id.* ¶¶ 54-55. These images show that the empty space in the porous layer is divided into pores because of the spreading of the binder (the white material that forms a matrix). *Id.* ¶ 81.



Ex. 1001 at Fig. 1. In this image, the pores are the empty space (or voids) between the solid white matrix, and it is the white matrix (the binder) that defines the boundary of each pore, much like a circle’s perimeter defines (or “forms”) a circle.

Ex. 2015 ¶ 81.

Thus, based on both the claim language and the specification, a POSITA would have understood that “pores formed by the binder” requires that it is the binder, not the inorganic particles, that defines the boundaries of (and thus formation of) the pores. *Id.* ¶ 82.

b. Murakami Fails to Disclose Any Imaging Showing that a Binder Defines the Structure of Pores

Murakami does not disclose or suggest that the pores in its porous layer are “formed by the binder.” This lack of disclosure is not surprising because Murakami

is focused on a different problem than the '148 Patent. *See* Ex. 2015 ¶ 83. Whereas the '148 Patent is directed to filling a gap that forms between the separator and electrode during the life cycle of a battery by adjusting the characteristics of the porous film (Ex. 2015 ¶ 49; Ex. 1001, 1:29-37), Murakami is directed to improving the cycle characteristics of a battery by minimizing variability in voidage (*i.e.*, empty space) throughout a porous layer (Ex. 2015 ¶¶ 74, 83; Ex. 1005, Abstract). A POSITA would have understood that minimizing voidage variability is unrelated to how any voids or pores are actually formed and what material(s) form the boundaries of any pores or voids. Ex. 2015 ¶ 85.

Murakami does not provide any disclosure that would enable a POSITA to reliably determine the structure of the porous layer because it lacks any text or images depicting pore structure. A POSITA would have understood that imaging, such as SEM imaging, is critical for determining pore structure. Ex. 2015 ¶ 84. Unlike the '148 Patent, Murakami discloses *no* images of the porous layer by which a POSITA would be able to determine the pore structure, let alone how they are formed. Ex. 2015 ¶ 85. While Murakami references SEM images (Ex. 1004 ¶ [0095]), it never provides those images or explains what they show in terms of which element of the porous layer dictates the pore structure. Ex. 2015 ¶ 85. Instead, Murakami focuses solely on calculating the voidage (*i.e.* total amount of empty

space) of different slices of the porous layer. *Id.* Thus, Murakami fails to disclose that the binder defines the structure of the pores.

c. If anything, Murakami Discloses Pores Formed by Inorganic Particles, Not a Binder

Even if a POSITA could tell based on the text of Murakami how the pores are formed, Murakami's disclosure would lead a POSITA to arrive at the opposite conclusion—that the pores in Murakami's porous layer are *not* formed by the binder but instead by the inorganic particles. Ex. 2015 ¶ 86.

(i) Paragraph 70 of Murakami Teaches Away From Using a Binder to Form Pores

A POSITA would have understood based on Murakami that the role of the binder in Murakami is to glue the inorganic particles together—not to form pores. Ex. 1005 ¶ 91. Petitioner cites to Paragraph 70 of Murakami, which states that “a porous layer in which a filler is dispersed in a resin (binder resin) is not suitable as the porous layer containing a filler and a binder resin.” Ex. 1005 ¶ 70; Pet. at 23. While the Petition cites Paragraph 70 to argue that the pores are formed by the binder, it does not explain why. Pet. at 23. As Dr. Wheeler explains in his declaration, this paragraph actually teaches the opposite; it teaches away from using a binder to form pores because it teaches that the inorganic particles (filler) should *not* be dispersed in the binder resin. Ex. 2015 ¶ 87. A POSITA would understand this statement (together with the rest of Murakami, discussed below) to mean that

the amount of binder resin in Murakami is minimal and is specifically restricted to be just enough binder resin to bind the filler particles together—not enough binder resin for the filler particles to be mostly or fully encapsulated or coated by the binder resin. *Id.* Thus, according to Murakami, the amount of binder should be minimal, such that the filler particles are not dispersed in it, and the boundaries of any pores in Murakami would not be formed by the binder, but rather by the inorganic filler particles. *Id.*

(ii) Murakami Teaches that the Pores Are Formed By Inorganic Particles, Not a Binder

Paragraph 69 of Murakami teaches that the pores are not formed by the binder, but rather are formed by “gaps formed by contacts of particles of the filler,” (i.e. the pores are formed by the inorganic particles):

In a case where the porous layer contains a filler, a filler content is preferably 1 volume % to 99 volume %, more preferably 5 volume % to 95 volume %, relative to the porous layer. In a case where the filler content is within the above range, ***gaps formed by contacts of particles of the filler are less likely to be blocked by a resin and the like***, and it is therefore possible to obtain a sufficient ion permeability and an appropriate weight per unit area.

Ex. 1005 ¶ 69; Ex. 2015 ¶ 88. This understanding is confirmed by Murakami’s disclosure that there is (most preferably) very little binder used, meaning Murakami’s binder is incapable of being the element of the porous layer that drives

pore formation. Ex. 2015 ¶ 88 citing Ex. 1005 ¶ 70 (explaining that the filler content is “*most preferably 90 mass % or higher*,” up to 99 mass %, relative to the total mass of the porous layer); *see also* Pet. at 26 (“Murakami’s Examples contain a *much larger amount of filler* (inorganic particles) than binder resin by weight.”). In contrast, and as explained in the ’148 Patent, the amount of binder in the porous layer dictates how the pores are formed and the structure of those pores. Ex. 1001, 5:52-55 (requiring 25 to 83 volume percent of binder in the porous film to form the pores). A POSITA would have understood that, for the binder to form the pores, there would need to be enough binder in the porous layer to surround the empty spaces (i.e. 25 to 83 weight percent of binder). Ex. 2015 ¶ 89. But Murakami teaches (and Petitioner’s expert admits) that the Murakami porous layer includes very little binder (most preferably between 1 and 10 %, or 3 parts by weight in Examples 1 and 2 compared to 100 parts by weight of alumina filler). Ex. 1005 ¶¶ 70, 141, 161; *see also* Ex. 1003 ¶ 103 (admitting that, in Murakami, “the porous layer consists of *nearly all filler material* and relatively little [binder] resin by weight”). A POSITA would have understood that this very small amount of binder is not enough to form the pores. Ex. 2015 ¶ 89. Instead, and based on the minimal amount of binder, a POSITA would necessarily conclude that the pores of Murakami must be formed—as Murakami teaches—by gaps in between the inorganic particles, which unlike the ’148 Patent make up a vast majority of the porous layer in Murakami. Ex. 2015

¶¶ 88-92. The binder, far from driving formation of the pores, simply acts as “little dots of glue” that hold together the inorganic particles that form Murakami’s pores. *Id.* ¶ 91. Thus, based on the disclosure of Murakami and the lack of images, a POSITA would predict that the pores in Murakami were formed by its inorganic particles. *Id.* ¶ 92. In this way, Murakami discloses pores formed by inorganic particles, not pores formed by a binder as required by all claims of the ’148 Patent. *Id.*

d. Murakami’s Process of Making Its Porous Layer Does Not Create “Pores Formed by the Binder”

The Petition also argues that Murakami discloses “pores formed by the binder” because it discloses a solvent-based process that allegedly functions the same way as the ’148 Patent. Pet. at 23-25. This is incorrect.

The ’148 Patent discloses that “after the coating solution is coated on the substrate and then immersed in the coagulation solution, since the first solvent in the coating solution is extracted into the third solvent (for example, deionized water) in the coagulation solution, the binder in the coating solution is coagulated and separated out, thus forming a porous film.” *Id.*, 6:26-32. Nothing in Murakami can be construed as teaching coagulating a binder and separating it out to “form[] a porous film.” Ex. 2015 ¶ 93.

Murakami teaches creating a basic solvent mixture containing a small amount of binder and large amount of inorganic particles, dispersing the alumina (inorganic particle) filler by high pressure dispersion, applying that coating layer to a different porous layer that was subjected to corona treatment, and letting the coating film dry. Ex. 1005 ¶ [0143]; *see also* Ex. 2015 ¶ 94; Pet., at 26 (“[] Murakami’s porous layer comprises mostly inorganic filler, with a filler-to-binder weight ratio of 97:3 in Examples 1 and 2.”). As Dr. Wheeler explains, a POSITA would have understood that this method described by Murakami is not the same as using a “third solvent” to cause the binder to coagulate and separate out of solution to form the pores. Ex. 2015 ¶ 94.

Indeed, a POSITA would have understood that the method of forming a porous layer described by Murakami would lead to very different results compared to the method of the ’148 Patent. Ex. 2015 ¶ 95. In the ’148 Patent method, the binder has already been coagulated by the time the drying step is reached. *Id.* This means that the binder has formed into a separate and stable solid phase from the liquid mixture ***before*** the drying step. *Id.* In contrast to the ’148 Patent method, in the Murakami method, the binder does not become a solid phase until ***during*** the drying step, at which point the binder is brought out of the liquid through the process of drying. *Id.* This difference has a significant impact on the resulting pore structures of the dried films. *Id.*

Finally, even if Murakami did use the same process as the '148 Patent (which it does not), there would still not be enough binder in Murakami for the binder to form the pores for the reasons explained above. Ex. 2015 ¶ 89. No matter which process is used, there would always need to be enough binder in the porous layer for it to spread out and encapsulate the empty space, thereby forming pores. Without a certain amount of binder (which the patent describes as 25 to 83 volume percent), a POSITA would have understood that the binder could not form the pores regardless of the solvent method used to form the porous layer. Murakami teaches a POSITA to most preferably use very little binder (most preferably less than 10 mass % and as low as 1 mass %). *Id.* ¶ 70.

Thus, Murakami fails to disclose, suggest, or otherwise render obvious pores “formed by the binder.”

2. The Petition Fails to Show that Murakami Discloses or Renders Obvious “Pores At Least Comprise[] a Part of the Inorganic Particles” as Recited in Claim Elements [1.4] and [10.9]

Like with the requirement that the pores be “formed by the binder,” the Petition also fails to acknowledge the plain and ordinary meaning of “pores at least comprise[] a part of the inorganic particles.” For a pore to comprise a part of the inorganic particles, that means that at least some of the inorganic particles must extend into the empty space delineated by the boundary of the binder. Ex. 2015 ¶ 98.

This is evident from the claim language, which has two distinct requirements. First, the pore must be “formed by the binder,” and second, the pore must “at least comprise[] a part of the inorganic particles.” A POSITA, when reading these two requirements together, would understand that the pore geometry is defined by the binder because the binder is what divides the empty spaces, and at least some of the inorganic particles extend at least partially into those empty spaces (the pores). *Id.* A POSITA would have understood this claim limitation to mean that the inorganic particles cannot merely be the walls that surround the pores. *Id.* Rather, at least some inorganic particles must be part of the pores themselves. *Id.*

As the Petition emphasizes, Murakami teaches using predominantly inorganic particles (filler) and very little binder. Pet. at 26-28. Murakami also states that the pores are created by “gaps formed by contact of particles of the filler.” Ex. 1005 ¶ [0069]. As explained above, this means that the pores in Murakami are in fact formed by the inorganic particles, not by the binder. Put differently, the inorganic particles in Murakami act as the pore walls themselves. Ex. 2015 ¶ 99. This makes it physically impossible for the inorganic particles to also extend into the pores such that the pores comprise at least a part of the inorganic particles. *Id.*

3. The Petition Fails to Show That Murakami Discloses or Renders Obvious the Claimed Particle Size Distributions of the Inorganic Particles *In* the Porous Layer as Required by Claim Elements [1.5]-[1.9] and [10.10]-[10.14]

Murakami also fails to disclose or render obvious the claims because it does not disclose or suggest the claimed particle size distributions (Dv10, Dv50, and Dv90). The Petition asserts that Murakami discloses or renders obvious the claimed particle size distributions in three ways: (1) the general disclosure that “D10 is 0.005 um to 0.4 um, D50 is 0.01 um to 1.0 um, and D90 is 0.5 um to 5.0 um,” where “particle diameter [is] obtained based on volume;” (2) Example 1’s disclosure that “[a]s a filler, α -alumina (D10: 0.22 um, D50: 0.44 um, D90: 1.03 um) was used;” and (3) Example 2’s disclosure that α -alumina (D10: 0.26 um, D50: 0.66 um, D90: 1.53 um) was used as a filler.” Pet. 31-34. But Petitioner’s assertions are based on unreliable and incompatible disclosures in Murakami and therefore fail.

a. The Plain Meaning of the Claims Require the Dv10, Dv50, and Dv90 Values to Be Satisfied By the Particles *In* the Porous Film

All the claims in the ’148 Patent require certain particle size distributions of the inorganic particles *in* the porous film. Ex. 2015 ¶ 101. In contrast, Murakami only discloses the initial size distributions of inorganic particles *before* they become part of the porous layer and the high pressure dispersion manufacturing step that would reduce their sizes significantly. *Id.*

That the claimed particle size distributions are the sizes when the particles are part of the porous layer is dictated by the claim language, which states: “the porous film comprises pores formed by the binder, the pores at least comprise[s] a part of the inorganic particles, wherein the inorganic particles have particle sizes that Dv10 is in a range of 0.015 μm to 3 μm , Dv50 is in a range of 0.2 μm to 5 μm , and Dv90 is in a range of 1 μm to 10 μm .” This language discusses the inorganic particles and their size distributions in the context of the porous film having pores, requiring that these are the sizes of the particles that comprise a part of the pore. In other words, “[t]he fact that the claimed particles sizes are of ‘the’ inorganic particles to be part of the pores shows that those are the particle size ranges for the particles *in the porous layer*.” Ex. 2015 ¶ 102.

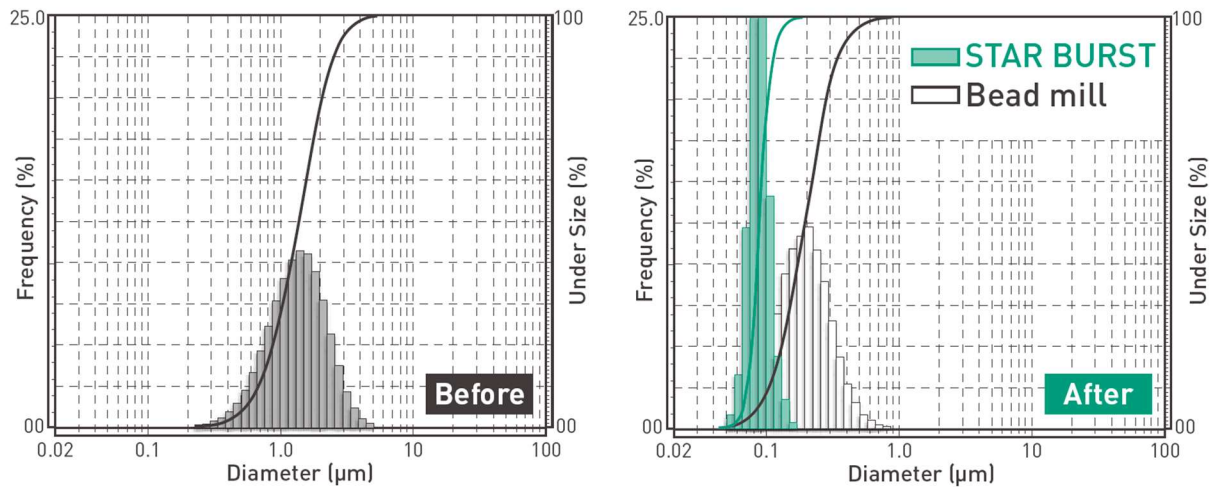
Thus, to satisfy the claims, Murakami would have to provide particle sizes that accurately reflect the particle sizes of the inorganic particles when those particles are part of the porous film. Ex. 2015 ¶ 103. Murakami does not meet this requirement. *Id.* Instead, as explained in more detail below, the reported particle size distributions of Murakami are measurements of particle size *before* the inorganic filler becomes part of the porous layer, and these particle sizes are changed during the process of making the porous layer.

b. Murakami Does Not Provide Particle Sizes of Inorganic Particles When Those Particles are Part of a Porous Film

The particle sizes cited by Petitioner and provided in Murakami are the sizes and distributions of the particles prior to applying a high-pressure dispersion technique, and thus they do not represent the actual sizes and distributions of the particles by the time the particles make it into Murakami's porous layer. Ex. 2015 ¶ 104.

Take the analogy explained by Dr. Wheeler in his declaration: if you buy two large rectangles of chocolate to make chocolate chunk cookies, the sizes of the chocolate chunks ultimately formed in the cookies will vary based on the steps taken during the manufacturing process. *Id.* If you use a high-speed mixer, for example, you will break down the two chocolate chunks into much smaller pieces during the mixing process. Similarly, a POSITA would have understood that the particle sizes disclosed in Murakami are the initial particle sizes—before any of the mixing or manufacturing of the porous layer is done. A POSITA would have read the examples of Murakami and seen that, for example, “ α -alumina (D10: 0.22 μm , D50: 0.44 μm , D90: 1.03 μm) was used.” *Id.* (citing Ex. 1005 ¶ [0140]). The POSITA would have understood that those numbers represent the *initial* particle distributions of alumina as purchased, but that those particle size distributions would not remain the same after completing all the steps in Muarakami's manufacturing process. *Id.*

In contrast to the '148 Patent, which does not use high-pressure dispersion techniques, Murakami discloses a method in which a high-pressure dispersion technique is applied **three** times at a pressure of 100 MPa. Ex. 1005 ¶ [0141] (describing the “high-pressure dispersion condition” as “100 MPax3-pass”); Ex. 2015 ¶ 105. Using a high-pressure dispersion machine to disperse the inorganic particles under high pressure would damage the particles, such that they would not be the same sizes or distributions they were when considered before the dispersion technique. Ex. 2015 ¶ 106. In fact, this effect on particle size and particle size distribution was expected (and even intended) when using this type of machine. *Id.* ¶¶ 106-07. The manufacturers of the *same machine* used in Murakami (the Sugino Machine Ltd. Star Burst) report that, when using this machine, ten passes at a pressure of 98 MPa (2 MPa lower than the 100 MPa in Murakami) on alumina (the same material used in Murakami) at a median diameter of 20 µm would reduce the median particle size to just 0.2 µm—a *hundredfold* decrease. *Id.* ¶ 106 (citing Ex. 2029, 5). As shown in the visual below (taken from the manufacturers’ brochure), high pressure dispersion would (by design) significantly alter the particle size distribution of the particles in the porous layer from their initial distribution. Ex. 2015 ¶ 107.



Ex. 2029.

The plots above show a “before” and “after” view of the particle size distributions (on a logarithmic scale) for a sample mixed and dispersed using the same “STAR BURST” high-pressure dispersion machine disclosed in Murakami. Ex. 2015 ¶ 108. This shows not only that the initial particle sizes would decrease, but also that the distribution curve would be significantly narrowed. *Id.* So too would the initial particle sizes in Murakami not accurately reflect the sizes and distribution of particles in the porous layer. *Id.* ¶¶ 108-09. Neither Petitioner nor its expert address the material impacts of Murakami’s high-pressure dispersion technique.³

³High-pressure dispersion is a technique that a POSITA would understand would be beneficial when attempting to reduce inconsistency in voidage. Ex. 2015. ¶ 105.

For these reasons, Murakami does not disclose, suggest, or otherwise render obvious “wherein the inorganic particles have particle sizes that Dv10 is in a range of 0.015 μm to 3 μm , Dv50 is in a range of 0.2 μm to 5 μm , and Dv90 is in a range of 1 μm to 10 μm .” *Id.* ¶ 109.

4. The Petition Fails to Show that Murakami Discloses or Render Obvious the “Ratio of Dv90 to Dv10” as Recited in Claim Elements [1.10] and 10.15]

The Petition argues that Murakami discloses “the inorganic particles have particle sizes that the ratio of Dv90 to Dv10 is in a range of 2 to 100.” Pet. 34. This argument also fails.

First, as discussed above, the particle sizes reported in Murakami are the sizes of the inorganic particles prior to being dispersed by high-pressure dispersion, and thus do not represent the size of the inorganic particles when they are part of the porous film, which is required by the claims. *Id.* ¶ 111. For at least this reason, the Petition fails to show that Murakami discloses the claimed ratio range.

Second, Murakami does not disclose taking the *ratio* of Dv90 to Dv10. In contrast, it discloses taking a *difference* between Dv90 and Dv10. Ex. 1005 ¶ [0018]; Ex. 2015 ¶ 112. Petitioner’s assertions rely on its expert’s unsupported theory that *if* a POSITA were to divide Dv90 by Dv10, which Murakami does not teach, they would end up with a ratio of 1.25 to 1000 (or 4.68 for Example 1, 5.88 for Example 2), and that range overlaps the claimed ratio of 2 to 100. Ex. 2015 ¶ 113. But a

POSITA would not have known to consider a *ratio* based on the teachings of *taking a difference* in Murakami. *Id.* ¶¶ 112-14. Indeed, a ratio of Dv90 to Dv10 is very different in that it is a dimensionless ratio in which length units advantageously cancel out and that mathematically leads to a preferred shape for the particle size distribution, a solution not taught or even suggested by Murakami. *Id.* This is distinct from Murakami’s “difference” between Dv90 and Dv10, which has length units, is not dimensionless, and hence is meaningless unless tied to other particle size information, which Murakami does not teach a POSITA to do. Ex. 2015 ¶ 114. As such, the POSITA would not have modified the Murakami *difference* as alleged by Petitioner.

Third, Petitioner relies on a range that is much larger than what is claimed and, thus, this argument fails to consider the criticality of the claimed ratio range. *See E.I. du Pont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018) (a “claimed range that demonstrates [] unexpected results is referred to as a ‘critical’ range, and the patentee has the burden of proving criticality”) (citation omitted). The ’148 Patent explains that “[i]f Dv90/Dv10 is greater than 100” then this “will lead to the particle size distribution of the inorganic particles being too wide, the uniformity of the formed pores [being] poor, and polarization reactions [] easily occur[ring] in the lithium-ion battery.” Ex. 1001, 4:54-60. Thus, it is critical

to the objectives of the '148 Patent that the ratio of Dv90 to Dv10 not exceed 100. Ex. 2015 ¶¶ 112, 114.

In direct contrast to these teachings of '148 Patent, Murakami teaches a range of sizes whose ratios (if calculated, which Murakami does not teach to do) go far above that ratio—all the way to 1000. Ex. 2015 ¶ 113. A POSITA would not have recognized the importance of the upper limit on size distribution ratio from the teachings of Murakami, especially given that Murakami teaches that the mathematical relationship that matter is the difference not the ratio. Ex. 2015 ¶¶ 112-115; *see, e.g., E Ink Corporation v. Research Frontiers Incorporated*, IPR2014-00422, Paper 6 (P.T.A.B. Aug. 14, 2014) (finding Patent Owner's criticality arguments persuasive where the claim language had a lower limit and the prior art, while citing an overlapping range, did not recognize the importance of that limit).

Thus, Murakami does not disclose or render obvious that “the inorganic particles have particle sizes that the ratio of Dv90 to Dv10 is in a range of 2 to 100.”

B. Ground 2: Murakami and Honda Do Not Render Obvious Claims 3 and 12

The Petition asserts that Murakami and Honda render obvious Claims 3 and 12. Pet., 41-42. These claims recite:

3. The porous film according to claim 1, wherein the average wall thickness between the pores is in a range of 20 nm to 500 nm.

12. The lithium-ion battery according to claim 10, wherein the average wall thickness between the pores is in a range of 20 nm to 500 nm.

These claims are not obvious for at least the same reasons noted above with respect to Independent Claims 1 and 10.

C. Ground 3: Murakami and Tanaka Do Not Render Obvious Claims 4 and 13

The Petition asserts that Murakami and Tanaka render obvious Claims 4 and

13. Pet., 43-48. These claims recite:

4. The porous film according to claim 1, wherein a pore size distribution coefficient of the pores in the porous film is in a range of 1 to 5.

13. The lithium-ion battery according to claim 10, wherein a pore size distribution coefficient of the pores in the porous film is in a range of 1 to 5.

These claims are not obvious for at least the same reasons noted above with respect to Independent Claims 1 and 10.

D. Ground 4: Murakami and Beard Do Not Render Obvious Claims 1, 2, 5-11, and 14-19

The Petition asserts that Murakami and Beard render obvious Claims 1, 2, 5-11, and 14-19 of the '148 Patent. Pet., 48-56. These claims are reproduced above with respect to Ground 1.

Petitioner argues that, if Murakami does not “disclose or suggest Elements [1.3]’s and [10.8]’s requirement that “*the porous film comprises pores formed by the binder*” and/or Element [1.4]’s and [10.9]’s requirement that “*the pores at least comprises a part of the inorganic particles,*” then “Beard separately discloses these features.” Pet., 48.

Petitioner is incorrect. Beard does not disclose or suggest “the pores at least comprises a part of the inorganic particles,” as recited in claims 1 and 10. Ex. 2015 ¶¶ 124-34. And even if it did, a POSITA would not have been motivated to combine Murakami and Beard with a reasonable expectation of success. Ex. 2015 ¶¶ 135-49. Finally, Petitioner does not assert and Beard does not address, the shortcomings in Murakami with respect to Claim Elements [1.5]-[1.9] and [10.10]-[10.14], discussed above.

1. Neither Beard Nor Murakami Disclose or Render Obvious Pores that “At Least Comprise[] a Part of the Inorganic Particles”

As explained above, Murakami does not disclose pores that “at least comprise a part of the inorganic particles.” The Petition tries to fill this hole with Beard’s disclosure, arguing that Beard discloses pores that “at least comprise a part of the inorganic particles” for three main reasons: (1) Beard’s inorganic particles are part of the pore wall, and being a part of the pore wall counts as being a part of the pore itself; (2) even if the claims require the inorganic particles to be a part of the pore

itself, Figure 1 allegedly shows some of the small inorganic particles poking out of the binder in the pore walls, and (3) Beard allegedly discloses larger particle sizes in the voids of the pores. Pet., 52-54. Petitioner's arguments fail.

a. "Pores . . . At Least Comprise a Part of the Inorganic Particles" Requires At Least Some of the Inorganic Particles to Extend Into the Pores

As explained above, the plain meaning of "pores . . . at least comprise a part of the inorganic particles" requires at least some of the inorganic particles to extend into the pores. A POSITA would have understood this language to require that the inorganic particles be part of the pores themselves (i.e. the void) and not part of the walls that surround the pores. Ex. 2015 ¶ 126. This is because a POSITA would understand that "pore" means an empty space divided from other empty space by a wall, which could be understood as the "pore wall." *Id.*

The claim language has two distinct requirements: (1) the pores must be "formed by the binder," and (2) the pores must "at least comprise a part of the inorganic particles." As explained above in detail, "pores formed by the binder" indicates that the binder is what defines the geometry of the pores (i.e. the binder mostly makes up the pore walls to define the geometry of the empty spaces). *Id.* At the same time, the requirement that these empty spaces include "a part of the inorganic particles" means that there should be at least some inorganic particles that extend into those empty spaces that are primarily defined by the binder. *Id.* In other

words, the claim language describes a careful balance that can be understood as a spider web of binder with inorganic particles caught throughout the web like flies.

Id. ¶¶ 79, 126.

b. The Particles In Beard’s Preferred Embodiment Are, At Best, Part of the Walls that Define the Pores and Not Part of the Pores Themselves

Unlike the claims, which require at least some inorganic particles to extend into the pores defined by the binder, Beard teaches that all the inorganic particles are confined within the walls that surround the pores and do not extend into the pores themselves. *See, e.g.,* Ex. 1010 ¶ [0026] (“The particles in the example of embodiment 100 may be captured inside the polymer binder 108, as opposed to having the particles loosely positioned within the pores.”). The Petition argues that some of the small particles in Beard extend into the pores themselves. Pet. at 53. But this argument relies entirely on Figure 1 of Beard (reproduced below), which is a handwritten conceptual drawing (using a draftsman’s identically-sized particles) of what Beard’s inventors hoped to see in Beard’s pore structure. *See Hockerson-Halberstadt, Inc. v. Avia Group Int’l*, 222 F.3d 951, 956 (Fed. Cir. 2000) (in a case where the prior art disclosure gave no indication that the drawings were drawn to scale: “it is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.”).

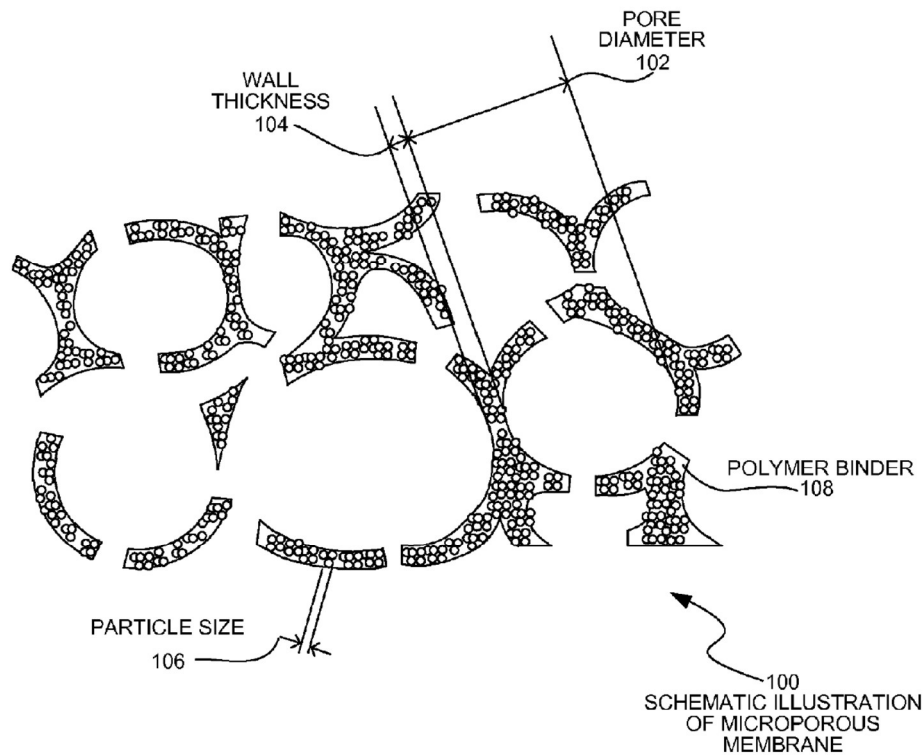


FIG. 1

Ex. 1010 at Fig. 1.

As Dr. Wheeler explains in his declaration, a POSITA would not be able to tell with any level of certainty based off this drawing that Beard's pores comprise at least a part of the inorganic particles or that Beard intended for any part of its particles to extend into the pores. Ex. 2015 ¶¶ 127-29. Additionally, the SEM images provided in Beard (which are the most scientific source in Beard from which to draw conclusions about pore structure), such as Figure 2, do not support Petitioner's interpretation of Figure 1, and Petitioner does not cite to these SEM images. *Id.* ¶ 128. For example, Figure 2 shows no regular incorporation of filler particles into

the pores such that the pores comprise a part of the inorganic particles—and in any event, Petitioner does not make that argument or rely on that evidence. *Id.*

Moreover, Petitioner’s arguments regarding Figure 1 contradict Beard’s explicit disclosure in its specification. For example, when describing Figure 1, Beard states that “[t]he particles in the example of embodiment 100 may be *captured inside the polymer binder 108*, as opposed to having the particles loosely positioned within the pores.” Ex. 1010 ¶ [0026]; Ex. 2015 ¶ 129. Beard also states that the inorganic particles are “[w]ithin the pore walls” and “may be less than 0.02 microns in width,” and “a densely packed filler material may have an average diameter of less than 0.005 microns.” Ex. 1010, Abstract. Beard states that the “TiO₂ particles are on the order of or smaller than the cell wall thickness **208**,” and that “[g]ood results may be achieved when the solid particles are contained exclusively or largely within the pore walls.” *Id.* ¶¶ [0037], [0086]. Thus, a POSITA would understand that Beard teaches trapping the inorganic particles within the pore walls, rather than having them extend into the pores themselves. Ex. 2015 ¶ 129.

Finally, if anything, Beard teaches away from pores that “at least comprise part of the inorganic particles.” Ex. 2015 ¶ 130. For example, Beard teaches: “When filler additives are allowed to block the pore pathways or when the total porosity and pore structures are negatively impacted either by the direct filler addition or by indirect interference in pore creation, an inferior membrane may result.” Ex. 1010

¶ [0086]. Thus, a POSITA would understand Beard to **not** have the pores comprise any filler (e.g. inorganic particles or parts thereof) and to teach away from using pores that comprise filler or parts of filler. Ex. 2015 ¶ 130.

c. The Particles In Beard’s Alternative Embodiment Define the Pore Structure, Such that Beard’s Alternative Disclosure Lacks “Pores Formed by the Binder”

Apart from Figure 1, Petitioner relies on an *alternative* embodiment in Beard, in which “larger fibrous particles, greater than 1 micron may extend through, across or between the pores creating a porous fibrous network independent of the fillers deployed within the polymer membrane walls that surround the larger fibrous particles.” Ex. 1010 ¶ [0025]; Pet., 54. At the outset, Petitioner’s conclusory argument based on the alternative embodiment in Beard fails because Petitioner has provided no reason why a POSITA making the proposed combination of Murakami and Beard would have been motivated to choose Beard’s “second optional embodiment” at all, let alone over the primary embodiment illustrated in Figure 1. *See Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882 (Fed. Cir. 2024); Ex. 2015 ¶ 132.

Moreover, in the motivation to combine section with Murakami and in reliance on the primary preferred embodiment of Beard, the Petition argues that one of the reasons a POSITA would have been motivated to combine Murakami and

Beard is that Beard teaches that “[g]ood results may be achieved when the solid particles are contained exclusively or largely within the pore walls” Ex. 1010 ¶ [0086]; Pet., 55. This benefit, and thus Petitioner’s entire rationale for the proposed combination, describes Beard’s preferred embodiment of Figure 1, not the alternative embodiment in Beard that Petition attempts to rely on at page 54.⁴ Ex. 2015 ¶ 132. Thus, if anything, Beard explicitly instructs a POSITA to use the preferred primary embodiment instead of the alternative second embodiment with larger particles outside of the pore walls. *Id.*

Finally, even if a POSITA were to pursue the alternative embodiment, the Petition runs into the other requirement that the pores must be “formed by the binder.” In the alternative embodiment, there is no evidence to suggest that the pores in this embodiment would be “formed by the binder.” To the contrary, Beard says the opposite, that the pores in this embodiment are formed by the larger filler particles rather than by the binder. *Id.* (“**larger fibrous particles**, greater than 1 micron may extend through, across or between the pores **creating a porous fibrous network**. . .”) (emphasis added). Ex. 1010 ¶ [0025]; Ex. 2015 ¶ 133.

⁴ Petitioner does not provide a motivation to combine Murakami with the relied upon alternative embodiment of Beard.

Thus, regardless of which embodiment a POSITA were to consider, Beard does not teach or suggest having pores that are *both* (1) formed by the binder and (2) comprise a part of the inorganic particles, as the claims require. Ex. 2015 ¶ 134.

2. Petitioner Fails to Show That a POSITA Would have Combined Beard with Murakami to Arrive at the Claimed Invention

Petitioner argues that a POSITA would have been motivated to combine Beard and Murakami because Beard teaches that its “highly filled membrane” leads to “good results.” Pet., 55. Again, Petitioner does not suggest combining Beard’s “second optional embodiment” with Murakami, only the primary embodiment. Regardless, a POSITA would not have been motivated to combine Beard with Murakami for at least the following reasons.

First, Beard and Murakami have incompatible particle sizes and particle size distributions. Ex. 2015 ¶¶ 136-40. Beard teaches using very small inorganic particles. *E.g.*, Ex. 1010 ¶ [0064] (“In order to form a highly porous material, *extremely small particles* may be blended into a polymer melt or solvent solution with both a polymer and a liquid.”); Abstract (“Within the pore walls that may be less than 0.02 microns in width, a densely packed filler material may have an *average diameter of less than 0.005 microns.*”); ¶ [0037] (“The TiO₂ particles are *on the order of or smaller than the cell wall thickness 208.*”); Ex. 2015 ¶ 136. Moreover, Beard explicitly teaches that the small size of those inorganic particle is

critical in achieving its pore structure. *See, e.g., id.* ¶ [0086] (attributing Beard’s “[g]ood results” to the fact that “the solid particles are contained exclusively or largely within the pore walls”); Ex. 2015 ¶ 136.

Contrary to Beard, Petitioner cites to disclosure in Murakami that references much larger and incompatible particle sizes in its porous layer. *See, e.g.,* Ex. 1005 ¶ [0018] (“The porous layer of the present invention preferably contains a filler in which, in terms of average particle diameter obtained based on a volume, (i) D10 is 0.005 um to 0.4 um, D50 is 0.01 um to 1.0 um, and D90 is 0.5 um to 5.0 um.”).⁵ A POSITA would have understood that these larger particle sizes in Murakami and the extremely small particle sizes of Beard are mutually exclusive. Ex. 2015 ¶¶ 138-40.

Second, a POSITA would not have been motivated to combine Beard and Murakami because they use materially different amounts of binder, which as explained above, influences whether the pores are “formed by the binder” or not. Ex. 2015 ¶¶ 141-42. Murakami teaches using only between 1 to 10% by mass of binder

⁵ While these particles would necessarily be broken down into smaller sizes for the reasons stated above in Section VI.A.3.b, the extent to which they would be reduced is not clear from Murakami (and, in any event, is not addressed by the Petition). If they were reduced to Beard’s particle size, then they would not disclose the claimed size distributions. Ex. 2015 ¶ 137.

compared to mass of inorganic particles (*see* Ex. 1005 ¶ [0070]), while Beard discloses using at least 50% and as high as 200% by volume of binder compared to volume of inorganic particles (*see* Ex. 1010 ¶ [0029]). Ex. 2015 ¶ 141. A POSITA would have understood that the large amount of binder in Beard is incompatible with the small amount of binder in Murakami. Indeed, Murakami teaches (and Petitioner admits) that using a very little amount of binder is essential to Murakami's porous layer. Ex. 1005 ¶ 70; *see also* Ex. 1003 ¶ 103 (admitting that, in Murakami, "the porous layer consists of nearly all filler material and relatively little resin by weight"); Ex. 2015 ¶ 142. Thus, the two references cannot be combined for this additional reason. Ex. 2015 ¶ 142.

A POSITA would need to choose whether to use the small amount of binder in Murakami or the large amount of binder in Beard. Ex. 2015 ¶ 142. If the POSITA chose to use the small amount of binder in Murakami, like the Petition suggests, then the pores would no longer be able to be "formed by the binder." This is because there must be enough binder present to fully surround the empty spaces that are the pores. *See* discussion *supra* at Section VI.A.1.c. As Dr. Wheeler explains in his declaration, the small amount of binder in Murakami is not enough to facilitate formation of the pores—rather, it is just enough binder to act as "dots of glue" that hold Murakami's inorganic particles together. Ex. 2015 ¶ 91.

Third, Beard and Murakami have incompatible bonding and dispersing properties. Ex. 2015 ¶¶ 143-46. As explained above with respect to Ground 1, Murakami uses a high-pressure dispersion technique in making its porous layer. Beard does not use such a high-pressure dispersion technique. Rather, Beard simply states that its porous membranes are manufactured using “a two-liquid casting process.” Ex. 1010 ¶¶ [0034], [0054]. Petitioner does not explain which technique to use, and a POSITA would not be able to use both. Ex. 2015 ¶ 143.

In addition, Beard teaches that the particles are contained within the pore walls, which is the opposite of Murakami. Ex. 2015 ¶ 144. That is, Murakami explicitly teaches a POSITA *not* to engulf inorganic particles in a binder. Ex. 1005 ¶ [0070] (“That is, *a porous layer in which a filler is dispersed in a resin* (binder resin) *is not suitable* as the porous layer containing a filler and a binder resin.”). Beard teaches the exact opposite—filler dispersed in a resin. Ex. 1010 at [0086] (“Good results may be achieved when the solid particles are contained exclusively or largely within the pore walls and when an open, continuous pore structure is provided throughout the film.”). The Petition does not address these differences.

Yet another key difference between Murakami and Beard is that they teach different procedures for forming the porous layer. Whereas Murakami discloses removing solvent and forming the porous layer by simply driving off solvent with heat, Beard is unclear as to how the solvent should be removed. Ex. 2015 ¶ 145. The

Petition does not specify which process to use, but regardless, neither is the same as the NIPs pore formation process disclosed in the '148 Patent. *Id.* ¶ 146. As explained above, the '148 Patent describes a coagulation process in which the binder separates out of its solvent and forms the pores in the porous layer. Neither Beard nor Murakami disclose this process, and thus, a POSITA would not arrive at the claimed invention regardless of which process is used. *Id.*

Fourth, a POSITA would not have been motivated to combine Beard with Murakami because Beard's SEM in Figure 2 shows a porous structure that is highly inconsistent. *Id.* ¶ 147. This is in direct contrast to Murakami, which teaches that its intention is to minimize variability in the porous structure. See e.g., Ex. 1005 ¶ [0088]. Thus, a POSITA looking to improve upon Murakami would not look to Beard to minimize variability because Beard does the opposite—it has worse variability than Murakami. Ex. 2015 ¶ 147.

Finally, even if a POSITA were to combine Beard with Murakami, a POSITA would not have had a reasonable expectation of success in combining these references to arrive at the claimed invention. Ex. 2015 ¶ 148. The Petition relies on the “good results” of Beard and the fact that Beard and Murakami both use solvent processes as evidence of a reasonable expectation of success. Pet. at 54-56. But Beard's “good results” are due to the use of very small inorganic particles that are trapped in a polymer. Ex. 1010 ¶ [0086]; Ex. 2015 ¶ 149.

The Petition suggests replacing the small inorganic particles of Beard with the larger particle sizes of Murakami. Using Murakami's larger particle sizes, and having those particles not be trapped in the binder, would negate the "good results" reported in Beard as being caused by using very small inorganic particles subsumed in binder. As explained above, using Murakami's particle sizes in Beard means that the pores would no longer be formed by the binder, but rather formed by inorganic particles like in Murakami, and thus the combination would not satisfy the requirements of the claims. Ex. 2015 ¶ 149. Alternatively, if a POSITA were to use the small particle sizes of Beard, then there is not even an argument that the particle size distribution limitations are met. *Id.*

3. Even if Combined, Petitioner's Ground Fails.

A POSITA would either have to (a) choose the small particle size of Beard or (b) choose the larger particle size of Murakami.⁶ Ex. 2015 ¶ 138. Regardless of whether the POSITA chooses to use the particle sizes of Beard or of Murakami, Ground 4 fails. *Id.*

In this ground, Petitioner relies on its arguments in Ground 1 regarding Murakami's particle sizes for claim elements [1.5]-[1.10] and [10.0]-[10.15]. As

⁶ Petitioner does not propose to, and a POSITA would not be motivated to, select a particle size different than the particle sizes disclosed by the references.

described in Ground 1, if a POSITA chooses the larger particle sizes of Murakami, then the pores would not be “formed by the binder” or “comprise[] a part of the inorganic particles” as is required by claim elements [1.3], [1.4], [10.8], and [10.9]. This is because the larger particles would not be encapsulated by the binder, like in Beard, and instead the pores would be formed by gaps in between larger inorganic particles—not by the binder. Ex. 2015 ¶ 140; Section VI.A. Indeed, as the Petition admits, Murakami teaches using predominantly inorganic particles (filler) and very little binder. Pet. at 26-28. A POSITA would have understood that this little amount of binder is not enough for the binder to form the pores. Ex. 2015 ¶ 91. Instead, a POSITA would have expected the pores in Murakami to be formed by gaps in between the inorganic particles. *Id.* A POSITA would have understood that this is exactly what Murakami teaches when it states that the pores are created by “gaps formed by contact of particles of the filler.” Ex. 1005 ¶ [0069]; Ex. 2015 ¶ 88.

On the other hand, if a POSITA chooses the small particle sizes of Beard, which the Petition suggests to do for the purposes of disclosing claim elements [1.3], [1.4], [10.8], and [10.9] before abandoning these particles for later claim recitations, then the size distribution requirements of the claims are clearly not met. Ex. 2015 ¶ 139. Beard teaches using very small inorganic particles. *E.g.*, Ex. 1010 ¶ [0064] (“In order to form a highly porous material, *extremely small particles* may be blended into a polymer melt or solvent solution with both a polymer and a liquid.”);

Abstract (“Within the pore walls that may be less than 0.02 microns in width, a densely packed filler material may have an *average diameter of less than 0.005 microns.*”); ¶ [0037] (“The TiO₂ particles are *on the order of or smaller than the cell wall thickness 208.*”). However, the claims require, for example, “Dv50 is in a range of 0.2 µm to 5 µm.” A POSITA would have understood this to mean that the diameter of fifty percent by volume of the inorganic particles must be in the range of 0.2 µm to 5 µm. *See* Ex. 2015 ¶ 59. This is clearly not the case for Beard’s inorganic particles, which teaches that 100% of its inorganic particles have a diameter less than the cell wall thickness, which is 0.02 µm, and so the particle sizes of Beard fall well outside the claimed range. Ex. 2015 ¶ 139.

Thus, if a POSITA chooses the Beard inorganic particles to meet elements [1.3], [1.4], [10.8], and [10.9], then this combination does not and cannot meet the particle size requirements of [1.5]-[1.10] and [10.10]-[10.15].

The Petition therefore fails to set forth a proposed selection of particles for its combination that would meet *all* claim elements simultaneously.

E. Ground 5: Murakami, Beard, and Honda Do Not Render Obvious Claims 3 and 12

Petitioner asserts that Murakami, Beard, and Honda render obvious Claims 3 and 12. Pet., 48-56. These claims are reproduced above with respect to Ground 2.

These claims are not obvious for at least the same reasons noted above with respect to Independent Claims 1 and 10.

F. Ground 6: Murakami, Beard, and Tanaka Do Not Render Obvious Claims 4 and 13

Petitioner asserts that Murakami, Beard, and Tanaka render obvious Claims 4 and 13. Pet., 48-56. These claims are reproduced above with respect to Ground 3.

These claims are not obvious for at least the same reasons noted above with respect to Independent Claims 1 and 10.

G. Ground 7: Beard and Akiike Do Not Render Obvious Claims 1-3, 5-12, and 14-19

Petitioner asserts that Beard and Akiike render obvious Claims 1-3, 5-12, and 14-19 of the '148 Patent. These claims are reproduced above with respect to Grounds 1 and 2.

The Petition asserts that a POSITA would combine Beard's pore structure with Akiike's particle sizes. *See* Pet., 60-67. Not only would a POSITA not be motivated to combine Akiike with Beard, but this combination fails to disclose or render obvious all the claimed elements for the additional reasons discussed below (in addition to the failures of Beard noted above).

1. Neither Beard nor Akiike Disclose or Render Obvious “The Pores At Least Comprise[] a Part of the Inorganic Particles”

This combination relies solely on Beard for the pore structure limitations (i.e. “pores formed by a binder” and “comprising a part of the inorganic particles”) found

in recitations [1.3], [1.4], [10.8], and [10.9]. Pet. at 60. For the same reasons noted above with respect to Beard in Ground 4, Beard does not disclose or render obvious that the pores “at least comprises a part of the inorganic particles,” as recited in independent claims 1 and 10. *See* discussion *supra* at Section VI.D.1. For this reason alone, this combination fails. Ex. 2015 ¶ 158.

2. Petitioner Fails to Show That a POSITA Would have Combined Akiike with Beard to Arrive at the Claimed Invention

Petitioner argues that a POSITA would have been motivated to combine Beard and Akiike because Beard discloses “a highly packed spherical filler material . . . bound with a polymer” but it does not provide size distributions of the filler particles. Pet., 63. According to the Petition, this lack of implementation details would have led a POSITA to look to “a similar separator porous membrane reference like Akiike for guidance on the appropriate size distributions for Beard’s filler particles.” *Id.* The Petition then relies on Akiike’s disclosure about size distributions to arrive at the claimed ranges. *Id.*, 63-65. The Petition further concludes there was a motivation to combine and reasonable expectation of success because Akiike and Beard both teach using the same type of inorganic particles, titanium dioxide. *Id.*, 65.

The Petition is incorrect that a POSITA would have been motivated to combine Akiike with Beard. *First*, Beard is not “lacking these implementation

details” regarding particle size distribution requirements. Ex. 2015 ¶ 161. A POSITA would have understood that Beard does not provide specific particle size distributions at Dv10, Dv50, and Dv90 because it uses other distribution requirements of either a maximum particle size or simply an average or median particle size. *Id.*; Ex. 1010 at [0022] (“In some embodiments, the particle size may be measured as a maximum size. . . . Some embodiments may measure particle size by an average or median particle size.”). At the very least, the lack of Dv10, Dv50, and Dv90 particle size distributions in Beard would indicate to a POSITA that particle size distribution along these lines is not important for Beard’s invention. *Id.* The Petition provides no reason why a POSITA would have been motivated to ***not*** simply use the maximum or average particle size distributions for all the inorganic particles, as disclosed in Beard. Nor does the Petition explain why a POSITA would have thought particle size distribution of Dv10, Dv50, and Dv90 would have been important in the first place and therefore go looking for another reference with these particle size distributions, like Akiike.

Second, a POSITA would not have been motivated to use Akiike’s particle size distributions because Beard teaches that very small particle sizes are key to its pore structure, and Akiike (like Murakami) discloses much larger particle sizes that would not work with Beard’s disclosure. Ex. 2015 ¶¶ 162-64. As explained above with respect to Ground 4, Beard teaches using very small inorganic particles. *E.g.*,

Ex. 1010 ¶ [0064] (“In order to form a highly porous material, *extremely small particles* may be blended into a polymer melt or solvent solution with both a polymer and a liquid.”); Abstract (“Within the pore walls that may be less than 0.02 microns in width, a densely packed filler material may have an *average diameter of less than 0.005 microns*.”); ¶ [0037] (“The TiO₂ particles are *on the order of or smaller than the cell wall thickness 208*.”). Beard also explicitly teaches that those small inorganic particle sizes are critical in achieving its pore structure. *See, e.g., id.* ¶ [0086] (attributing Beard’s “[g]ood results” to the fact that “the solid particles are contained exclusively or largely within the pore walls”).

In contrast, Akiike teaches using much larger particle sizes. Ex. 1011 ¶¶ [0011]-[0013] (disclosing D10 values of 0.2 µm to 0.4 µm, D50 values of 0.5 µm to 0.9 µm, and D90 values of 1.0 µm to 3.0 µm). A POSITA would have understood that the large particle sizes of Akiike are incompatible with the extremely small particle sizes of Beard, such that the two references cannot be effectively combined. Ex. 2015 ¶ 164.

Third, a POSITA would not have been motivated to combine Beard and Akiike because they use extremely different amounts of binder, which influences whether the pores can be “formed by the binder” or not. Ex. 2015 ¶¶ 165-68. Beard discloses using at least 50% and as high as 200% by volume of binder compared to volume of inorganic particles, while Akiike discloses a much smaller amount: at

least 0.1 parts by weight and no more than 10 parts by weight “relative to 100 parts by weight of the non-conductive particles.” Ex. 1011 ¶ [0096]; Ex. 2015 ¶ 166. A POSITA would have understood that the large amount of binder in Beard is incompatible with the small amount of binder in Akiike, and thus the two references cannot be combined for this additional reason. Ex. 2015 ¶¶ 167-68. As with Murakami in Ground 4, a POSITA would have to choose between the large amount of binder in Beard or the small amount of binder in Murakami—they could not use both amounts. Ex. 2015 ¶ 167. Moreover, the Petition does not suggest finding a middle ground between the references. The Petition likewise is silent about whether its proposed combination would use the large amount of binder from Beard or the small amount from Akiike. And if the POSITA were to use the amount of binder disclosed in Akiike, this very small amount of binder would simply not enough for the pores to be “formed by the binder.” Ex. 2015 ¶ 168.

Fourth, Beard and Akiike have incompatible bonding and dispersing properties. Ex. 2015 ¶¶ 169-71. Beard teaches completely surrounding the inorganic particles in the polymer binder. *See, e.g.*, Ex. 1010 ¶ [0026] (“The particles in the example of embodiment 100 may be captured inside the polymer binder 108, as opposed to having the particles loosely positioned within the pores.”); ¶ [0030] (“The membrane may be manufactured so that the fillers are dispersed within the wall structures . . .”); ¶ [0086] (“Good results may be achieved when the solid

particles are contained exclusively or largely within the pore walls. . .”); Ex. 2015 ¶ 170.

In contrast, Akiike teaches that the polymer (i.e. binder) “is formed in a particulate shape,” such that “the particulate polymer can be bound to the non-conductive particles not through a face contact but through a point contact.” Ex. 1011 ¶ [0094]. Like in Murakami, this type of bonding used by Akiike involves the polymer acting like “little dots of glue” to bind the inorganic particles together. Ex. 2015 ¶ 171. Akiike explains that this type of bonding is preferable because “the space between the non-conductive particles in the porous membrane can be made large, and thus the porosity of the porous membrane can be large.” Ex. 1011 ¶ [0094]. In other words, Akiike teaches that the pores are not formed by the binder but rather are formed by “space[s] between the non-conductive particles.” *Id.*; Ex. 2015 ¶ 171.

Petitioner does not explain which of Beard’s or Akiike’s bonding and dispersion technique to use, and a POSITA would not be able to use both simultaneously. Ex. 2015 ¶ 171. In other words, a POSITA would need to choose between using Beard’s bonding and dispersion techniques or Akiike’s bonding and dispersion techniques. The Petition does not explain which a POSITA would choose or why a POSITA could expect the different techniques of one reference to work with the disclosures of the other.

Finally, even if a POSITA were to combine Beard and Akiike, there would be no reasonable expectation of success—to the contrary, the combination would not result in the claimed invention. Ex. 2015 ¶¶ 172-74. Petitioner argues that a POSITA would have had a reasonable expectation of success in using Akiike’s particle size distributions in Beard’s porous membrane for the following reasons: (1) both Beard and Akiike use a polymer binder and (2) both use titanium dioxide as their inorganic particles. Pet., 65. These alleged reasons do not result in a reasonable expectation of success. Ex. 2015 ¶ 173.

As Beard explains, its “good results” are due to the use of very small inorganic particles that are trapped in a polymer. Ex. 1010 ¶ [0086]. As explained above, using the larger particle sizes of Akiike would mean that the pores would no longer be formed by the binder, but instead would be formed by the nonconductive particles (Ex. 1011 ¶ [0094]), and thus the combination would not meet the claims. Ex. 2015 ¶ 174. Alternatively, if a POSITA were to use the small particle sizes of Beard, then there is not even an argument that the particle size distribution limitations are met. *Id.*

3. Even if Combined, Petitioner’s Ground Fails.

If a POSITA were to use the small particle sizes of Beard, there is no argument that the particle size distribution requirements of Claim Elements [1.5]-[1.9] and

[10.10]-[10.14] are met. Pet. at 60 (“Beard does not specify particle size distributions of its inorganic filler particles.”); *see also* discussion *supra* at Section VI.D.3.

But if a POSITA were to use the larger particle sizes of Akiike⁷, which is what Petitioner suggests to do, then the inorganic particles would be too big to be contained within the binder and thus would form the porous network rather than the binder forming the pores. Ex. 2015 ¶ 164. The pore wall thickness in Beard is 0.02 µm. *Id.* The particle size distributions in Akiike mean that Akiike discloses inorganic particles that are much larger than this thickness. *Id.*; Ex. 1003 ¶¶ 196-98 (citing, for example, disclosures where D10 is 0.2 µm to 0.4 µm, D50 is 0.5 µm to 0.9 µm, and D90 is 1.2 µm to 2.0 µm). Using the much larger particle sizes disclosed in Akiike would mean that the particles would extend far beyond the binder walls and would themselves defines gaps between the other large inorganic particles that themselves form the pores. Ex. 2015 ¶ 164. This would mean the proposed combination does not disclose pores “formed by the binder” as required by the claims.

The Petition therefore fails to set forth a proposed selection of particles and binder for its combination that would meet *all* claim elements simultaneously.

⁷ Petitioner does not propose to, and a POSITA would not be motivated to, select a particle size different than the particle sizes disclosed by the references.

H. Ground 8: Beard, Akiike, and Tanaka Do Not Render Obvious Claims 4 and 13

Petitioner asserts that Beard, Akiike, and Tanaka render obvious Claims 4 and 13. Pet., 73-75. These claims are reproduced above with respect to Ground 3.

These claims are not obvious for at least the same reasons noted above with respect to Independent Claims 1 and 10.

VII. CONCLUSION

Patent Owner respectfully submits that the Board should deny institution. All of the Petition's Grounds lack merit. To the extent, however, that the Board finds that even some Grounds fail to meet the reasonable likelihood standard, it would not be an efficient use of resources for the Board to institute. *See, e.g., Chevron Oronite Co. v. Infieum USA LP*, IPR2018-00923, Paper 9, 9-11 (P.T.A.B. Nov. 7, 2018) (informative) (the Board may consider the number of claims and grounds that meet the reasonable likelihood standard when deciding whether to institute inter partes review).

Dated: June 6, 2025

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 preliminary response complies with the type-volume limits of 37 C.F.R. §42.24(b)(1) because it contains 12,646 words, according to the word-processing system used to prepare this preliminary response, excluding the parts of this preliminary response that are exempted by 37 C.F.R. §42.24(b) (including a 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 6, 2025

By: /Christopher TL Douglas /
Christopher TL Douglas

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §42.6(e), the undersigned hereby certifies that true and correct copies of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE and NINGDE AMPEREX TECH. EXHIBITS 2015, 2016, and 2025-2029** were served in their entirety on June 6, 2025 by filing this document through the PTAB's P-TACTS Filing System as well as delivering a true and correct copy by electronic mail on Petitioner's lead and backup counsel at the following email addresses (as agreed by counsel for Petitioner):

James D. Stein (james.stein@leehayes.com)

Richard Uberto (Richard.uberto@leehayes.com)

Jason D. Eisenberg (jasone-PTAB@sternekessler.com)

Jason A. Fitnzsimmons (jfitzsimmons-PTAB@sternekessler.com)

COSMX-PTAB@leehayes.com

PTAB@sternekessler.com

Dated: June 6, 2025

By: /Christopher TL Douglas/
Christopher TL Douglas