

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHUHAI COSMX BATTERY CO., LTD.,
Petitioner

v.

NINGDE AMPEREX TECHNOLOGY LIMITED,
Patent Owner

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

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,575,148**

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EXHIBIT LIST

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

Exhibit No.	Description
1015	Complaint, <i>Ningde AmpereX Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , No. 2:24-cv-00728-JRG (E.D. Tex. Sept. 6, 2024), ECF 1.
1016	Unopposed Application for Extension of Time to Answer Complaint, <i>Ningde AmpereX Tech. Ltd. v. Zhuhai CosMX Battery Co.</i> , No. 2:24-cv-00728-JRG (E.D. Tex. Dec. 4, 2024), ECF 16.
1017	U.S. Patent No. 9,065,119 to Nishikawa (“Nishikawa”)

CLAIMS APPENDIX

Claim Element	Language
Claim 1	
[1.pre]	<i>A porous film, comprising:</i>
[1.1]	<i>a binder; and</i>
[1.2]	<i>inorganic particles;</i>
[1.3]	<i>wherein the porous film comprises pores formed by the binder</i>
[1.4]	<i>the pores at least comprises a part of the inorganic particles</i>
[1.5]	<i>wherein the inorganic particles have particle sizes that Dv10 is in a range of 0.015 μm to 3 μm,</i>
[1.6]	<i>Dv50 is in a range of 0.2 μm to 5 μm, and</i>
[1.7]	<i>Dv90 is in a range of 1 μm to 10 μm;</i>
[1.8]	<i>Dv10 of the inorganic particles is less than Dv50 of the inorganic particles, and</i>
[1.9]	<i>Dv50 of the inorganic particles is less than Dv90 of the inorganic particles, and</i>
[1.10]	<i>the inorganic particles have particle sizes that the ratio of Dv90 to Dv10 is in a range of 2 to 100.</i>
Claim 2	
[2.1]	<i>The porous film according to claim 1, wherein the porous film has an average pore size of 0.3 μm to 20 μm.</i>
Claim 3	
[3.1]	<i>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.</i>
Claim 4	
[4.1]	<i>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.</i>

Claim Element	Language
Claim 5	
[5.1]	<i>The porous film according to claim 1, wherein the inorganic particles are at least one selected from the group consisting of alumina, silica, magnesia, titanium oxide, hafnium dioxide, tin oxide, cerium dioxide, nickel oxide, zirconia, zinc oxide, calcium oxide, boehmite, aluminum hydroxide, magnesium hydroxide, calcium hydroxide, and barium sulfate.</i>
Claim 6	
[6.1]	<i>The porous film according to claim 1, wherein the binder is at least one selected from the group consisting of polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylate, polyacrylic acid, polyacrylic acid salt, sodium carboxymethylcellulose, polyvinylpyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene and polyhexafluoropropylene.</i>
Claim 7	
[7.1]	<i>The porous film according to claim 1, wherein the porous film has a porosity of 20% to 90%.</i>
Claim 8	
[8.1]	<i>The porous film according to claim 1, wherein the porous film has a thickness of 0.2 to 10 μm.</i>
Claim 9	
[9.1]	<i>The porous film according to claim 1, wherein a volume ratio of the inorganic particles to the binder is in a range of 0.2 to 3.0.</i>
Claim 10	
[10.pre]	<i>A lithium-ion battery, comprising:</i>
[10.1]	<i>a positive electrode;</i>
[10.2]	<i>a negative electrode;</i>
[10.3]	<i>a separator, arranged between the positive electrode and the negative electrode;</i>
[10.4]	<i>non-aqueous electrolyte; and</i>

Claim Element	Language
[10.5]	<i>a porous film, comprising:</i>
[10.6]	<i>a binder; and</i>
[10.7]	<i>inorganic particles;</i>
[10.8]	<i>wherein the porous film comprises pores formed by the binder,</i>
[10.9]	<i>the pores at least comprises a part of the inorganic particles,</i>
[10.10]	<i>wherein the inorganic particles have particle sizes that Dv10 is in a range of 0.015 μm to 3 μm,</i>
[10.11]	<i>Dv50 is in a range of 0.2 μm to 5 μm,</i>
[10.12]	<i>Dv90 is in a range of 1 μm to 10 μm;</i>
[10.13]	<i>Dv10 of the inorganic particles is less than Dv50 of the inorganic particles, and</i>
[10.14]	<i>Dv50 of the inorganic particles is less than Dv90 of the inorganic particles; and</i>
[10.15]	<i>the inorganic particles have particle sizes that the ratio of Dv90 to Dv10 is in a range of 2 to 100.</i>
Claim 11	
[11.1]	<i>The lithium-ion battery according to claim 10, wherein the porous film has an average pore size of 0.3 μm to 20 μm.</i>
Claim 12	
[12.1]	<i>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.</i>
Claim 13	
[13.1]	<i>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.</i>

Claim Element	Language
Claim 14	
[14.1]	<i>The lithium-ion battery according to claim 10, wherein the inorganic particles are at least one selected from the group consisting of alumina, silica, magnesia, titanium oxide, hafnium dioxide, tin oxide, cerium dioxide, nickel oxide, zirconia, zinc oxide, calcium oxide, boehmite, aluminum hydroxide, magnesium hydroxide, calcium hydroxide, and barium sulfate.</i>
Claim 15	
[15.1]	<i>The lithium-ion battery according to claim 10, wherein the binder is at least one selected from the group consisting of polyvinylidene fluoride, vinylidene fluoride-hexafluoropropylene copolymer, polyamide, polyacrylonitrile, polyacrylate, polyacrylic acid, polyacrylic acid salt, sodium carboxymethylcellulose, polyvinylpyrrolidone, polyvinyl ether, polymethyl methacrylate, polytetrafluoroethylene and polyhexafluoropropylene.</i>
Claim 16	
[16.1]	<i>The lithium-ion battery according to claim 10, wherein the porous film has a porosity of 20% to 90%.</i>
Claim 17	
[17.1]	<i>The lithium-ion battery according to claim 10, wherein the porous film has a thickness of 0.2 to 10 μm.</i>
Claim 18	
[18.1]	<i>The lithium-ion battery according to claim 10, wherein a volume ratio of the inorganic particles to the binder is in a range of 0.2 to 3.0.</i>
Claim 19	
[19.1]	<i>The lithium-ion battery according to claim 10, wherein the porous film is arranged on a surface of at least one selected from the group consisting of the positive electrode, the negative electrode and the separator.</i>

I. INTRODUCTION

Zhuhai CosMX Battery Co., Ltd (“Petitioner”) requests *inter partes* review to cancel claims 1-19 (“the challenged claims”) of U.S. Patent No. 11,575,148 (“the ’148 Patent,” EX1001), assigned to Ningde Amperex Technology Limited (“Patent Owner”). This Petition is supported by the declaration of Dr. Samuel Gido (EX1003), an expert in the field of materials science and engineering, including for battery applications.

The challenged claims of the ’148 Patent recite a porous film having inorganic particles meeting certain size distributions. EX1001, Abstract. Specifically, the claims recite that the inorganic particles meet certain ranges for Dv10, Dv50, and Dv90—particle sizes at or below which includes 10%, 50%, and 90% of the film’s volume, respectively. *Id.* The Examiner of the ’148 Patent application only allowed the challenged claims after the applicant amended the independent claims to recite the specific Dv10, Dv50, and Dv90 ranges now recited in independent claims 1 and 10. EX1002, 22.

But the recited ranges cover prior art porous films—not before the Examiner during prosecution—having the recited inorganic particle size distribution characteristics. For example, Murakami (EX1005, Ground 1) discloses a porous film used for a lithium-ion battery separator having inorganic particle Dv10, Dv50, and Dv90 ranges that overlap the claimed ranges, thus rendering the challenged claims

obvious. *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003) (The Federal Circuit has long held that “even a slight overlap in range establishes a prima facie case of obviousness.”). Murakami also describes specific example porous layers having Dv10, Dv50, and Dv90 values falling squarely within the claimed ranges, again rendering the claims obvious. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782-783 (Fed. Cir. 1985) (claimed range met by prior art teaching points within the claimed range).

Akiike (EX1011, Ground 7) similarly discloses a porous membrane for a lithium-ion battery separator with inorganic particle Dv10, Dv50, and Dv90 ranges and values respectively overlapping and falling within the claimed ranges. Beard (EX1010), when combined with Akiike’s inorganic particle size distributions, separately renders obvious the challenged claims.

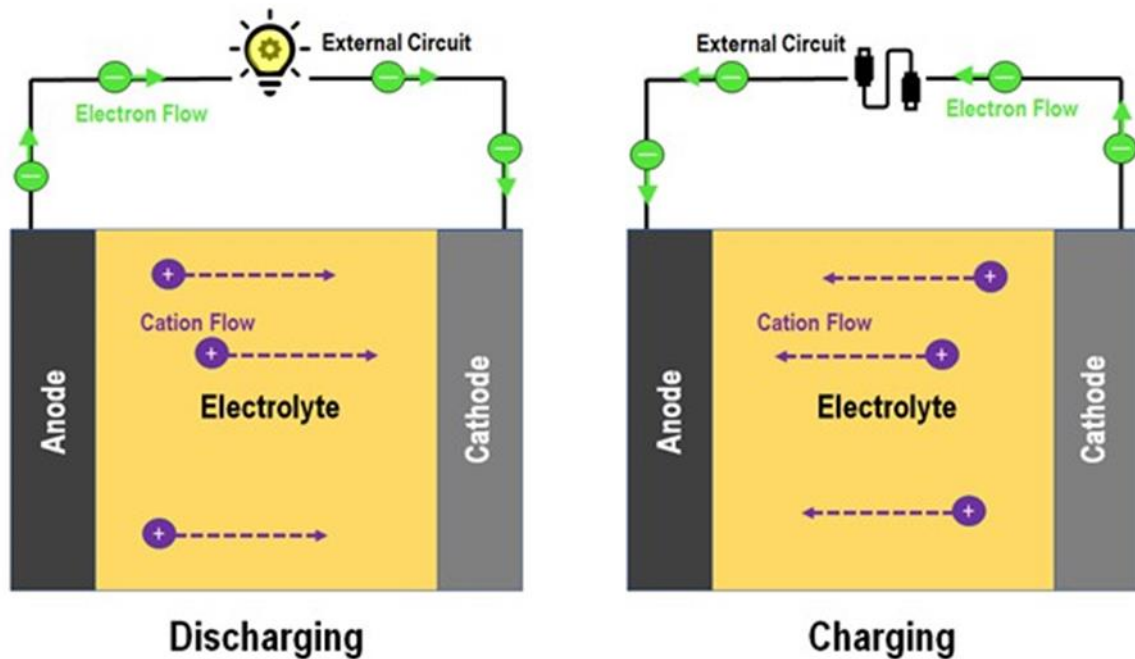
Accordingly, for the reasons below, Petitioner requests institution of IPR and cancelation of the challenged claims as unpatentable.

II. TECHNOLOGY BACKGROUND

A. Lithium-Ion Battery Technology

The basic structure of a battery is illustrated below. EX1003, ¶26.

General Battery Schematic



Battery Structure

The battery includes a negative electrode, called an anode, and a positive electrode, called a cathode. EX1003, ¶27. The electrodes are separated from one another and immersed in an electrolyte through which ions can be transported. *Id.*

When the battery discharges, positive ions diffuse from the anode, through the electrolyte, to the cathode. *Id.*, ¶28. Electrons move separately through an external circuit from the anode to the cathode, combining with the ions at the cathode. *Id.* The electrons generate an electrical current when moving through the external circuit.

Charging the battery involves the reverse process. *Id.*, ¶29. An external voltage pushes electrons through the external circuit to the anode, creating positive

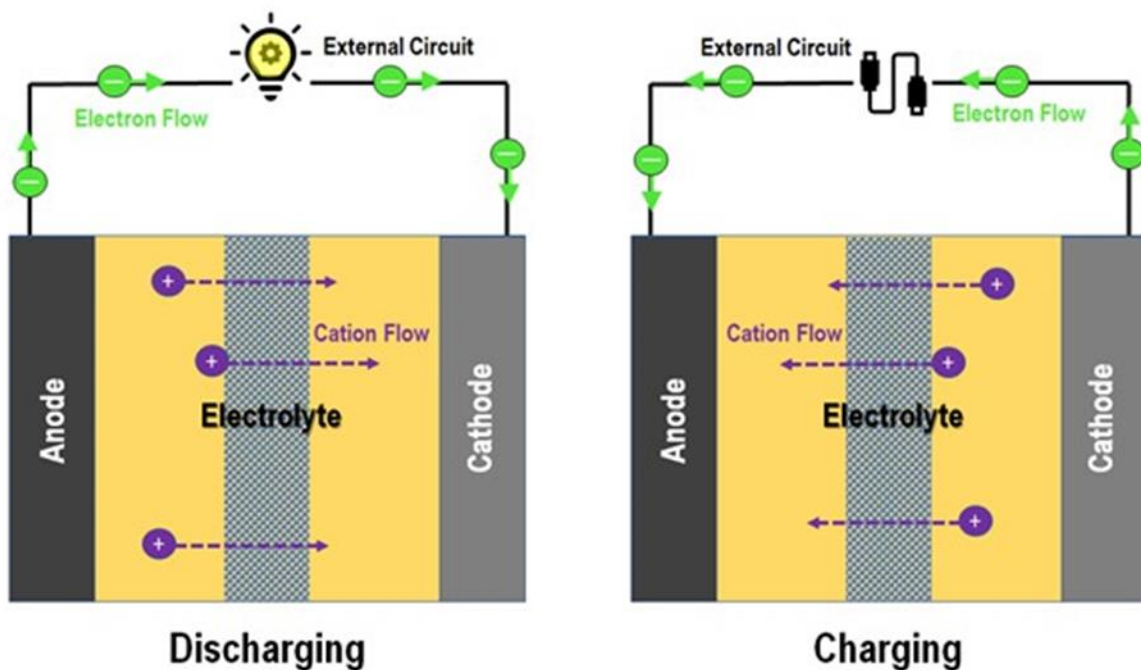
ions at the cathode. The positive ions migrate through the electrolyte and combine with the electrons at the anode. *Id.*

One type of battery is a lithium-ion battery. EX1003, ¶30. These batteries pose an issue: the anode and the cathode must never touch or an electrical short circuit will result, discharging the battery so quickly that the battery may explode. *Id.*

B. Separator Technology

A separator prevents short circuits between the electrodes. EX1003, ¶31.

Li-Ion Battery with Separator

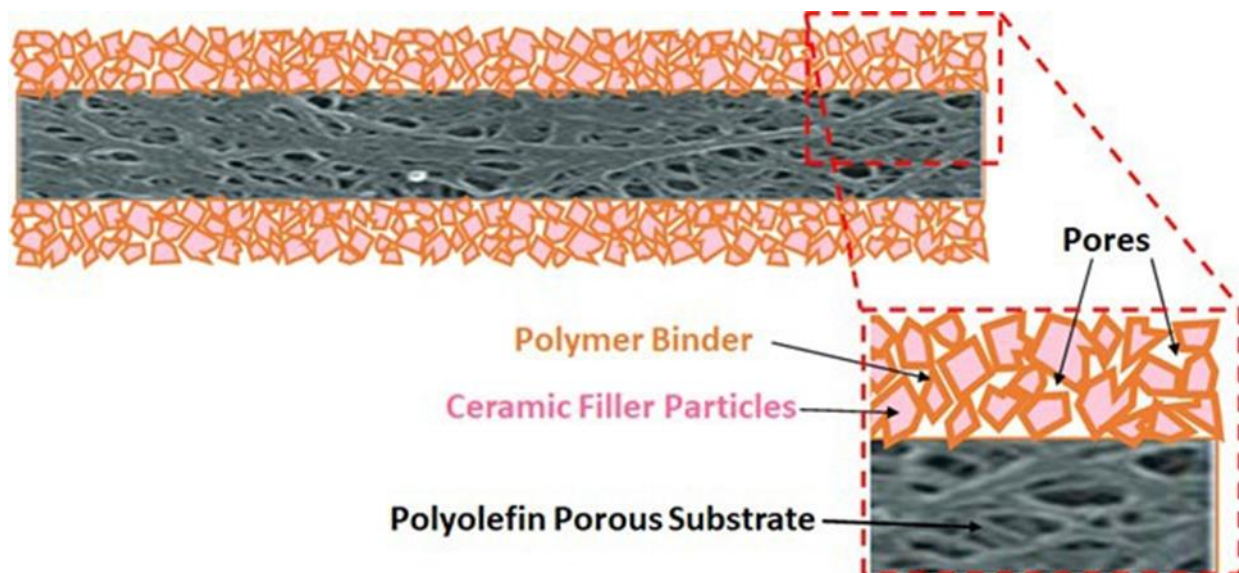


Separator Structure

Thus, separators must be electrically insulating, preventing flow of electrical current between the anode and the cathode. EX1003, ¶32. But separators must simultaneously permit the transport of ions through the electrolyte, allowing discharging and charging to occur. *Id.* Thus, separators are typically both porous—

to allow ion passage—but non-conducting to prevent flow of electrical current between the electrodes. *Id.*

Conventional separators included a porous substrate and a porous layer formed on one or both sides of the substrate. *Id.*, ¶33. It was known to form the porous layer from a polymer binder and inorganic filler particles, like magnesia or alumina. *See, e.g.*, EX1005, ¶¶[0060], [0070]; EX1007, Abstract; EX1009, ¶¶[0003], [0039]; EX1003, ¶33. A polymer binder is non-conducting and can be porous, while the addition of inorganic particles improves mechanical strength and high-temperature stability. EX1003, ¶33.

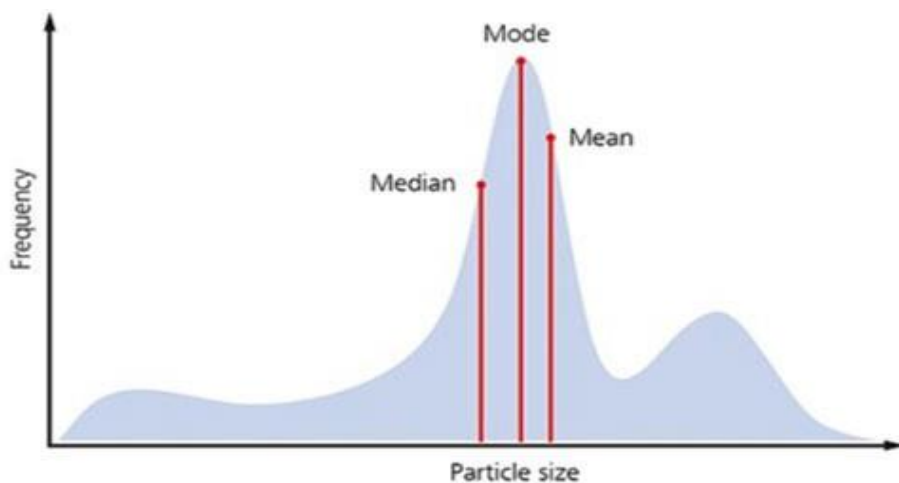


Separator Structure

One approach to improve separator safety was to adjust parameters of the polymer binder and inorganic particles to achieve desirable properties in the porous layer, such as mechanical strength, high-temperature stability, adhesion, internal

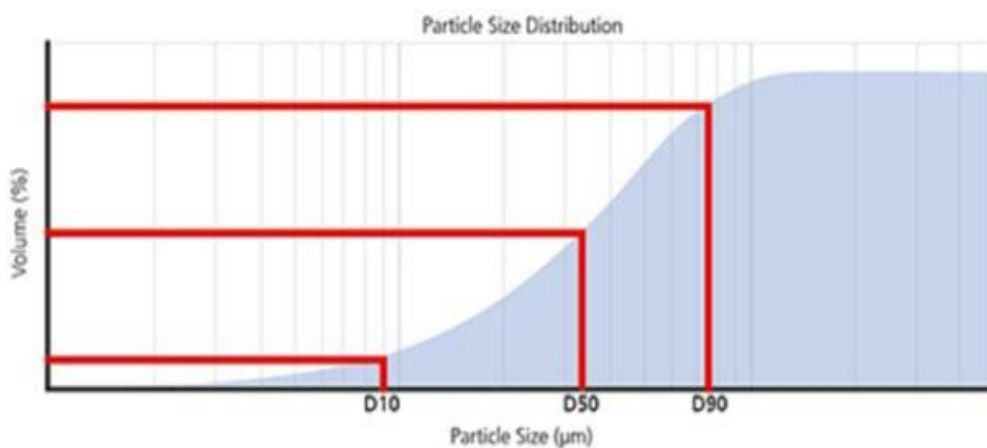
resistance, flame retardancy, energy density, or other properties. EX1003, ¶34. One parameter was inorganic particle size (usually diameter). EX1003, ¶35. Specifically, it was known to adjust cumulative particle size values known as “D10,” “D50,” and “D90.” *Id.*; see also, e.g., EX1005, ¶[0018]; EX1011, ¶¶[0010]-[0013]. While D10, D50, and D90 may refer to particle size based on a cumulative weight (e.g., Dw90) or volume distribution (e.g., Dv90), the ’148 Patent and prior art references applied in the Grounds below use the latter metric based on volume. EX1001, 1:53-2:15; EX1005, ¶[0018]; EX1011, ¶¶[0010]-[0013]; EX1003, ¶36.

Cumulative particle size values are typically used because inorganic particles are prepared through processes like pulverizing, grinding, or milling that produce particles of varying sizes. EX1003, ¶37. Varying particle sizes may be represented by a distribution showing particle size plotted against frequency of particles in the sample having that particle size. *Id.*



Particle Size Distribution

The distribution of particle sizes may be multimodal—having multiple peaks rather than a strict bell shape. EX1003, ¶38. While certain values—mean, median, and mode—flow from the distribution, these values alone typically do not adequately describe the distribution overall. *Id.* Thus, skilled artisans frequently refer to cumulative particle size distributions, like that illustrated below, which provide a more complete picture. *Id.*



Particle Size Distribution

The plot shows, as particle size increases along the x-axis, a running total of the particle volume (as a percentage of the total volume of the sample) of particles have a size up to and including that size. EX1003, ¶39. Eventually, at a large particle size, the cumulative particle size distribution plateaus because it includes all particles in the distribution.

The cumulative particle size distribution can be characterized by particle sizes at which the cumulative volume reaches different percentages of the total. EX1003, ¶40. Shown in the figure, for example, particle sizes designated D10, D50, and D90

refer to the particle sizes at which 10%, 50%, and 90% of the total volume is reached, respectively. *Id.* That is, 10%, 50%, and 90% of the particles by volume have a size equal to less than the values D10, D50, and D90, respectively. Thus, it was known in the art to adjust particle size—including through cumulative particle size values D10, D50, and D90—of the inorganic particles to achieve desirable separator properties.

Finally, it was known in the art to adjust pore size and porosity of the porous layer to improve permeability and, thus, ion conductivity. EX1003, ¶41. *See also* EX1005, ¶¶[0013]-[0015], [0066], [0093], [0121], [0209]-[0211] (adjusting pore diameter and “voidage” of the porous layer); EX1010, ¶¶[0020], [0029], [0030], EX1011, ¶¶[0094], [0096]; EX1012, ¶¶[0045]-[0046], [0053], [0101], [0102].

III. STATEMENT OF PRECISE RELIEF REQUESTED

Petitioner requests *inter partes* review, seeking cancellation of claims 1-19 of the '148 Patent under 35 U.S.C. § 103(a).

IV. THE '148 PATENT

The '148 Patent issued on February 7, 2023, from U.S. Application No. 17/061,427 (“the '427 Application”), which is a continuation of U.S. Application No. 16/000,764 (“the '764 Application”) filed June 5, 2018 (now U.S. Patent No. 10,833,355). EX1001, 1. The '148 Patent claims priority to China Patent Application No. 201810322931.1 filed April 11, 2018.

A. Specification and Claims

The '148 Patent describes a porous film for lithium-ion batteries and batteries incorporating this film, with the porous film arranged on the separator, positive electrode, or negative electrode. *See, e.g.*, EX1001, Abstract, 1:42-2:56; 3:16-51. The porous film is composed of binder and inorganic particles fixed by the binder. *See, e.g., id.*, Abstract, 1:45-2:37, 3:16-51.

The '148 Patent specifies ranges of inorganic particle sizes based on “volume accumulation” and relationships between those ranges:

- **Dv10:** “[T]he inorganic particles have particle sizes such that particle size having a volume accumulation of 10% (Dv10) is in a range of 0.015 μm to 3 μm .” *Id.*, 1:53-55; *see also id.*, 1:60-62.
- **Dv50:** “[P]article size having a volume accumulation of 50% (Dv50) is in a range of 0.2 μm to 5 μm .” *Id.*, 1:56-57; *see also id.*, 1:63-66.
- **Dv90:** “[P]article size having a volume accumulation of 90% (Dv90) is in a range of 1 μm to 10 μm [.]” *Id.*, 1:57-58; *see also id.*, 1:67-2:3.
- **Dv10<Dv50, Dv50<Dv90:** “[P]article size having a volume accumulation of 10% (Dv10) is less than particle size having a volume accumulation of 50% (Dv50), and particle size having a volume accumulation of 50% (Dv50) is less than particle size having a volume accumulation of 90% (Dv90).” *Id.*, 2:4-9.

- **Dv90/Dv10 ratio:** The '148 Patent specifies a ratio of Dv90 to Dv10, stating “the ratio of particle size having a volume accumulation of 90% (Dv90) to particle size having a volume accumulation of 10% (Dv10) is in a range of 2 to 100.” *Id.*, 2:10-15.

According to the '148 Patent, when particle size distribution obeys these ranges (and other attributes of composition and structure), “[t]he porous film ... has excellent adhesion” and “the pore structure ... can still be well maintained,” which “enable[es] ... high ionic conductivity.” *Id.*, 2:4-53. As a result, the '148 Patent claims “the provided lithium-ion battery has excellent rate performance and cycle performance.” *Id.*, 2:53-56.

The independent claims recite a porous film having the above-described particle size characteristics. EX1001, 25:33-46. The '148 Patent also discloses and claims other parameters, such as certain pore characteristics. *See, e.g., id.*, 1:48-52, 2:16-18, 2:33-37, 5:15-28, 5:40-42, 25:47-55, 26:4-10.

B. Prosecution History

1. The '427 Application

Although the Examiner allowed the '427 Application in the first action on the merits, the Examiner's reasons for allowance established unpatentability over Murata (EX1013) of a porous film comprising (1) a binder, (2) inorganic particles, (3) pores formed by the binder, and (4) the pores comprising at least a part of the

inorganic particles. EX1002, 20-23. Rather, according to the Examiner, the specific “particle sizes and ranges as required in the independent claims”—i.e., the Dv10, Dv50, and Dv90 characteristics—distinguished the claims over Murata. *Id.*, 22.

2. Parent ’764 Application

The ’764 Application, the parent of the ’427 Application, confirms the claimed subject matter was unpatentable over Murata but for the claimed Dv10, Dv10, and Dv90 characteristics. EX1014, 60-64. Then, independent claim 1 broadly recited a porous film having (1) a binder, (2) inorganic particles, (3) pores formed by the binder, and (4) the pores comprising at least a part of the inorganic particles. *Id.*, 197. It also recited that “the average wall thickness between the pores is in a range of 20 nm to 500 nm,” *id.*, now recited in dependent claims 3 and 12 of the ’148 Patent. EX1001, 25:49-51, 26:34-36.

Responding to an Office Action rejecting the claims over Murata, the applicant amended independent claim 1 to add the Dv10, Dv50, and Dv90 ranges and relationships. *See* EX1014, 37. Regarding claim 1 as written before the amendment, the applicant argued that Murata does not “disclose that the resin binder ... forms a pore and the pore formed by the binder ... at least comprises a part of the inorganic particles.” *Id.*, 42. The applicant also disputed that Murata discloses the claimed wall thickness. *Id.* The applicant further argued that “Murata does not disclose ... the particle size range of Dv10 Dv50, Dv90 of the inorganic particles or

the ratio range of Dv90 and Dv10, which is not obvious to those skilled in the art.”
Id., 45.

The Examiner then allowed the amended claims, but only for one reason provided by the applicant. *Id.*, 16-21. The Examiner rejected the applicant’s argument that Murata did not disclose the independent claim as written before the amendment adding the particle size limitations “[because] pores are found within the binder and porous layer. The pores at least comprises a part of the inorganic particles (filler).” *Id.*, 19. Instead, the Examiner found the amended claims to be allowable because Murata did not disclose the claimed particle size ranges. *Id.*, 20.

Thus, in both the ’427 and ’764 Applications, the Examiner consistently held as unpatentable a porous film comprising (1) a binder, (2) inorganic particles, (3) pores formed by the binder, and (4) the pores comprising at least a part of the inorganic particles. Rather, the Examiner found the features relating to “the particle[] sizes and ranges as required in the independent claim” made the claims allowable over the prior art of record. EX1014, 20.

None of the references relied upon in the Grounds below, however, was before the Examiner during prosecution of the ’427 or ’764 Applications. Petitioner’s prior art references address the reason the Examiner allowed both applications: Murakami (EX1005) and Akiike (EX1011) both disclose porous films comprising binder and inorganic particles having the claimed Dv10, Dv50, and Dv90 features. Petitioner’s

prior art even addresses the (unpersuasive) reasons the applicant contended the independent claim of the '764 Application was allowable.

Murakami (EX1005): In addition to disclosing the claimed Dv10, Dv50, and Dv90 characteristics, Murakami describes a formation process like the '148 Patent that removes solvent from the binder coating, leaving the binder resin in a “fibrillar” or “granular” (i.e., porous) state. Thus, Murakami’s pores are formed “by the binder” in the same way disclosed in the specification of the '148 Patent.

Murakami’s description of its porous layer composition suggests or renders obvious that the pores of Murakami’s porous layer include at least some portion of the filler material (claimed inorganic particles). Compared to the porous film described in the '148 Patent specification, Murakami’s porous layer has even more filler than binder resin and the filler particles are larger compared to the thickness of the layer. This suggests or renders obvious that Murakami’s pores include at least some portion of the filler.

Beard (EX1010): Beard discloses a porous membrane for a separator that has a high concentration of filler (inorganic particles) held together by a binder. EX1010, Abstract. The filler is densely packed inside the pore walls of the porous membrane with some particles extending into the voids of the pores, so “the pores at least comprises a part of the inorganic particles,” as claimed. *Id.*

Akiike (EX1011): Akiike discloses a separator having a porous membrane comprising a polymer binder holding together inorganic, non-conductive particles. The inorganic particles have the claimed Dv10, Dv50, and Dv90 ranges and relationships.

V. PERSON OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) at the time of the alleged invention in 2018 would have had at least a bachelor’s degree or equivalent degree from an accredited institution in chemistry, chemical engineering, materials science, or a similar discipline covering relevant principles of organic and inorganic chemistry, polymer processing, ceramic materials, and ceramic processing, as well as three or more years of experience in electrochemical energy storage devices, lithium-ion battery technology, separators, characterizations and analyses of particle size, film thickness, and/or materials compositions, battery performance characterization, or other applications of polymer chemistry, ceramic chemistry, and ceramic processing. More education could substitute for less experience, and *vice versa*. *Id.* Petitioner’s technical expert, Dr. Guido, qualified as a POSITA by at least 2004. EX1003, ¶17.

VI. CLAIM CONSTRUCTION

In IPR, all claim terms receive their ordinary and customary meaning as understood by a POSITA at the time of the invention, in light of the specification

and the prosecution history. *See* 37 C.F.R. § 42.100(b); 35 U.S.C. § 282(b). No claim terms require express construction for purposes of granting the Petition, and the prior art renders obvious the challenged claims under any reasonable construction.

VII. IDENTIFICATION OF CHALLENGES AND PRIOR ART

Petitioner requests IPR and review of the challenged claims under 35 U.S.C.

§ 103 as follows:

Ground	Claims	Reference(s)
Murakami as Primary Reference		
1	1, 2, 5-11, 14-19	• U.S. Patent Application Publication No. 2017/0162849 A1 (“Murakami,” EX1005)
2	3, 12	• Murakami • International Patent Application Publication No. WO 2015/178351 A1 (“Honda,” EX1006)
3	4, 13	• Murakami • Japan Patent Application No. 2017-137432A (“Tanaka”, EX1008)
4	1, 2, 5-11, 14-19	• Murakami • U.S. Patent Application Publication No. 2012/0228214 (“Beard”, EX1010)
5	3, 12	• Murakami • Beard • Honda
6	4, 13	• Murakami • Beard • Tanaka

Beard as Primary Reference		
7	1-3, 5-12, 14-19	• Beard • U.S. Patent Application Publication No. 2016/0013465 A1 (“Akiike”)
8	4, 13	• Beard • Akiike • Tanaka

Petitioner’s prior art references are U.S. or foreign patent documents that qualify as prior art under §§ 102(a)(1), 102(a)(2) even if the ’148 Patent is entitled to its earliest claimed priority date.

A. Murakami

Murakami was filed in 2015 and published in 2017. EX1005. Murakami describes a “porous layer ... and a separator formed by laminating the porous layer” for a lithium-ion battery. EX1005, Abstract. The porous layer includes a filler and a binder. *Id.*, ¶[0017]. This filler preferably consists of inorganic particles. *Id.*, ¶[0061]. Murakami discloses D10, D50, and D90 values based on volume for these inorganic particles. *See, e.g., id.*, ¶[0018].

B. Honda

Honda was filed on May 18, 2015, and published on November 26, 2015. EX1006; EX1007. Honda discloses a separator for nonaqueous secondary batteries comprising a porous base material containing thermoplastic resin and a porous layer containing polyvinylidene fluoride resin formed on one or both surfaces of the base

material. EX1007, ¶[0015]. The porous layer has a “honeycomb” structure with cells (pores) that open perpendicular to the surface and arranged adjacent to each other in the plane direction. *Id.*, ¶¶[0017], [0038]-[0040]. The thickness of the walls dividing the porous layer into cells is 0.1 μm to 2 μm . *Id.*, ¶[0045].

C. Tanaka

Tanaka was filed in 2016 and published in August 2017. EX1008; EX1009. Tanaka discloses a polyolefin body suitable for use as a separator for a lithium-ion battery. EX1009, ¶[0069]. Tanaka controls the pore size distribution ratio D10/D90—the reciprocal metric as the ’148 Patent’s pore size distribution ratio R90/R10—to provide mechanical strength and high permeability through the body. *See id.*, ¶¶[0019], [0020]. To achieve this control, Tanaka’s manufacturing process includes steps of controlled heating and cooling to suppress fluctuation in pore volume and average diameter, allowing “the D10/D90 ratio to be controlled to a desired value.” *Id.*, ¶[0020].

D. Beard

Beard was filed and published in 2012. EX1010. Beard discloses a microporous membrane comprising a polymer binder defining pores and containing filler material. *See* EX1010, Abstract, ¶¶[0003], [0026], [0029]. The microporous membrane has “spherical filler” particles densely packed in the pore walls, making the membrane suitable for use as a battery separator. *Id.*, ¶¶[0010], [0033]; *see also*

id., Abstract, ¶¶[0003], [0011], [0012]. The filler consists of inorganic particles such as titanium oxide (*id.*, ¶¶[0036], [0054]), and the polymer binder forms pores because the polymer binder and filler material are suspended in a “liquid pore forming agent,” which is later removed “after solidification begins” (*id.*, ¶¶[0057]-[0059]).

E. Akiike

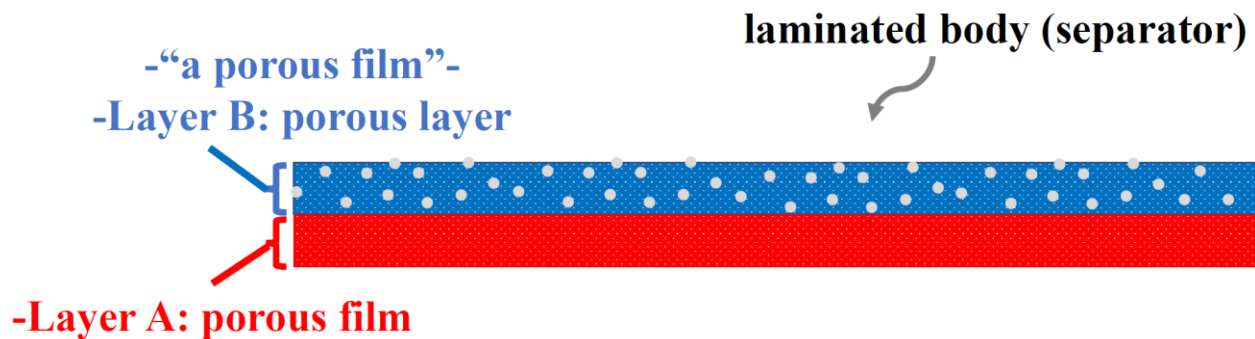
Akiike was filed on March 19, 2014, and published on January 14, 2016. EX1011. Akiike describes “[a] slurry for a lithium ion secondary battery porous membrane” used in a battery separator. EX1011, Abstract; *see also id.*, ¶[0001]. The separator includes “an organic separator layer; and a porous membrane obtained by applying onto the organic separator layer the slurry for a lithium ion secondary battery porous membrane.” *Id.*, ¶[0016]. The slurry “includes non-conductive particles, a water-soluble polymer, and a particulate polymer.” *Id.*, ¶[0026]. The particulate polymer “function[s] as a binder in the porous membrane.” *Id.*, ¶[0067]. Akiike discloses D10, D50, and D90 ranges and values based on volume for these inorganic particles. *Id.*, ¶¶[0010]-[0013], [0031]-[0033] (preferred D10, D50, and D90 ranges), (Tables 1-4).

VIII. GROUND 1: MURAKAMI RENDERS OBVIOUS CLAIMS 1, 2, 5-11, AND 14-19

A. Independent Claim 1

1. [1.pre]: “*A porous film, comprising:*”¹

Murakami discloses or suggests this element. EX1003, ¶¶75-81. Specifically, Murakami discloses *a porous film* (porous layer B):



EX1003, ¶75²

¹ The enclosed Claims Appendix includes the Challenged Claim language with bracketed reference numerals identifying respective Claim Elements referenced in the Petition.

² The '148 Patent and Murakami use slightly different nomenclature for parts of their separators. While Murakami's laminated body also has a “porous film,” Layer A, on which the porous layer is coated, Murakami's “porous film” corresponds to the '148 Patent's “porous substrate.” See EX1001, 7:46-48; EX1003, ¶75. Petitioner relies on Murakami's “porous layer” as the claimed “porous film” because it corresponds to the claimed “porous film.” EX1003, ¶75.

Specifically, Murakami discloses “a separator that is a laminated body in which the porous layer is laminated onto one surface or each of both surfaces of the porous film.” EX1005, ¶[0013]; *see also id.*, ¶¶[0003], [0029]-[0048] (describing Murakami’s porous film), [0049]-[0099] (describing Murakami’s porous layer). In the Examples, Murakami refers to the porous film as layer A and the porous layer (claimed *porous film*) as layer B. *See, e.g.*, EX1005, ¶[0124].

Petitioner relies on the following embodiments of Murakami as separately rendering the claimed *porous film* obvious:

- Murakami’s general description of the porous layer (*see* EX1005, ¶¶[0013]-[0134]);
- The porous layer of Example 1 (*id.*, ¶¶[0135]-[0156]); and
- The porous layer of Example 2 (*id.*, ¶¶[0157]-[0169]).

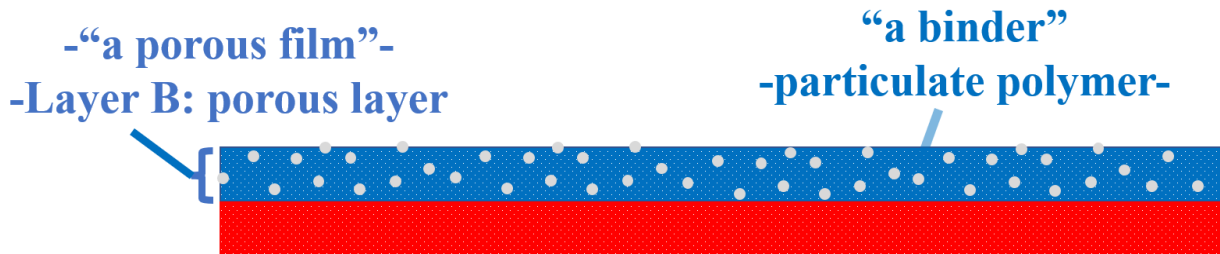
Petitioner’s reliance on discrete Examples 1 and 2 of Murakami does not involve “selecting from large lists of elements in a single reference” as a single embodiment rendering the challenged claims unpatentable. *Contra In re Stepan Co.*, 868 F.3d 1342, 1346 n.1 (Fed. Cir. 2017). Nonetheless, to the extent Patent Owner contends that Murakami discloses other potential permutations of porous layers, a POSITA would have been motivated to implement Examples 1 and 2 with a reasonable expectation of success. EX1003, ¶78.

Indeed, Murakami teaches, suggests, and motivates a POSITA to use the Example 1 and 2 embodiments. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417-418 (2007). Murakami observes a problem with conventional non-aqueous electrolyte secondary batteries in “retain[ing] initial discharge capacity” after a number of charge-discharge cycles. EX1005, ¶[0010]. Murakami thus sought to develop improve “initial discharge capacity even after a charge-discharge cycle is repeated.” *Id.*, ¶[0024].

Murakami tested six Examples and one Comparative Example of the laminated body. *See id.*, ¶¶[0123]-[0210]. Murakami “found that the porous layer whose degree of variability in voidage [i.e., porosity] ... is at most 16.0% can be suitably used as a member for a non-aqueous electrolyte secondary battery having an excellent cycle characteristic.” *Id.*, ¶[0211]. Examples 1 and 2 had the smallest voidage variability (3.1% and 3.8% respectively) and exhibited the best capacity retention of after 100 cycles—84%. *Id.*, ¶¶[0208]-[0209] (Tables 1 and 2). Their superior performance would have enticed a POSITA to, with a reasonable expectation of success, implement these working Examples rather than attempt to prepare a laminated body having other features. EX1003, ¶80.

2. [1.1]: “*a binder; and*”

Murakami discloses or suggests this element. EX1003, ¶¶82-84. Murakami’s porous layer B (*porous film*) has a binder resin (*binder*):



EX1003, ¶82

Murakami discloses that “[t]he porous layer of the present invention ... contains a filler and a binder resin.” EX1005, ¶¶[0017], [0053]. In the Examples, “[a]s a binder resin, sodium carboxymethyl cellulose (CMC) (manufactured by Daicel Corporation; CMC1110) was used.” *Id.*, ¶[0140].

3. [1.2]: “*inorganic particles*,”

Murakami discloses or suggests this element. EX1003, ¶¶85-87. In addition to the binder resin, Murakami’s porous layer B contains a filler (*inorganic particles*):



EX1003, ¶85

See EX1005, ¶¶[0017], [0018], [0059]. While the filler may be organic, “[t]he filler is more preferably a filler made of inorganic oxide.” *Id.*, ¶[0061]. Murakami’s characterization of inorganic filler as preferable to organic filler suggests or renders obvious using inorganic filler. EX1003, ¶86. Murakami’s Examples used α -

alumina—an inorganic material—as a filler. *Id.*, ¶¶[0140], [0161], [0185]; EX1003, ¶86.

4. [1.3]: “*wherein the porous film comprises pores formed by the binder,*”

Murakami discloses or suggests this element. EX1003, ¶¶88-95. Murakami’s *porous film* (porous layer) *comprises pores formed by the binder* (binder resin), as claimed.

By definition, Murakami’s *porous* layer comprises *pores*. EX1003, ¶89. Indeed, Murakami discloses that the porous layer has certain a “voidage” (i.e., porosity) and pore diameter. See EX1005, Abstract, ¶¶[0093], [0121], [0209], [0211], claims 10-13.

The pores of Murakami’s porous layer are *formed by the binder*, as claimed. EX1003, ¶90. First, like the Examiner found during prosecution for the Murata reference, in Murakami, “[t]he porous film comprises pores formed by the binder ... given pores are found within the binder and porous layer.” EX1002, 22. That is, “the filler is bound by the binder resin” containing the pores within the porous layer. EX1005, ¶[0070].

Second, though not required by the broad claim language, Murakami’s process for coating the porous layer onto the porous film forms the pores in a comparable way to the ’148 Patent’s process. EX1003, ¶91. This obviates the

applicant's unpersuasive argument during prosecution that Murata's method did not disclose that "the resin binder of the porous layer ... forms a pore[.]" EX1014, 42.

Specifically, in Murakami, "a coating liquid for forming the porous layer is prepared by dissolving the resin in a solvent and ... dispersing the filler," and "the resin [is] dispersed in the solvent." EX1005, ¶[0071]; *see also id.*, ¶¶[0072]-[0073]. After applying the coating liquid to one or both surfaces of the porous film (*id.*, ¶¶[0074]-[0079]), a drying process "remove[s] the solvent (dispersion medium) ... and then the coating liquid is dried so as to form a porous layer" (*id.*, ¶[0088]). *See also id.*, ¶¶[0087], [0089]. Optionally, before drying, "the coating liquid is substituted by another solvent" that "does not dissolve the resin contained in the coating liquid." *Id.*, ¶[0087]. This process leaves "a resin layer containing a fibrillar resin or a granular resin." *Id.*, ¶[0052]; *see also id.*, ¶¶[0016], [0023], [0058], [0071], [0088]; EX1003, ¶92.

Thus, Murakami's porous layer not only contains *pores formed by the binder* as claimed, but Murakami forms those pores through a solvent-removal process like that described in the '148 Patent. EX1003, ¶¶92-94. The NIPS process described in the '148 Patent involves coating a binder, dissolved in a first solvent, on a substrate and immersing the coating in a solution containing another mixed solvent made up of a second solvent and a third (coagulating liquid) solvent for the polymer binder

resin. EX1001, 6:16-32. This extracts the first solvent, coagulating the binder to form pores. *Id.*

Similarly, in Murakami, the drying process “remove[s] the solvent (dispersion medium) ... and then the coating liquid is dried so as to form a porous layer.” EX1005, ¶[0088]. The binder remaining after Murakami’s process forms “a resin layer containing a fibrillar resin or a granular resin” that is the porous layer. *Id.*, ¶[0016]; *see also id.* ¶¶[0023], [0058], [0071], [0087]; EX1003, ¶92. As Dr. Gido explains, the ’148 Patent and Murakami use a widely-known “phase inversion or coagulation process” to “obtain porosity in coating layers containing particles and resin binder.” EX1003, ¶93; *see also* EX1017, 9:57-10:2. They describe forming a porous layer by coating a solution containing binder, and then causing that binder to phase separate (coagulate) out of solution to form a solid porous structure by the addition another solvent that does not dissolve the binder resin. EX1003, ¶94.

5. [1.4]: “*the pores at least comprises a part of the inorganic particles,*”

Murakami suggests or renders obvious this element, to the extent it is not indefinite. EX1003, ¶¶96-108. While Murakami does not expressly disclose element [1.4], Murakami’s description of the porous layer’s composition makes clear this feature is inherent and/or renders it obvious. EX1003, ¶96.

First, as explained below, Murakami's porous layer comprises mostly inorganic filler, with a filler-to-binder weight ratio of 97:3 in Examples 1 and 2. Given this composition, a POSITA would understand that the pores in Murakami's porous layer necessarily include at least some portion of the inorganic filler or would have found this obvious. EX1003, ¶97.

Second, Murakami's porous layer features 10% of the filler particles (D90 and larger) having diameters approximately 1/3 of the pores layer's thickness, making it inevitable that some filler particles extend into the pores. EX1003, ¶98. Otherwise, the resulting structure would be densely packed with minimal porosity, contradicting Murakami's description of a porous layer with high porosity (up to 70% or 90%) and pore diameters of 3 µm. For the layer to achieve high porosity, these larger filler particles must protrude into the pore spaces—and/or themselves comprise a part of the pore walls—ensuring that the pores inherently contain portions of the inorganic filler material. *Id.*

Amount of filler>>amount of binder resin: Murakami's Examples contain a *much* larger amount of filler (*inorganic particles*) than binder resin by weight. EX1003, ¶99. For example, in Layer B of Examples 1 and 2, “3 parts by weight of CMC [the binder resin] was mixed with 100 parts by weight of the α-alumina.” EX1005, ¶[0141]; *see also id.*, ¶[0161] (In Example 2, “[a] coating liquid 2 was prepared by carrying out operation similar to that of Example 1”). This means

that the binder layer comprises 100/103=97 wt% filler in Examples 1 and 2.³ EX1003, ¶99. Likewise, in the general description, Murakami states that the filler content comprises most of the filler-binder combination by weight, preferably up to 99 wt%. EX1005, ¶[0070]; EX1003, ¶99. As Dr. Gido explains, on a volume basis as well, the “the filler particles still make up the overwhelming majority” of Layer B. EX1003, ¶100.

With Murakami’s binder composition consisting of nearly *all* filler material by weight and volume, a POSITA would have recognized as a necessary consequence that the pores of Murakami’s porous layer include at least some portion of the filler material. EX1003, ¶101. In short, there is not enough resin material to completely subsume the much greater amount of filler—just enough for “the filler [to be] bound by the binder resin.” EX1005, ¶[0070]; EX1003, ¶101. Similarly, the ’148 Patent explains that the porous film can have up to three times more inorganic particles than binder—i.e., 75/25 inorganic particles to binder by volume—significantly *less* than Murakami’s binder. EX1001, 5:50-60. Thus, Murakami’s

³ Although Murakami then adds a solvent comprising water and isopropyl alcohol that temporarily reduces the weight proportion of filler (*id.*, ¶[0141]), Murakami teaches that the solvent is dried and removed from the mixture to form the porous layer, *id.*, ¶¶[0074], [0087]-[0089]. EX1003, ¶99.

description of the binder composition “make[s] clear that” the feature of Murakami’s pores including at least some portion of inorganic particles is “necessarily present in [the prior art].” *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (citation omitted); *see also* EX1003, ¶101.

If Patent Owner disputes (wrongly) that Murakami expressly discloses pores comprising at least some portion of filler material, Murakami certainly renders it obvious. EX1003, ¶102. As here, to show “inherency in an obviousness analysis,” the prior art “disclosure is sufficient [if it] show[s] that *the natural result flowing* from the operation as taught would result in the performance of the questioned function[.]” *Par Pharm., Inc. v. TWi Pharms., Inc.*, 773 F.3d 1186, 1195 (Fed. Cir. 2014)⁴. Here, the natural result flowing from Murakami’s disclosure—the porous layer consists of nearly all filler and relatively little resin by weight—is that the pores of Murakami’s porous layer would include at least some portion of filler material. EX1003, ¶103.

Porous layer thickness vs. filler particle diameter: Murakami also suggests or renders obvious that the pores of its porous layer include at least some filler material by its description of the porous layer film thickness compared to the particle diameters of the filler material. EX1003, ¶104. For example, Examples 1 and 2 had

⁴ Unless otherwise specified, emphasis is added.

respective Dv90 of the filler particles of 1.03 μm and 1.53 μm —meaning that at least 10 percent of the particles, by volume, have diameters equal to or greater than those values. See EX1005, ¶¶[0140], [0161].⁵ But Layer B—containing those filler particles—has respective film thicknesses of only 3.5 μm and 4.5 μm in Examples 1 and 2. EX1005, ¶[0208] (Table 1). With the diameter of 10% of the filler particles being roughly 1/3, or greater, of the thickness of Layer B in which they sit, a POSITA would recognize the feature of the pores of Layer B including at least some portion of the filler particles to be a necessary consequence flowing from the composition of Layer B. EX1003, ¶105.

Indeed, a POSITA would expect Murakami's porous layer to have at least as much inorganic filler particles included in pores as the porous film of the '148 Patent. EX1003, ¶106. Most Example porous films in the '148 Patent had a Dv90 of the inorganic particles of only 3.0 μm , while the porous film had a thickness of at least 24 μm —a ratio (8x) much greater than that of Murakami (about 3x). EX1001, Table 2; EX1003, ¶106. In other words, Murakami's inorganic particles are larger

⁵ Table 1 of Murakami agrees that Example 2 has a Dv90 of the inorganic particles of 1.53 μm but has a slightly different value (1.09 μm) for Dv90 of Example 1. EX1005, ¶[0208] (Table 1).

compared to the thickness of Layer B than the diameter of the '148 Patent's inorganic particles compared to the thickness of its porous film. EX1003, ¶106.

The '148 Patent teaches “the porous film has a porosity of 20% to 90%. EX1001, 5:40-41, Claim 7. Examples had porosities ranging from 42% to 61%. EX1001, 5:41-42, Table 2. Thus, all remaining binder polymer and inorganic particles must be contained in the remaining $100\% - (42\% \text{ to } 61\%) = 39\% \text{ to } 58\%$ of the volume of the porous film. EX1003, ¶107. Murakami, however, teaches “[a] voidage of the porous layer is preferably 10 volume % to 90 volume %, more preferably 30 volume % to 70 volume %.” EX1005, ¶[0093]. When practicing the upper end of Murakami's preferred voidage range of 70%, all the binder polymer and particles must be contained in *only 30%* of Layer B (“porous film”)—less volume than that provided by the '148 Patent Examples. EX1003, ¶107. In short, Murakami's porous layer has even less “room” to avoid having portions of particles included in the pores than the '148 Patent's porous film. If the '148 Patent's porous film has inorganic particles included in the pores, a POSITA would also have expected Murakami's porous layer to have this same characteristic. EX1003, ¶107.

6. [1.5]: “*wherein the inorganic particles have particle sizes that Dv10 is in a range of 0.015 μm to 3 μm,*”

[1.6]: “*Dv50 is in a range of 0.2 μm to 5 μm, and*”

[1.7] “*Dv90 is in a range of 1 μm to 10 μm;*”

As explained, Petitioner relies on Murakami’s general description of the porous layer, as well as Examples 1 and 2, as distinct embodiments rendering obvious the challenged claims. *Supra* Section VIII.A.6. Each of these embodiments discloses or suggests the claimed Dv10, Dv50, and Dv90 ranges:

Embodiment	Dv10 (μm)	Claimed Dv10 Range (μm)	Dv50 (μm)	Claimed Dv50 Range (μm)	Dv90 (μm)	Claimed Dv50 Range (μm)
General Description	0.005 to 0.4	0.015 to 3	0.01 to 1.0	0.2 to 5.0	0.5 to 5.0	1 to 10
Example 1	0.22		0.44		1.03	
Example 2	0.26		0.66		1.53	

See also EX1003, ¶¶109-112. In the general description, Murakami states that “[t]he 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 μm to 0.4 μm, D50 is 0.01 μm to 1.0 μm, and D90 is 0.5 μm to 5.0 μm[.]” EX1005, ¶[0018].

Murakami's *Dv10*, *Dv50*, and *Dv90*⁶ ranges overlap the corresponding claimed ranges, thus rendering each range obvious. *Peterson*, 315 F.3d at 1329.

In Example 1, “[a]s a filler, α -alumina (D10: 0.22 μm , D50: 0.44 μm , D90: 1.03 μm) was used.” EX1005, ¶[0140]. In Example 2, “coating liquid 2 was prepared by carrying out operation similar to that of Example 1, except that α -alumina (D10: 0.26 μm , D50: 0.66 μm , D90: 1.53 μm) was used as a filler.” *Id.*, ¶[0161]. In both Murakami Examples 1 and 2, each *Dv10*, *Dv50*, and *Dv90* value falls squarely within its respective claimed range, rendering the claimed ranges obvious. *Titanium Metals*, 778 F.2d at 782-783.

7. [1.8]: “*Dv10 of the inorganic particles is less than Dv50 of the inorganic particles, and*”

Murakami discloses or suggests this element. EX1003, ¶¶113-115. As explained above, Murakami's general embodiment and Examples 1 and 2 have the following *Dv10* and *Dv50* values:

⁶ Murakami's values for D10, D50, and D90 refer respectively to *D_v10*, *D_v50*, and *D_v90* because Murakami explains that they are expressed “in terms of average particle diameter obtained *based on a volume*[.]” EX1005, ¶[0018]; *see also id.*, ¶[0066], claim 10 (D values “based on a volume”); EX1003, ¶110.

Embodiment	Dv10 (μm)	Dv50 (μm)
General Description	0.005 to 0.4	0.01 to 1.0
Example 1	0.22	0.44
Example 2	0.26	0.66

Supra Section VIII.A.6; EX1005, ¶¶[0018], [0140], [0161]. In each case, the former is less than the latter: (1) in the general description, the Dv10 range 0.005 μm to 0.4 μm covers a lower span than the Dv50 range 0.1 μm to 1.0 μm; (2) in Example 1, a Dv10 of 0.22 μm is less than a Dv50 of 0.44 μm; and (3) in Example 2, a Dv10 of 0.26 μm is less than a Dv50 of 0.66 μm. EX1003, ¶113.⁷

8. [1.9]: “*Dv50 of the inorganic particles is less than Dv90 of the inorganic particles, and*”

Murakami discloses or suggests this element. EX1003, ¶¶116-118. As explained above, Murakami’s general embodiment and Examples 1 and 2 have the following *Dv50* and *Dv90* values:

Embodiment	Dv50 (μm)	Dv90 (μm)
General Description	0.01 to 1.0	0.5 to 5.0
Example 1	0.44	1.03
Example 2	0.66	1.53

⁷ As Dr. Gido explains, element [1.9] recites an inherent characteristic of *any* distribution of particles. *Id.*, ¶114.

Supra Section VIII.A.6; EX1005, ¶¶[0018], [0140], [0161]. In each case, the former is less than the latter: (1) in the general description, the Dv50 range 0.01 µm to 1.0 µm covers a lower span than the Dv90 range 0.5 µm to 5.0 µm; (2) in Example 1, a Dv50 of 0.44 µm is less than a Dv90 of 1.03µm; and (3) in Example 2, a Dv50 of 0.66 µm is less than a Dv90 of 1.53 µm. EX1003, ¶116.

9. [1.10]: “*the inorganic particles have particle sizes that the ratio of Dv90 to Dv10 is in a range of 2 to 100.*”

Murakami discloses or suggests this element. EX1003, ¶¶119-121. As explained above, Murakami’s general embodiment and Examples 1 and 2 have the following *Dv90* and *Dv10* values, yielding the following ratios:

Embodiment	Dv90 (µm)	Dv10 (µm)	Ratio	Claimed Ratio
General Description	0.5 to 5.0	0.005 to 0.4	1.25 to 1000	2 to 100
Example 1	1.03	0.22	4.68	
Example 2	1.53	0.26	5.88	

Supra Section VIII.A.6; EX1005, ¶¶[0018], [0140], [0161]. In each case, Murakami’s Dv90/Dv10 ratio overlaps, or falls squarely within, the claimed range of 2 to 100, thus rendering it obvious. *Peterson*, 315 F.3d at 1329; *Titanium Metals*, 778 F.2d at 782-783.

B. Dependent Claim 2

1. [2.1]

Murakami discloses “[a] pore diameter of each of pores in the porous film is preferably 3 μm or less, more preferably 1 μm or less,” EX1005, ¶[0037], falling within or overlapping the claimed range. *Peterson*, 315 F.3d at 1329; *Titanium Metals*, 778 F.2d at 782-783; EX1003, ¶122.

C. Dependent Claim 5

1. [5.1]

Murakami discloses potential filler materials including at least the claimed *silica*, *calcium oxide*, *magnesium oxide*, *titanium oxide*, and *alumina*. EX1005, ¶[0061]. Moreover, Examples 1 and 2 used α -*alumina* as filler. *Id.*, ¶¶[0140], [0161]; EX1003, ¶123.

D. Dependent Claim 6

1. [6.1]

Regarding the general embodiment, Murakami teaches “[t]he binder resin is particularly preferably any of the fluorine-containing resins, the aromatic polyamides, and the water-soluble polymers.” EX1005, ¶[0057]. As Dr. Gido explains, *polyvinylidene fluoride*, *vinylidene fluoride-hexafluoropropylene copolymer*, *polytetrafluoroethylene* and *polyhexafluoropropylene*, as claimed, are examples of fluorine-containing resins. EX1003, ¶124. Aromatic polyamides, as taught by Murakami, are examples of the claimed *polyamide*. *Id.* Murakami teaches

“water-soluble polymers” (EX1005, ¶[0053]), and several binder resins recited in claim 6 are water soluble polymers, including *polyacrylic acid*, *polyacrylic acid salt*, and *sodium carboxymethylcellulose*. EX1003, ¶124. In Examples 1 and 2, “[a]s a binder resin, sodium carboxymethyl cellulose (CMC) (manufactured by Daicel Corporation; CMC1110) was used”—one of the claimed options. *Id.*, EX1005, ¶[0140].

E. Dependent Claim 7

1. [7.1]

Murakami discloses that “[a] voidage of the porous layer is preferably 10 volume % to 90 volume %, more preferably 30 volume % to 70 volume % so as to obtain a sufficient ion permeability.” EX1005, ¶[0093]. Each of Murakami’s preferred voidage ranges overlaps or falls within the claimed range, thus rendering it obvious. *Peterson*, 315 F.3d at 1329; *Titanium Metals*, 778 F.2d at 782-783; EX1003, ¶125.

F. Dependent Claim 8

1. [8.1]

In the general embodiment, Murakami’s porous layer (Layer B) (the claimed *porous film*) has a thickness “preferably 0.1 μm to 20 μm ” and “more preferably 2 μm to 15 μm ,” EX1005, ¶[0090], both overlapping the claimed range and thus rendering it obvious. *Peterson*, 315 F.3d at 1329. And in Examples 1 and 2, the

thickness of the porous layer (3.5 μm and 4.5 μm , respectively) falls within the claimed range and thus renders it obvious. EX1005, ¶[0208] (Table 1); *see also Titanium Metals*, 778 F.2d at 782-783; EX1003, ¶126.

G. Dependent Claim 9

1. [9.1]

Murakami discloses that “[the] filler content is preferably 1 volume % to 99 volume %, more preferably 5 volume % to 95 volume %, relative to the porous layer”—i.e., preferably 0.01 to 0.99 and more preferably 0.02 to 0.95. EX1005, ¶[0069]; *see also* EX1003, ¶127. Both Murakami’s preferred ranges overlap the claimed range, rendering it obvious. *Peterson*, 315 F.3d at 1329; EX1003, ¶127.

H. Independent Claim 10

1. [10.pre]

Murakami discloses “[t]he porous layer of the present invention and a separator formed by laminating the porous layer are suitable as a member for a non-aqueous electrolyte secondary battery that has an excellent cycle characteristic.” EX1005, Abstract. Murakami also discloses that a lithium-ion secondary battery is a type of non-aqueous electrolyte secondary battery. *Id.*, ¶¶[0002], [0106]. In Murakami’s examples, the positive electrode was prepared using $\text{LiNi}_{1/3}\text{Mn}_{1/3}\text{Co}_{1/3}\text{O}_2$. *Id.*, ¶[0148]. As Dr. Gido explains, Murakami’s lithium

composition of the electrolyte and cathode render obvious to a POSITA *a lithium-ion battery*. EX1003, ¶¶128-129.

2. [10.1], [10.2]

Murakami discloses that “[t]he porous layer of the present invention can be ... formed on a surface of at least one of a *positive electrode* and a *negative electrode*. EX1005, ¶[0029]; *see also id.*, ¶[0021]. Murakami also prepared and tested the Example 1 and 2 porous layers in non-aqueous electrolyte secondary battery, which necessarily has positive and negative electrodes. *See id.*, ¶¶[0146]-[0156], [0166]-[0169]; EX1003, ¶130.

3. [10.3]

Murakami discloses arranging the laminated member (*separator*) including porous layer *between the positive and the negative electrode*, as claimed. EX1005, ¶[0021]; *see also id.*, ¶[0013] (Layer B is part of “a separator that is a laminated body in which the porous layer is laminated onto one surface or each of both surfaces of the porous film”); EX1003, ¶¶132-133.

4. [10.4]

Murakami discloses “[a] non-aqueous electrolyte secondary battery.” EX1005, ¶[0022]. Murakami notes that “a non-aqueous electrolyte obtained by dissolving lithium salt into an organic solvent.” *Id.*, ¶[0106]; *see also* EX1003, ¶¶134-35.

5. Remaining elements [10.5] through [10.15]

Murakami discloses, suggests, and/or renders obvious the remaining elements of claim 10 for the reasons discussed above for the following identical corresponding elements of independent claim 1:

Claim 10 Element	Corresponding Claim 1 Element	Analysis
[10.5]	[1.pre]	Section VIII.A.1
[10.6]	[1.1]	Section VIII.A.2
[10.7]	[1.2]	Section VIII.A.3
[10.8]	[1.3]	Section VIII.A.4
[10.9]	[1.4]	Section VIII.A.5
[10.10]	[1.5]	Section VIII.A.6
[10.11]	[1.6]	Section VIII.A.6
[10.12]	[1.7]	Section VIII.A.6
[10.13]	[1.8]	Section VIII.A.7
[10.14]	[1.9]	Section VIII.A.8
[10.15]	[1.10]	Section VIII.A.9

EX1003, ¶136.

I. Dependent Claim 19

1. [19.1]

Murakami discloses or suggests this element by disclosing its porous layer arranged on a surface of the separator. EX1003, ¶¶137-138. Specifically, Murakami discloses that “[t]he separator of the present invention is formed by laminating the porous layer on one surface or each of both surfaces of a porous film which contains

polyolefin as a main component.” EX1005, ¶[0019]. Moreover, as explained above, the porous layer (Layer B) of Murakami is part of “a separator that is a laminated body in which the porous layer is laminated onto one surface or each of both surfaces of the porous film, [which] has an excellent cycle characteristic.” *Id.*, ¶[0013].

J. Remaining Dependent Claims 11 and 14-18

Murakami discloses, suggests, and/or renders obvious claims 11 and 14-18 for the reasons discussed above for the following identical corresponding elements of claims 2 and 5-9:

Remaining Claim Element	Corresponding Claim Element	Analysis
[11.1]	[2.1]	Section VIII.B.1
[14.1]	[5.1]	Section VIII.C.1
[15.1]	[6.1]	Section VIII.D.1
[16.1]	[7.1]	Section VIII.E.1
[17.1]	[8.1]	Section VIII.F.1
[18.1]	[9.1]	Section VIII.G.1

EX1003, ¶139.

IX. GROUND 2: MURAKAMI AND HONDA RENDER OBVIOUS CLAIMS 3 AND 12

A. Dependent Claims 3 and 12

1. [3.1], [12.1]

Murakami does not expressly disclose a wall thickness of the pores of Murakami's porous layer. Honda, however, discloses a pore wall thickness falling in the claimed range recited in dependent claims 3 and 12 and provides motivation for a POSITA to configure Murakami's porous layer to have the claimed wall thickness.

a. Honda discloses elements [3.1], [12.1]

Honda discloses or suggests this element. EX1003, ¶¶141-143. An analogous reference, Honda discloses a separator, for nonaqueous secondary batteries, having (1) a porous base that contains a thermoplastic resin and (2) a porous layer that is provided on one or both surfaces of the porous base and contains a polyvinylidene fluoride resin. EX1007, Abstract. Honda's "porous layer" corresponds to Murakami's Layer B and to the *porous film* claimed in the '148 Patent. Honda's porous layer has a "honeycomb structure" (*id.*, ¶[0017]), which Honda describes as "a structure in which a large number of cells that are open in a direction perpendicular to a surface of a porous layer are aligned adjacent to each other in the direction perpendicular to the surface of a porous layer" (*id.*, ¶[0038]). *See also id.*, ¶¶[0039]-[0045] (discussing the honeycomb structure).

Honda teaches that “a thickness of a partition wall [between cells] constituting a honeycomb structure”—i.e., the claimed “wall thickness”—can be “0.1 μm to 2 μm .” *Id.*, ¶[0045]. This range corresponds to a wall thickness of 100 nm to 2000 nm, overlapping the claimed range of 20 nm to 500 nm. *Peterson*, 315 F.3d at 1329; EX1003, ¶142.

b. Rationale to combine Murakami and Honda

Murakami and Honda teach, suggest, and motivate a POSITA to configure the pore walls of Murakami’s porous layer to have a thickness of 100 nm to 2000 nm. *KSR*, 550 U.S. at 417-418; EX1003, ¶¶144-147. Initially, Honda and Murakami are analogous art to each other and the ’148 Patent because they are directed to the same field of endeavor—porous films used as separators for lithium-ion batteries. *See, e.g.*, EX1001, 1:29-37, 2:38-46; EX1005, Abstract, ¶¶[0001]-[0005]; EX1007, Abstract.

Honda explains that its disclosed wall thickness allows micropores to interconnect larger pores in the porous layer: “[i]t is preferable that a large number of micropores are present in the partition wall constituting the honeycomb structure” and that “the pores of adjacent cells are connected by the micropores.” EX1007, ¶[0045]. That is, with thin pore walls, Honda’s micropores interconnect the larger pores, increasing interconnectedness of the pores and the porosity of the separator. EX1003, ¶145. Honda’s technique increases porosity in two ways: (1) thinner pore

walls increase porosity; and (2) micropores increase the interconnectedness of the larger pores. *Id.* Murakami prefers “[a] voidage of the porous layer” to be as high as 90 vol% (EX1005, ¶[0093]), motivating a POSITA to use Honda’s wall thickness to achieve this aim. EX1003, ¶145.

A POSITA would have had a reasonable expectation of success in achieving Honda’s “honeycomb” structure in the porous layer of Murakami. EX1003, ¶146. Indeed, Honda describes a “preferable” method to induce formation of the honeycomb structure, like Murakami’s and the ’148 Patent’s phase separation (i.e., coagulation, phase inversion, or NIPS) methods, that uses multiple solvents. *See* EX1007, ¶¶[0082]-[0083]; EX1001, 6:16-32; EX1005, ¶[0087]; EX1003, ¶146. Thus, to the extent that Murakami’s process did not already form Honda’s honeycomb structure, a POSITA could (and would) have reasonably achieved Honda’s honeycomb structure in Murakami’s porous layer with only routine skill. EX1003, ¶146.

X. GROUND 3: MURAKAMI AND TANAKA RENDER OBVIOUS CLAIMS 4 AND 13

A. Dependent Claims 4, 13

1. [4.1], [13.1]

Murakami does not expressly disclose that *a pore size distribution coefficient of the pores in Murakami’s porous layer is in a range of 1 to 5*, as recited in claims 4 and 13. Tanaka, however, discloses this feature, and a POSITA would have found

it obvious to configure Murakami's porous layer to have the claimed *pore size distribution*. EX1003, ¶¶148-161.

a. Tanaka discloses Elements [4.1], [13.1]

Tanaka describes “a polyolefin porous sintered compact” (EX1009, Abstract) layer that can be used as “a separator for a lithium ion secondary cell or a lead storage cell” (*id.*, ¶[0069]. Tanaka explains that “the D10/D90 ratio is 10 or less, preferably 8 or less, more preferably 6 or less” and “cannot be smaller than 1.” *Id.*, ¶[0019]; *see also id.*, Abstract. Additionally, “the D10/D90 ratio of example 1 was 2.73[.]” *Id.*, ¶[0073]. Because the '148 Patent defines R90 and R10 “from the side of *small* pore size” (EX1001, 5:15-24) while Tanaka defines D90 and D10 “from the *large* diameter side” (EX1009, ¶¶[0015], [0019]), Tanaka's D10 corresponds to the '148 Patent's R90, and Tanaka's D90 corresponds to the '148 Patent's R10.

Thus, Tanaka's D10/D90 ratio corresponds to the '148 Patent's R90/R10 ratio—the claimed *pore size distribution coefficient*. EX1003, ¶150. The '148 Patent explains that “[t]he pore size distribution coefficient D is equal to R90/R10” where “R10 represents pore sizes which reach 10% of the cumulative pore sizes from the side of small pore size in the pore size distribution curve” and “R90 represents pore sizes which reach 90% of the cumulative pore sizes from the side of small pore size in the pore size distribution curve.” EX1001, 5:17-24; *see also id.*, 22:21-35. Tanaka's D90 and D10 values likewise refer to pore sizes: “median *pore diameter*

corresponding to 10% cumulative and 90% cumulative from the large diameter side of the cumulative pore distribution as D10 and D90, respectively[.]” EX1009, Abstract.

In the context of the '148 Patent, Tanaka has the following *pore size distribution coefficient*:

Tanaka Embodiment	R90/R10
Preferred	$1 \leq R90/R10 \leq 10$
More preferred	$1 \leq R90/R10 \leq 8$
Most preferred	$1 \leq R90/R10 \leq 6$

EX1009, Abstract, ¶[0019]. Tanaka’s preferred R90/R10 ranges overlap the claimed range, thus rendering it obvious. *Peterson*, 315 F.3d at 1329.

Moreover, nearly every Tanaka example had a D10/D90 (i.e., R90/R10) *pore size distribution coefficient* between 1 and 5:

Example	R90/R10
1	2.7
2	4.9
3	2.5
4	3.9
5	4.3
6	2.9
7	9.5
8	4.9

EX1009, Table 1. Thus, Tanaka's Examples separately render obvious the claimed coefficient range of 1 to 5. *Titanium Metals*, 778 F.2d at 782-783; EX1003, ¶152.

b. Rationale to combine Murakami and Tanaka

The references provide teaching, suggestion, and motivation to configure Murakami's porous layer to have Tanaka's *pore size distribution coefficient* of ≤ 10 or equal to 2.73. EX1003, ¶154. Initially, Murakami and Tanaka are analogous art because they relate to the same field of endeavor—porous layers used for battery separators. *See, e.g.*, EX1001, 1:29-37, 2:38-46; EX1005, Abstract, ¶¶[0001]-[0005]; EX1009, ¶[0069].

Mechanical strength: Tanaka explains that “by controlling pore size distribution, it is possible to obtain ... excellent mechanical strength and durability, thereby arriving at the present invention.” EX1009, ¶[0010]. Specifically, Tanaka explains that, by controlling the D10/D90 ratio to be in preferred ranges “not only is deformation or breakage suppressed but also durability can be improved.” *Id.*, ¶[0019]. The desire to improve mechanical strength and durability of Murakami's separator would have enticed a POSITA to incorporate Tanaka's D10/D90 ratios. EX1003, ¶156.

High permeability: Tanaka teaches that controlling the D10/D90 ratio “ensure[s] high air permeability[.]” EX1009, ¶[0010]. A POSITA knows that air permeability of separators is measured to determine their potential ion permeability.

EX1003, ¶157. In Murakami’s separator, improved air permeability would translate to higher ion permeability, further motivating the combination. *Id.* This would have motivated the POSITA because Murakami teaches that reducing pore size variability facilitates uniform ion transport across the entire separator (EX1005, ¶[0099]), a necessary condition for achieving high ion transport. EX1003, ¶157.

A POSITA would have had a reasonable expectation of success incorporating Tanaka’s D10/D90 pore size ratio (claimed *pore size distribution coefficient*) into Murakami’s separator. EX1003, ¶158. Tanaka describes a technique specifically to “control” the D10/D90 ratio to have “a desired value.” EX1009, ¶[0020]. This involves heating at moderate temperatures (95°C to 115°C) followed by cooling to reduce the contraction of the pores. *Id.* A POSITA would be motivated to try the same type of controlled heating process to influence the pore size distribution coefficient and thus the permeability characteristics of Murakami’s porous layer. EX1003, ¶159.

Notably, as part of the process to form the porous layer, Murakami teaches heating up to 120°C—similar moderate temperatures to those used by Tanaka. EX1005, ¶[0087]. Murakami also teaches this heating achieves the same objective as Tanaka’s heating treatment—control the pore size distribution and thereby “avoid a decrease in air permeability caused by shrinkage of pores in the porous film.” *Id.* Thus, with a reasonable expectation of success, a POSITA could have incorporated,

as part of Murakami's process, Tanaka's controlled heating process to control the pore size distribution coefficient to Tanaka's desired ranges when forming Murakami's porous layer. EX1003, ¶160.

XI. GROUNDS 4-6: MURAKAMI, MURAKAMI/HONDA, AND MURAKAMI/TANAKA—FURTHER IN VIEW OF BEARD—RENDER OBVIOUS THE CHALLENGED CLAIMS

Patent Owner may contend that 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.*” While Patent Owner would be incorrect for the reasons discussed above in Section VIII.A.5, Beard separately discloses these features and provides rationale to incorporate it into Murakami's porous layer with a reasonable expectation of success. EX1003, ¶¶162-181. Accordingly, for the reasons below: (1) Murakami and Beard render obvious challenged 1, 2, 5-11, and 14-19; (2) Murakami/Honda and Beard render obvious claims 3 and 12; and (3) Murakami/Tanaka and Beard render obvious claims 4 and 13. For the remaining claim elements not addressed below, Petitioner incorporates by reference its analysis for those elements above in Grounds 1-3. *Supra* Sections VIII-X.

A. Beard discloses Elements [1.3] and [10.8]

Beard describes “[a] porous membrane [that] may have a high concentration of spherical fillers with a polymer binder.” EX1010, Abstract. Beard teaches the filler particles may be inorganic materials like ceramic, glass, oxide, or metal. *Id.*, ¶[0013]; *see also* ¶[0036] (“The membrane 202 is filled with TiO₂ particles). Beard teaches that its porous membrane can be used in “an electrochemical cell, such as a battery,” where “a highly filled membrane may be used as a separator between an anode and cathode.” *Id.*, ¶[0033].

In Figure 1 below, Beard “show[s] a cross section of porous material that may have filler material.” *Id.*, ¶[0017]. As highlighted, *the porous film* (porous membrane) *comprises pores formed by the binder* (polymer binder 108):

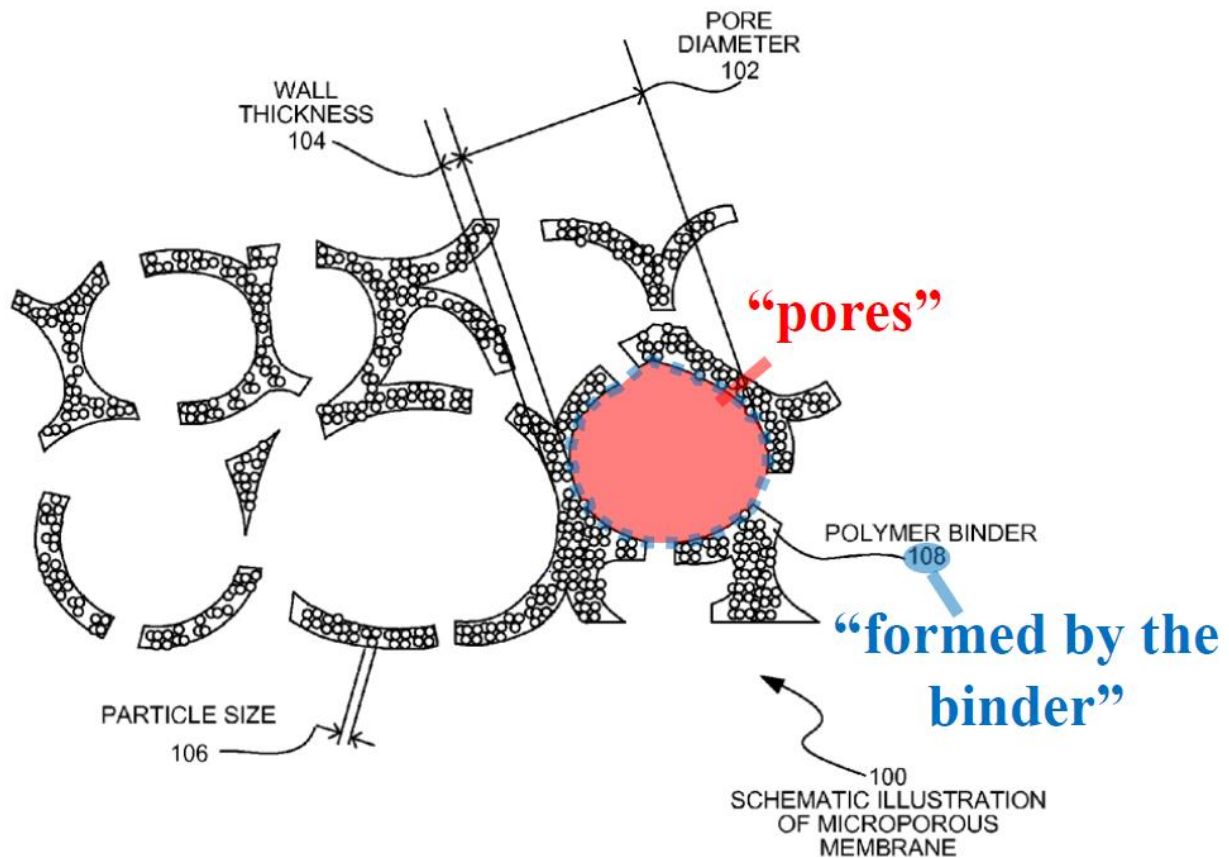


FIG. 1

Beard, FIG. 1*⁸

Pores: By definition, Beard’s *microporous* layer comprises *pores*. EX1003, ¶166. Beard teaches that the microporous layer has certain porosity, pore diameters, and pore wall thicknesses. *See, e.g.*, EX1010, ¶¶[0010]-[0012], [0030]-[0031] (discussing porosity), [0020], [0027], [0031], [0038] (discussing pore diameter), [0011]-[0012], [0021], [0028], [0031] (discussing pore wall thickness).

⁸ Petitioner uses an asterisk “*” to indicate annotated or otherwise modified figures from the references.

Formed by the binder: Apparent from Figure 1 of Beard, showing polymer binder 108 defining the pore voids, the pores in Beard’s porous membrane are formed *by the binder*, as claimed. EX1003, ¶167. Beard also expressly teaches this, explaining that the manufacturing process melts or dissolves the polymer, mixes the polymer with a pore-forming agent and filler material, and then solidifies it. EX1010, ¶¶[0057]-[0060]. The pore-forming agent is removed “after solidification begins,” leaving behind the porous layer—i.e., pores created by the binder. *Id.*, ¶[0059]. The pore-forming agent induces coagulation of the binder polymer or phase separation of the polymer binder upon cooling. *Id.*, ¶¶[0057]-[0059].

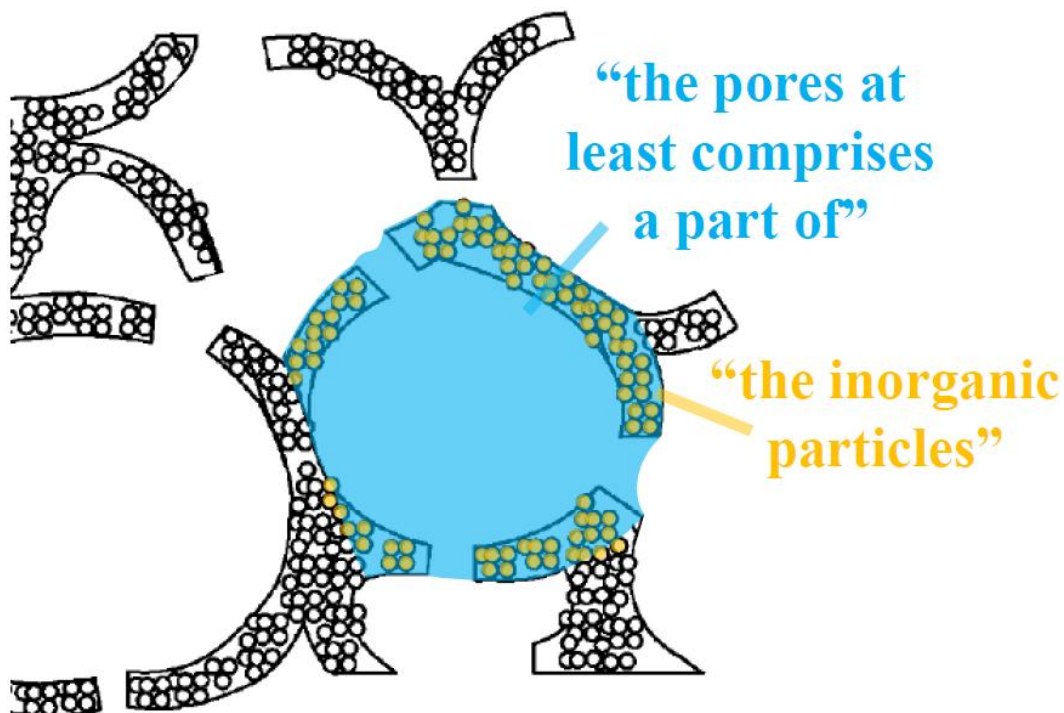
According to Beard, two main factors—the amount of pore forming agent and degree of thermodynamic energy required to wet the polymer—control how the pores in the porous layer are *formed by the binder*. EX1010, ¶¶[0066]-[0069]; EX1003, ¶168.

Thus, not only does Beard’s porous membrane contain *pores formed by the binder* as claimed, but Beard forms those pores through a solvent coagulation process like that described in the ’148 Patent, Murakami, and Honda. EX1003, ¶169. As discussed, the NIPS process described in the ’148 Patent specification involves coating a binder, dissolved in a first solvent, on a substrate and immersing the coating in a solution containing another solvent. EX1001, 6:16-32. This extracts the first solvent into the other nonsolvent, coagulating the binder to form pores. *Id.*

Similarly, Beard uses a “liquid pore forming agent” to suspend the polymer and filler material. EX1010, ¶[0057]. “[T]he polymer may be heated and mixed with the pore forming agent, *then cooled to form the microporous structure.*” *Id.*, ¶[0058]. “The pore forming agent may be removed after solidification begins,” leaving the porous membrane. *Id.*, ¶[0059]; *see also* EX1003, ¶¶169-172 (describing Beard’s coagulation process in more detail).

B. Beard discloses Elements [1.4] and [10.9]

Beard discloses these elements in two ways. EX1003, ¶¶174-177. First, Beard’s pore *walls* comprise a part of the inorganic filler, as highlighted below in Figure 1:



Beard, FIG. 1*

As seen above, the “fillers are very tightly packed *into the pore walls* of [the] microporous membrane.” EX1010, ¶[0012]; *see also* ¶¶[0010] (“*Within the pore walls*, a highly packed spherical filler material may be bound with a polymer.”), [0003] (“*Within the pore walls ... , a densely packed filler material ...*”). This occurs because “smaller fibrous particles may be *captured inside the polymer binder 108*[.]” EX1010, ¶[0025]. Thus, Beard’s pore walls comprise smaller filler particles.

Second, Beard’s pore *voids* comprise at least some filler material. EX1003, ¶176. The ’148 Patent provides no information about what it means for pores to at least comprise a part of the inorganic particles—beyond repeating the broad claim language. *See, e.g.*, EX1001, Abstract, 1:45-50. And the claim language does not require the inorganic particles to be inside the pore voids themselves. Regardless, Figure 1 of Beard shows at least some inorganic filler particles protruding beyond the pore wall and into the void itself:

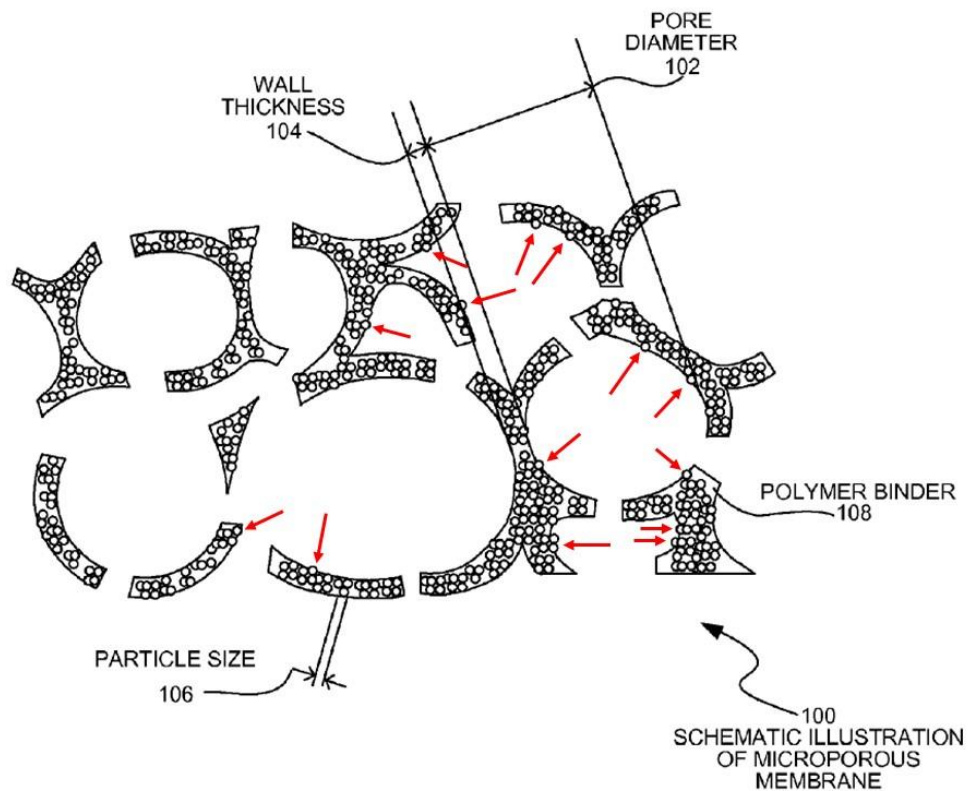


FIG. 1

Beard, FIG. 1*

Additionally, Beard explains that “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.*” EX1010, ¶[0025]. Thus, Beard’s pore voids contain at least a part of larger inorganic filler particles. EX1003, ¶176.

C. Rationale to Combine Murakami and Beard

A POSITA would have been motivated, with a reasonable expectation of success, to implement, in Murakami’s porous layer, Beard’s porous membrane

structure with inorganic particles densely packed in the pore walls. EX1003, ¶¶178-181. Initially, Beard is analogous art to Murakami and the '148 Patent because Beard also relates to the same field of endeavor—separators for lithium-ion batteries. *See, e.g.*, EX1001, 1:29-37, 2:38-46; EX1010, ¶¶[0002], [0009], [0030], [0033].

Beard explains that “[g]ood 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.” EX1010, ¶[0086]. Specifically, “incorporating high levels of desirable filler additives ... may have the following properties: high levels of porosity, uniform pore distribution, well defined and controlled pore geometry, and high film strength, including good bond between filler particles and polymers.” EX1010, ¶[0065]. Beard notes that its “highly filled membrane,” when used as a battery separator, helps prevent the porous structure from melting and collapsing, resulting in a “catastrophic release of energy” in a short circuit. *Id.*, ¶[0033]. A POSITA would have wanted the “good results” achieved by Beard. This would have motivated implementing Beard's pore structure, densely packed with particles, in Murakami's separator to improve porosity, pore distribution, and pore geometry while maintaining mechanical strength to prevent separator collapse and short circuits. EX1003, ¶179.

A POSITA would have had a reasonable expectation of success combining Murakami and Beard. EX1003, ¶180. For example, Beard teaches that “[t]he

manufacturing process” for the porous membrane “may suspend the filler material and the polymer in the pore forming agent, then solidify the polymer and filler material with the pore forming agent present.” EX1010, ¶[0057]. “After the polymer begins to gel, the pore forming agent may be removed.” *Id.*; *see also id.*, ¶¶[0058]-[0059]. Similarly, in Murakami’s process, “the resin can be dispersed in the solvent” (EX1005, ¶[0071]), which “dissolves the resin uniformly and stably” and “disperses the filler uniformly and stably” (*id.*, ¶[0072]). The solvent is then removed to form the porous layer. *Id.*, ¶[0087]. Thus, to the extent that Murakami’s process does not already create a pore structure with inorganic particles densely packed within the pore walls as taught by Beard, a POSITA would have been able to utilize Murakami’s and Beard’s disclosures to do so.

XII. GROUND 7: BEARD AND AKIIKE RENDER OBVIOUS CLAIMS 1-3, 5-12, AND 14-19

A. Independent Claim 1

1. [1.pre]

Beard’s porous membrane, sometimes called a “microporous” membrane, discloses the claimed *porous film*. *See, e.g.*, EX1010, ¶¶[0009], [0012], [0051]-[0053]; *see also id.*, Abstract, ¶¶[0001], [0010]; EX1003, ¶182. These microporous membranes (*porous films*) may be “suitable for battery separators.” EX1010, ¶[0065].

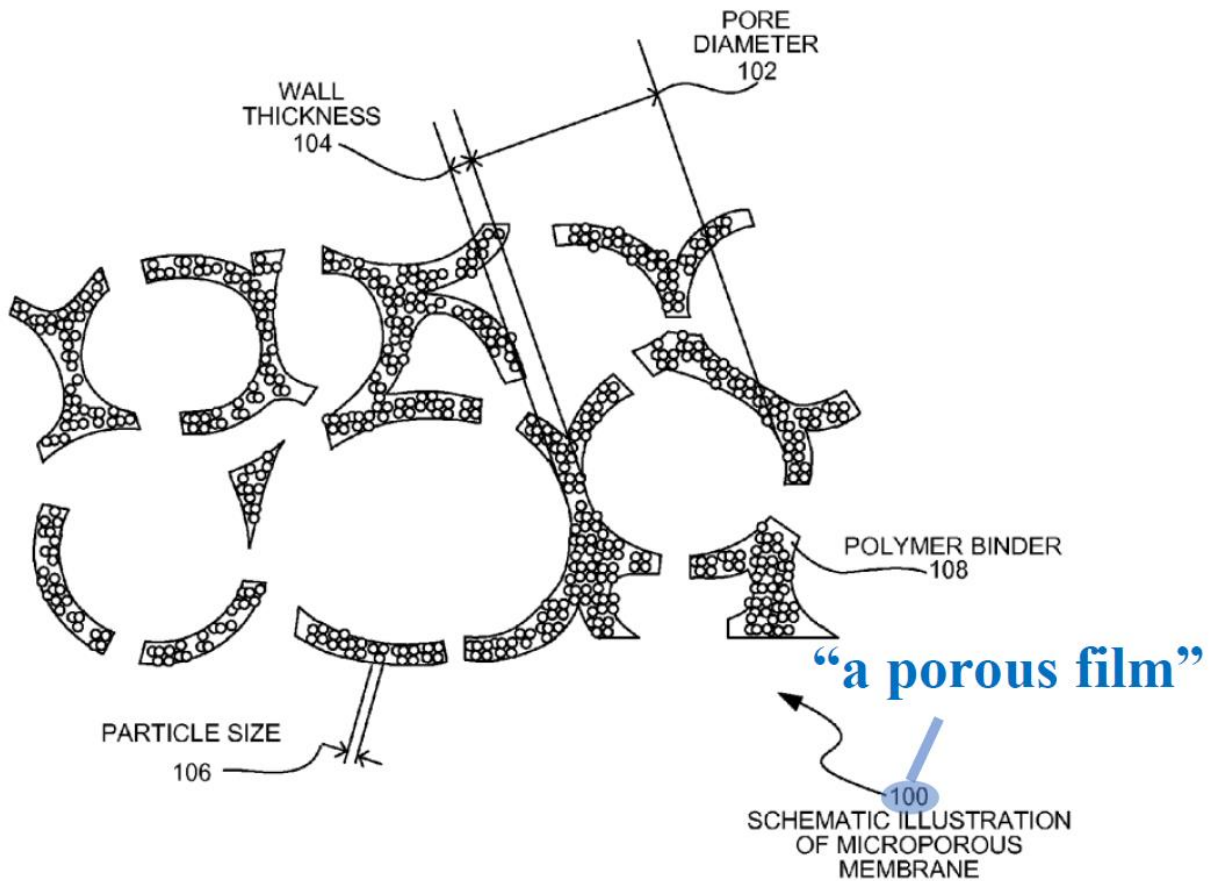


FIG. 1

Beard, FIG. 1*

2. [1.1]

Beard discloses that the porous membrane 100 has “a polymer binder,” disclosing the claimed *binder*. EX1010, Abstract; *see also id.*, ¶¶[0003], [0025], [0026], [0033], [0054], [0057]; EX1003, ¶184.

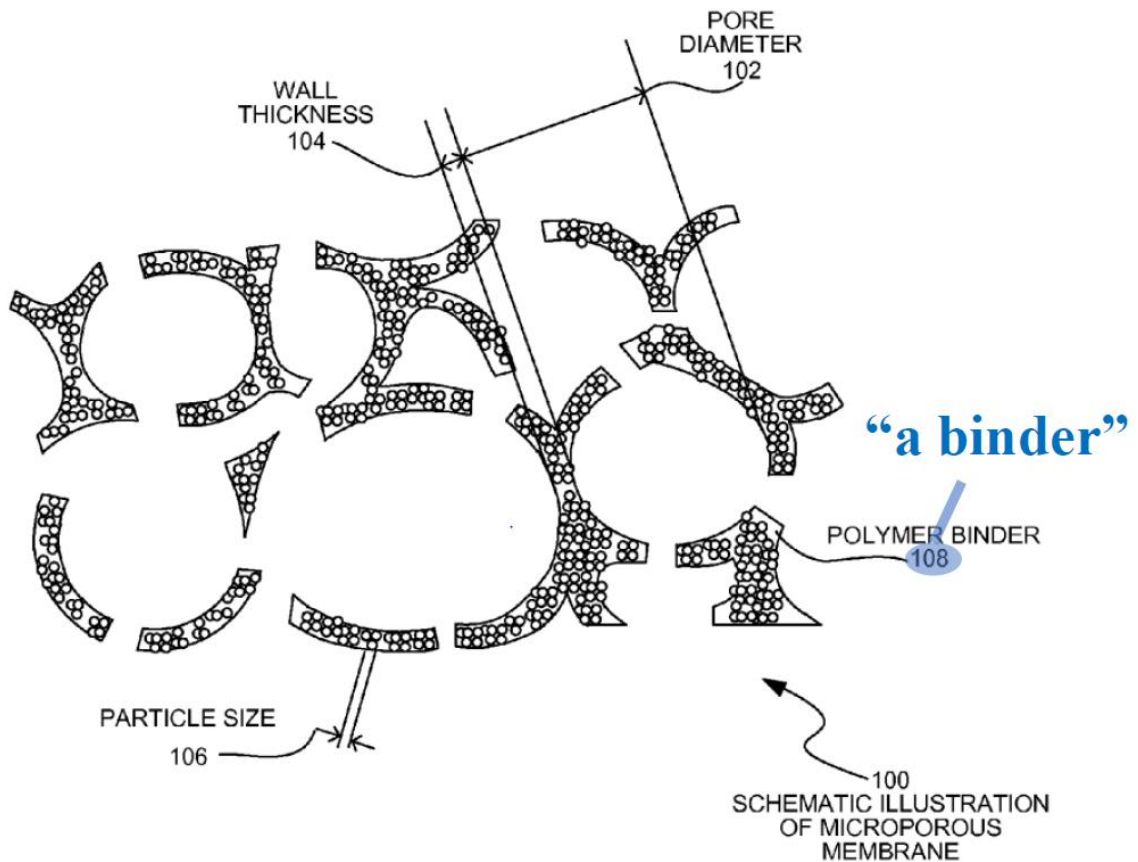
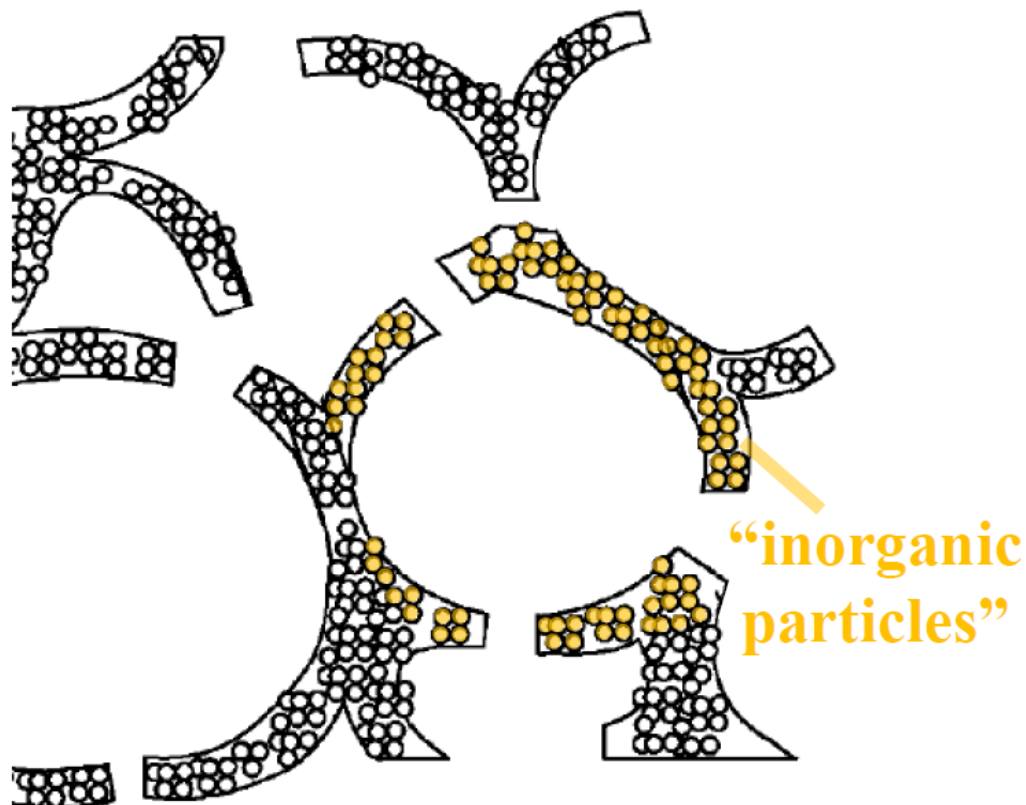


FIG. 1

Beard, FIG. 1*

3. [1.2]

Beard discloses that the polymer binder contains “a high concentration of spherical fillers,” corresponding to the claimed *inorganic particles*. EX1010, Abstract; *see also id.*, ¶¶[0003], [0010]-[0013] (discussing the filler material); EX1003, ¶186.



Beard, FIG. 1*

Beard discloses that the spherical filler particles can be *inorganic particles*, as claimed. EX1003, ¶187. For example, Beard teaches that “[t]he filler materials may be any solid material, such as ceramic, glass, oxide, carbon, composite, plastic, polymer composite, metal, cellulose in any shape or morphology” and “the particles may be spherical or nearly spherical in shape.” EX1010, ¶[0013]. At least ceramic, glass, oxide, and metal are inorganic materials. EX1003, ¶187.

Moreover, Beard explains that when using the porous membrane as a battery separator, “[t]he filler material, presumably manufactured from a higher temperature material, may serve to” prevent a short circuit and thermal runaway in the case of

battery failure. EX1010, ¶[0033]. Inorganic materials, like Beard's examples, withstand high temperatures generated by batteries. EX1003, ¶188. Moreover, Beard's examples used TiO₂ (an inorganic material) particles as the filler material. *Id.*, ¶[0054]; *see also id.*, ¶¶[0036]-[0037], [0049]-[0050], claim 14 (disclosing and claiming the use of TiO₂ as the filler). Thus, Beard discloses *inorganic particles*, and certainly renders their use obvious in the context of a porous membrane for a battery separator. EX1003, ¶188.

4. [1.3]

Beard discloses or suggests this element. *Supra* Section XI.A; EX1003, ¶190.

5. [1.4]

Beard discloses or suggests this element. *Supra* Section XI.B; EX1003, ¶191.

6. [1.5] to [1.7]

Beard does not specify particle size distributions of its inorganic filler particles. Akiike, however, discloses a porous membrane with inorganic particle size distributions falling in the claimed ranges, and provides motivation to use those particle size distributions for Beard's inorganic filler. EX1003, ¶192.

a. Akiike discloses elements [1.5]-[1.7]

Akiike teaches the use of “non-conductive particles” and that “any of inorganic particles and organic particles may be used.” EX1011, ¶[0038]. Initially, while terms like D10, D50, and D90 may sometimes refer to different types of

cumulative distributions (e.g., volume or weight) of particles, Akiike always uses these terms to refer to “cumulative *volume*” distributions—i.e., the claimed *Dv10*, *Dv50*, and *Dv90*, respectively. *See, e.g.*, EX1011, ¶¶[0010], [0031]-[0033], claim 2.

Akiike also always uses the D values to refer the distribution of the *non-conductive particles* in the porous membrane—i.e., the claimed *inorganic particles* discussed above. *See, e.g., id.*, ¶¶[0010], [0033], [0036], [0037], [0048], [0049], [0194].

Akiike’s general disclosure specifies ranges for D10, D50, and D90 overlapping the claimed *Dv10*, *Dv50*, and *Dv90*:

D10	Preferably	0.2 μm to 0.4 μm	EX1011, ¶[0031]
	More preferably	0.3 μm to 0.4 μm	
D50	Preferably	0.5 μm to 0.9 μm	EX1011, ¶[0032]
	More Preferably	0.7 μm to 0.9 μm	
D90	Preferably	1.0 μm to 3.0 μm	EX1011, ¶[0033]
	More preferably	1.2 μm to 2.0 μm	
	Further preferably	1.2 μm to 2.0 μm	

Thus, Akiike discloses or suggests the claimed ranges. *Peterson*, 315 F.3d at 1329.

Separately, all Akiike’s Examples exhibit *Dv10*, *Dv50*, and *Dv90* values falling within the respective claimed ranges of *0.015 μm to 3 μm*, of *0.2 μm to 5 μm*, and *1 μm to 10 μm*:

Akiike's Example	D10 (μm)	D50 (μm)	D90 (μm)
1	0.39	0.87	1.38
2	0.33	0.71	1.25
3	0.39	0.87	1.38
4	0.39	0.87	1.38
5	0.39	0.87	1.38
6	0.39	0.87	1.38
7	0.39	0.87	1.38
8	0.39	0.87	1.38
9	0.39	0.87	1.38
10	0.31	0.72	1.01
11	0.39	0.87	1.38
12	0.39	0.87	1.38
13	0.38	0.88	1.41
14	0.32	0.72	1.22
Comp. Ex. 1	0.39	0.87	1.38
Comp. Ex. 2	0.39	0.87	1.38
Comp. Ex 3	0.39	0.87	1.38

See EX1011, Tables 1-5. Thus, Akiike's Examples render the claimed ranges obvious. *Titanium Metals*, 778 F.2d at 782-783.

b. Rationale to combine Beard and Akiike

A POSITA would have found it obvious to combine Beard and Akiike so Beard's inorganic particles have particle sizes in which 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, as claimed. EX1003, ¶¶199-206.

The references provide teaching, suggestion, and motivation to do so. *KSR*, 550 U.S. at 417-418. Beard explains that its membrane contains “a highly packed spherical filler material ... bound with a polymer” in the pore walls. EX1010, ¶[0010]. Beard also mentions that “the filler particle size may be on the order of 0.001 microns or more,” but does not provide size distributions of the filler particles. *Id.*, ¶[0011]. Lacking these details, a POSITA would have looked to a similar separator porous membrane reference like Akiike for guidance on the appropriate size distributions for Beard’s filler particles. EX1003, ¶¶200-201.

- **Motivation for Dv10 in a range of 0.015 µm to 3 µm**

As explained, Akiike discloses that D10 (*Dv10*) of its non-conductive particles (*inorganic particles*) is “preferably 0.2 µm or more and more preferably 0.3 µm or more, and preferably 0.4 µm or less,” consistent with Akiike’s Examples. EX1011, ¶[0031]. Keeping D10 (*Dv10*) values above this floor reduces the number of inorganic particles with “extremely small sizes,” improving “battery properties such as high temperature cycle property.” *Id.* Reducing the number of extremely small particles also reduces “resistance against the passage of ions through the porous membrane” and decreases overall surface area of the membrane and limiting water absorption and resulting corrosion. *Id.*, ¶[0034]. Keeping D10 (*Dv10*) values under 0.4 µm, on the other hand, reduces the number of extremely large inorganic particles, improving mechanical strength and heat resistance of the porous

membrane. *Id.*, ¶¶[0031]-[0034]. Accordingly, a POSITA would have been motivated to use inorganic particles such that *Dv10 is in a range of 0.015 μm to 3 μm*, as claimed. EX1003, ¶202.

- **Motivation for Dv50 in a range of 0.2 μm to 5 μm**

As explained, Akiike discloses that D50 (*Dv50*) of its non-conductive particles (*inorganic particles*) is “preferably 0.5 μm or more and more preferably 0.7 μm or more, and preferably 0.9 μm or less,” consistent with Akiike’s Examples. EX1011, ¶[0032]. Keeping D50 (*Dv50*) values above a floor of 0.5 μm and preferably above 0.7 μm also reduces the number of inorganic particles with “extremely small sizes,” improving “battery properties such as high temperature cycle property.” *Id.* On the other hand, keeping D50 (*Dv50*) values below a ceiling of 0.9 μm reduces the number of extremely large inorganic particles, improving mechanical strength and heat resistance of the porous membrane. *Id.*

Accordingly, a POSITA would have been motivated to use inorganic particles such that *Dv50 is in a range of 0.2 μm to 5 μm*, as claimed. EX1003, ¶203.

- **Motivation for Dv90 in a range of 1 μm to 10 μm**

As discussed above, Akiike discloses that D90 (*Dv90*) of its non-conductive particles (*inorganic particles*) is “preferably 1.0 μm or more and more preferably 1.2 μm or more, and preferably 3.0 μm or less, more preferably 2.0 μm or less, and further preferably 1.5 μm or less,” consistent with Akiike’s Examples. EX1011,

¶[0033]. Again, Akiike explains that keeping D90 of the inorganic particles within these bounds reduces the number of extremely large and extremely small inorganic particles, improving temperature cycling, mechanical strength, and heat resistance of the porous membrane. *Id.* Akiike also teaches that reducing the number of extremely large inorganic particles allows dense packing of the inorganic particles in the porous membrane, providing “excellent mechanical strength, heat resistance, and electrical insulation ...” *Id.*, ¶[0035]. Accordingly, a POSITA would have been motivated to use inorganic particles such that *Dv90 is in a range of 1 μm to 10 μm*, as claimed. EX1003, ¶204.

- **Reasonable expectation of success**

A POSITA would have had a reasonable expectation of success in using Akiike’s particle size distributions in Beard’s porous membrane. EX1003, ¶205. For example, both Beard and Akiike use a polymer binder for their separators. *Compare* EX1010, ¶[0025] *with* EX1011, ¶[0067]. Beard teaches that its “polymer binder ... ha[s] an affinity for the filler materials and may hold the filler materials together in a porous structure with high tortuosity and consistent pore size” (EX1010, Abstract), and identifies TiO₂ as an example filler material (*id.*, ¶[0023]). Akiike also identifies TiO₂ (titania) a suitable inorganic filler, EX1011, ¶[0039], so a POSITA would expect Beard’s binder to have an affinity for Akiike’s inorganic particles, resulting in a separator that performs as the references describe. EX1003, ¶205.

7. [1.8] to [1.10]

The above-described combination of Beard and Akiike renders elements [1.8] to [1.10] obvious. EX1003, ¶207. First, in all Akiike's disclosed preferred ranges, the ranges for D10 fall below the ranges for D50, and the ranges for D50 fall below the ranges for D90. And, as discussed, this is an inherent characteristic of any collection of particles. EX1003, ¶114.

D10	Preferably	0.2 µm to 0.4 µm	EX1011, ¶[0031]
	More preferably	0.3 µm to 0.4 µm	
D50	Preferably	0.5 µm to 0.9 µm	EX1011, ¶[0032]
	More Preferably	0.7 µm to 0.9 µm	
D90	Preferably	1.0 µm to 3.0 µm	EX1011, ¶[0033]
	More preferably	1.2 µm to 2.0 µm	
	Further preferably	1.2 µm to 1.5 µm	

Separately, the particle size distributions in all Akiike's Examples, which would have been obvious to implement in Beard for the reasons above, satisfy these claim elements inherent in all particle distributions:

Akiike's Example	D10 (µm)	D50 (µm)	D90 (µm)	D90/D10
1	0.39	0.87	1.38	3.54
2	0.33	0.71	1.25	3.79
3	0.39	0.87	1.38	3.54
4	0.39	0.87	1.38	3.54
5	0.39	0.87	1.38	3.54
6	0.39	0.87	1.38	3.54

7	0.39	0.87	1.38	3.54
8	0.39	0.87	1.38	3.54
9	0.39	0.87	1.38	3.54
10	0.31	0.72	1.01	3.26
11	0.39	0.87	1.38	3.54
12	0.39	0.87	1.38	3.54
13	0.38	0.88	1.41	3.71
14	0.32	0.72	1.22	3.81
Comp. Ex. 1	0.39	0.87	1.38	3.54
Comp. Ex. 2	0.39	0.87	1.38	3.54
Comp. Ex 3	0.39	0.87	1.38	3.54

See EX1011, Tables 1-5.

B. Dependent Claim 2

1. [2.1]

Beard discloses that “[t]he pore diameter 102 may vary from 0.01 to 10 microns, with a typical size of 0.1 to 1 micron.” EX1010, ¶[0020]. Beard’s “typical size” range overlaps the claimed range and renders it obvious. EX1003, ¶210.

C. Dependent Claim 3

1. [3.1]

Beard discloses that “[t]he pore wall thickness may be on the order of 0.02 microns” (EX1010, ¶[0011]), which corresponds to 20 nm. EX1003, ¶212. Beard further discloses that “[t]he wall thickness 104 may vary from 0.01 to 0.05 microns,” which corresponds to 10 nm to 50 nm, falling within the claimed range. EX1010

¶[0021]. Thus, Beard discloses wherein the average wall thickness between the pores is in a range of 20 nm to 500 nm, as claimed.

D. Dependent Claim 5

1. [5.1]

Beard used TiO_2 (*titanium oxide*) as filler particles (*inorganic particles*) in its examples. EX1010, ¶[0054]; *see also id.*, ¶¶[0036], [0049], [0050], claim 14. Claim 3 of Beard also recites that the filler may be “ceramic, glass, oxide, carbon, composite, plastic, polymer composite, metal, and cellulose.” Akiike specifies several of the claimed inorganic hydroxides as inorganic particles including at least aluminum oxide (*alumina*), *aluminum hydroxide*, *magnesium hydroxide*, and *titanium oxide* (*titania*). EX1011, ¶[0039]. Alternatively, it would have been obvious to use any of Akiike’s inorganic particles in Beard’s porous membrane. EX1003, ¶¶214-216.

E. Dependent Claim 6

1. [6.1]

Beard discloses that PVDF (*polyvinylidene fluoride*) was used as a binder. EX1010, ¶[0054] (“Several example materials have been manufactured using PVDF polymer binder with TiO_2 fillers using a two-liquid casting process.”). *See also id.*, ¶[0014] (“The membrane may use various polymers, such as polyethylene,

polypropylene, PET, PVDF, acrylic, PVC, amide, or other polymers.”); EX1003, ¶218.

F. Dependent Claim 7

1. [7.1]

Beard discloses that its microporous membrane (*porous film*) “may have a porosity of greater than 50%[.]” EX1010, ¶[0011]. Beard further discloses that “an example membrane may have 70% voids[.]” *Id.*, ¶[0029]. In each of Beard’s Examples, the samples had “void[] percentages from 69-81%.” *Id.*, ¶[0054]. Each of these disclosures falls in, or overlaps, the claimed porosity range of 20% to 90%. EX1003, ¶220.

G. Dependent Claim 8

1. [8.1]

To the extent Beard does not expressly disclose a thickness for its porous membrane, a POSITA creating Beard’s separator would have looked to Akiike for implementation details. EX1003, ¶¶222-223. Akiike teaches several preferred thickness ranges for its porous membrane—all overlapping or falling within the claimed thickness range. EX1011, ¶[0155]. Notably, the most preferred range of 0.3 μm to 10 μm falls entirely within the claimed range. EX1003, ¶222.

Because Akiike also teaches a porous membrane for a lithium-ion battery separator and the porous membrane must have *some* thickness, a POSITA would

have found it obvious to make Beard's porous membrane have the preferred thickness disclosed by Akiike. *Id.*, ¶223. Giving the POSITA a reasonable expectation of success, Akiike teaches that its preferred thickness ranges balance the competing benefits of heat resistance and ion permeability. *Id.* Thus, a POSITA would have expected using Akiike's disclosed thickness for Beard's separator to result in a separator that performs well in both heat resistance and lithium ion conductivity. *Id.*

H. Dependent Claim 9

1. [9.1]

Beard discloses that the volume of filler (*inorganic particles*) to polymer (*binder*) “may be 1:1, 1:2, 2:1, 1:1.5, 1.5:1, or some other ratio.” EX1010, ¶[0029]. Each of these ratios falls in the claimed range. When converted into the form used in the claim, Beard's ratios are: 1.0, 0.5, 2.0, 0.67, and 1.5. EX1003, ¶224.

I. Independent Claim 10

1. [10.pre] to [10.4]

Beard discloses, suggests, or renders obvious these conventional elements of a lithium-ion battery. For example, Beard discloses using its porous membrane as a separator in a lithium-ion battery. *See, e.g.*, ¶¶[0009], [0051]. A lithium-ion battery necessitates (and certainly would render obvious) a positive electrode, a negative electrode, a separator, and a non-aqueous electrolyte—the essential components of

a lithium-ion battery. EX1003, ¶¶226-231. POSITA understands that a lithium-ion battery requires an electrolyte to function but is incompatible with water, necessitating and rendering obvious a non-aqueous electrolyte, as claimed. *Id.*, ¶226. If additional lithium-ion battery implementation details were needed to make a lithium-ion battery with Beard's separator, the POSITA would have simply looked to Akiike. *See, e.g.*, EX1011, ¶¶[0016], [0138]-[0186]; EX1003, ¶227.

J. Remaining elements [10.5] through [10.15]

Beard discloses, suggests, and/or renders obvious the remaining elements of claim 10 for the reasons discussed above for identical corresponding elements of independent claim 1:

Claim 10 Element	Claim 1 Element	Analysis
[10.5]	[1.pre]	Section XII.A.1
[10.6]	[1.1]	Section XII.A.2
[10.7]	[1.2]	Section XII.A.3
[10.8]	[1.3]	Section XII.A.4
[10.9]	[1.4]	Section XII.A.5
[10.10]	[1.5]	Section XII.A.6
[10.11]	[1.6]	
[10.12]	[1.7]	
[10.13]	[1.8]	Section XII.A.7
[10.14]	[1.9]	
[10.15]	[1.10]	

EX1003, ¶232.

K. Dependent Claim 19

1. [19.1]

Beard discloses, suggests, or renders obvious this element. Specifically, Beard teaches that, “[i]n ... a battery,” Beard’s “highly filled [porous] membrane may be used as a separator between an anode and cathode ” to facilitate ion transfer while preventing short circuits “when the porous structure collapses” from very high temperature. EX1010, ¶[0033]; *see also id.*, ¶¶[0030], [0051], [0055], [0056] (discussing use of porous membrane as a battery separator). Because the porous membrane sits between the two battery electrodes, Beard discloses or suggests claim 19. To the extent a POSITA needed more guidance to implement Beard’s separator in a lithium-ion battery, the POSITA would have looked to Akiike and, based on its teachings, arranged Beard’s porous membrane as recited in Element [19.1]. *See* EX1011, ¶¶[0016], [0144], claim 7; EX1003, ¶¶233-234.

L. Remaining Dependent Claims 11, 12, and 14-18

Beard discloses, suggests, and/or renders obvious claims 11, 12, and 14-18 for the reasons discussed above for identical corresponding elements of claims 2, 3, and 5-9:

Remaining Claim Elements	Previous Claim Elements	Analysis
[11.1]	[2.1]	Section XII.B.1
[12.1]	[3.1]	Section XII.C.1

[14.1]	[5.1]	Section XII.D.1
[15.1]	[6.1]	Section XII.E.1
[16.1]	[7.1]	Section XII.F.1
[17.1]	[8.1]	Section XII.G.1
[18.1]	[9.1]	Section XII.H.1

EX1003, ¶235.

XIII. GROUND 8: BEARD AND AKIIKE, FURTHER IN VIEW OF TANAKA, RENDER OBVIOUS CLAIMS 4 AND 13

A. Dependent Claims 4, 13

1. Tanaka discloses elements [4.1], [13.1]

See discussion above for elements [4.1], [13.1] in Ground 3. *Supra* Section X.A.

2. Rationale to combine Beard and Tanaka

The same rationale discussed above for the Murakami-Tanaka combination in Ground 3 would have motivated a POSITA to combine Beard and Tanaka. *Supra* Section X.A.2.b. The following additional rationale applies to the Beard-Tanaka combination.

Beard and Tanaka are analogous prior art. EX1003, ¶238. Beard relates to a porous membrane used as a separator in a lithium-ion battery, like the '148 Patent. *See, e.g.*, EX1010, ¶¶[0030], [0033], [0050], [0051], [0054], [0056]; EX1001, 1:29-37, 2:38-46. And, as discussed, Tanaka also relates to a porous, polyolefin body used as “a separator for a lithium ion secondary cell ... and the like.” *See, e.g.*, EX1009,

¶[0069], *see also id.*, Abstract. Thus, a POSITA would have looked to Beard and Tanaka for the proposed combination. EX1003, ¶238.

Beard notes that membranes “suitable for battery separators” should have “uniform pore distribution” and “high film strength.” EX1010, ¶[0065]. This would have motivated a POSITA to look to Tanaka’s technique to tune the D10/D90 ratio for uniform pore size distribution and increased mechanical strength. *Supra* Section X.A.2.b.

A POSITA would have had a reasonable expectation of success implementing Tanaka’s D10/D90 pore distribution size ratio in Beard’s porous membrane. EX1003, ¶240. As explained, Tanaka describes a technique to “control” this ratio to have “a desired value” by a heat treatment suppressing pore deformation and thereby suppressing fluctuation of pore volume and average diameter. EX1009, ¶[0020]. A POSITA could have incorporated Tanaka’s controlled heating technique in Beard’s manufacturing process where “the polymer may be heated ... then cooled to form the microporous structure.” EX1010, ¶[0058]. Thus, within Beard’s existing process, a POSITA could have, subjected Beard’s porous membrane to a controlled heating process, based on Tanaka’s teachings, to control the pore size distribution ratio. EX1003, ¶240.

A POSITA would have expected Tanaka’s technique to work in Beard because both references teach forming their porous layers from common polymers,

including polyethylene and polypropylene. *Compare* EX1010, ¶[0014] (“various polymers, such as polyethylene, polypropylene ...”) *with* EX1009, ¶[0026] (“Examples of the polyolefin used ... include, but are not limited to, homopolymers of ethylene, propylene ...”); EX1003, ¶241. Thus, a POSITA could reasonably expect Tanaka’s controlled heating technique to work with Beard’s polyolefin separator, allowing control over the D90/D10 ratio as described by Tanaka. EX1003, ¶241.

XIV. INSTITUTION IS APPROPRIATE

A. Section 325(d) Does Not Bar Trial

Grounds 1-8 present substantially different prior art and arguments than those previously considered by the Office. *See* 35 U.S.C. § 325(d); *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 7-10 (PTAB Feb. 13, 2020) (precedential).

Regarding the first *Advanced Bionics* factor, none of the prior art or arguments in Grounds 1-8 was previously considered by the Office with respect to the ’148 Patent. Petitioner’s prior art references and Grounds materially differ from the Murata reference and rejections applied by the Office. *Supra* Section IV.B.

For example, Murakami and Akiike both disclose porous films comprising binder and inorganic particles having the claimed *Dv10*, *Dv50*, and *Dv90* characteristics, thus addressing the reason the Examiner allowed the ’148 Patent

claims. The Examiner did not consider any reference disclosing the claimed particle sizes characteristics.

Murakami describes a formation process like the '148 Patent that removes the solvent from the binder coating, resulting in porous layer, in a similar way to the '148 Patent. Murakami's description of its porous layer composition suggests or renders obvious that the pores of Murakami's porous layer include at least some portion of the filler material (claimed inorganic particles). And Beard discloses a porous membrane for a separator in which the filler material is densely packed inside the pore walls of the porous membrane and, in some cases, protruding into the pore void, meaning that "*the pores at least comprises a part of the inorganic particles,*" as claimed.

B. Institution Is Appropriate Under *Fintiv*

Patent Owner asserts the '148 Patent against Petitioner in *Ningde Amperex Technology Limited v. Zhuhai CosMX Battery Co.*, filed September 6, 2024. EX1015. IPR should be instituted under *Fintiv*. See *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential). Petitioner has filed this Petition before the January 20, 2025 due date for its Answer. EX1016. With the case in such an early stage, the parties have invested little resources and timing remains uncertain, so this proceeding will help resolve the parties' dispute. The Petition sets forth compelling patentability challenges, overriding all other *Fintiv*

concerns. K. Vidal, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings With Parallel District Court Litigation (June 21, 2022), 2-3. Further rendering *Fintiv* discretion moot, if IPR is instituted, Petitioner stipulates not to pursue in the parallel litigation Grounds 1-8 in this Petition or any other ground that Petitioner reasonably could have raised in this Petition. *Id.*, 3; *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential as to § II.A).

XV. GROUNDS FOR STANDING

Petitioner certifies that the '148 Patent is available for IPR and Petitioner is not barred or estopped from requesting IPR of any '148 Patent claim.

XVI. MANDATORY NOTICES

Real Party-in-Interest (37 C.F.R. § 42.8(b)(1)): The real party-in-interest is Petitioner Zhuhai CosMX Battery Co., Ltd.

Related Matters (37 C.F.R. § 42.8(b)(2)): The '148 Patent is currently at issue in *Ningde Amperex Technology Limited v. Zhuhai CosMX Battery Co.*, No. 2:24-cv-00728 (E.D. Tex.).

Lead and Back-up Counsel (37 C.F.R. § 42.8(b)(3)):

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Service Information (37 C.F.R. § 42.8(b)(4)): Please direct all correspondence regarding this Petition to counsel at the above addresses, COSMX-PTAB@leehayes.com and PTAB@sternekessler.com. Petitioner consents to service by email at the addresses above.

XVII. CONCLUSION

Petitioner respectfully requests that the Board institute review and cancel challenged claims 1-19 as unpatentable.

Respectfully submitted,

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/James D. Stein/

James D. Stein
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Lead Counsel for Petitioner

Date: January 10, 2025

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

This Petition for *Inter Partes* Review complies with the type-volume limitation of 14,000 words, comprising 13,998 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

This Petition for *Inter Partes* Review complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word in 14-point Times New Roman font.

Respectfully submitted,

LEE & HAYES, P.C.

/James D. Stein/

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Registration No. 63,782
Lead Counsel for Petitioner

Date: January 10, 2025

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

I certify that the above-captioned **PETITION FOR *INTER PARTES* REVIEW FOR U.S. PATENT NO. 11,575,148** and associated Exhibits 1001-1017 were served in their entireties upon the Patent Owner on January 10, 2025, via FedEx® Express at the following addresses:

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Date: January 10, 2025