

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

SUPPLEMENTAL DECLARATION OF SAMUEL P. GIDO, Ph.D.

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I, Samuel P. Gido, Ph.D., declare as follows:

I. INTRODUCTION

1. I have been retained by Lee & Hayes, P.C. as a technical expert for Zhuhai CosMX Battery Co., Ltd. (“CosMX” or “Petitioner”), who is the Petitioner in an *Inter Partes* review before the United States Patent and Trademark Office (“USPTO”) involving U.S. Patent No. 11,575,148 (“the ’148 Patent,” EX1001).

2. I previously submitted a Declaration (EX1003) in this proceeding in support of Petitioner’s Petition (Paper 2) for *Inter Partes* Review of the ’148 Patent.

3. I understand that the Patent Trial and Appeal Board (PTAB) of the USPTO granted institution of review of the ’148 Patent in an Institution Decision (“Decision,” Paper 10). I further understand that prior to institution, Patent Owner (“PO”) filed a Patent Owner’s Preliminary Response (Paper 7), supported by a Declaration of its technical expert, Dean R. Wheeler, Ph.D. (EX2015). Following institution, I understand PO filed a Patent Owner Response (Paper 21), supported by a Supplemental Declaration of Dr. Wheeler (EX2034).

4. I have reviewed the Patent Owner’s Preliminary Response (Paper 7), and the first Wheeler Declaration (EX2015), the Board’s Institution Decision (Paper 15), the Patent Owner Response (“POR,” Paper 21), the Supplemental Wheeler Declaration (EX2034), and the documents cited in those filings.

5. I have been asked by counsel for Petitioner to consider and respond to the arguments and opinions set forth in POR and in Dr. Wheeler's Supplemental Declaration.

6. After reviewing these materials, my opinions have not changed. It remains my opinion that the Challenged Claims of the '148 Patent would have been obvious to a person of ordinary skill in the art (POSA) at the time of the alleged invention for the reasons set forth in my original Declaration (EX1003), and as further explained below. I expressly incorporate by reference the content of my original Declaration in its entirety, including my background and qualifications, understanding of the relevant legal standards, analysis of the '148 Patent and prior art, and my opinions demonstrating obviousness of the Challenged Claims.

7. To the extent necessary, this Supplemental Declaration elaborates on and responds to specific arguments raised by PO and Dr. Wheeler. My opinions in this Supplemental Declaration are offered from the perspective of a POSA as defined in my original Declaration (EX1003), which I understand Patent Owner has adopted, and are based on my education, training, and experience as well as my review of the materials identified above.

8. Although I am being compensated at my usual rate of \$520 per hour for the time I spend on this matter, no part of my compensation depends on the outcome of this proceeding or the content of my testimony in this Supplemental Declaration.

I have no financial interest in any of the parties. I have no affiliation with either party in this case besides having been retained as an independent consultant in this matter.

9. I have personal knowledge of the facts and matters in this Supplemental Declaration and believe them to be true.

II. CLAIM CONSTRUCTION

10. I understand that two terms are in dispute. It is my opinion that each term should be given their plain and ordinary meaning. It is further my opinion that the constructions offered by PO and Dr. Wheeler are unsupported and contradictory.

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

11. It is my understanding that the district court did not find this term to be indefinite and ordered this term be given its plain and ordinary meaning: the “inorganic particles are a part of the pores.” EX2056, 32-33. I agree with the district court, given the court’s finding that the term is not indefinite.

12. It is my opinion that the *pore* wall is part of the pore. The Board implicitly accepted this construction. Decision, 19 (rejecting argument that inorganic particles within the pore wall do not comprise part of the pore). PO and Dr. Wheeler argue they are not. Instead, pores are solely the “voids or interstitial spaces.” POR, 11-12; EX2034, ¶¶61-64. I disagree.

13. I have been instructed by counsel that claim terms are generally given their plain and ordinary meaning unless the patentee acts as their own lexicographer

by providing their own definition or the patentee disavows the full scope of a claim term either in the specification or during prosecution. Neither exception applies here, so the plain and ordinary meaning of “pores” applies, which includes the pore walls. Simply put, without the pore wall, there is no pore. Borrowing PO’s analogy, while you may not include the thickness of the walls when measuring the dimensions of a room, the walls are nonetheless part of the room. Without the walls, there would just be undefined open space.

14. PO’s support for excluding pore walls from “pores” is unpersuasive. First, my prior testimony in a different proceeding is irrelevant. Whether the pore wall was part of the pore was not at issue, so my testimony cannot be used to reach such a conclusion. The testimony the PO is citing is even more irrelevant because I was testifying about a totally different type of material from the particle and binder porous layer of the ’148 Patent. In this testimony I was explaining how the polyolefin porous substrate, which is the base on which the claimed porous film is coated, but which is not claimed in the ’148 Patent, is made. Moreover, my statement—that stretching “opens up voids or pores in the film”—does not mean that a pore wall is not part of the pore. Stretching a porous structure “opens up” the pores by expanding the pore walls, which consequently increases the void space. My testimony is accurate and entirely consistent with Petitioner’s position.

15. Second, “porosity” and “pore” are different terms – one does not define the other. A pore is a physical object, while porosity is a property of materials created by the presence of pores. For an analogy, take an iron weight. One might argue about whether the outer surface of that weight is part of the weight itself or not. (I would say that it clearly is and so would just about anyone.) The mass of the iron weight is a property of the weight. This property does not impact or depend on whether or not one defines the surface of the weight to be part of the weight. In the case of “pore” and “porosity” the PO and its expert are attempting to confuse the issue by exploiting the linguistic similarity of pore and porosity to distort the nature of the connection between these two terms.

16. The physical object, the pore, needs to include the pore wall in order to give it form and definition. Without a pore wall, a void is just empty space. This understanding is evident from the claim language: “the porous film comprises pores formed by the binder.” The only way for the pores to be formed by the binder is for the pore walls, to be made of or with binder. The PO’s construction that the pore is only the void, would require the claim term “pores formed by the binder” to mean that the void is made of binder. This is not possible, since the binder is a physical material, while the void is empty space. Porosity refers to the fraction of the total volume of the material that is comprised of void space. EX1037, 53:11-14. Dr. Wheeler explained the void space is the numerator, while the total apparent volume

(including space occupied by physical matter and voids) is the denominator. *Id.* Under PO's definition of "pore," porosity would be pore volume divided by total volume. But the volume of the particles that "comprise" or form part of the pores is "not [] part of the numerator" in the "porosity calculation." *Id.*, 53:15-54:3. PO's argument is self-defeating. In other words, PO and Dr. Wheeler are trying to say that because "pore" is included in "porosity" and porosity is the fraction of empty space, then "pore" must only mean empty space. However, they end up arguing against themselves because it would then logically follow that particles, even when sitting in the pores, are not part of the pore (but rather the pore boundaries or walls) because they are not empty space.

17. Third, the '148 Patent's specification does not state that it defines "pore" as excluding the pore walls. Describing how increasing the "average wall thickness between adjacent pores" decreases average pore size does not redefine the term "pores" to mean "void space only." For example, two adjacent rooms share a common wall. That wall is between the adjacent rooms, but that does not mean a room excludes the very walls that define it. The same logic applies to pores.

18. Defining "pores" as solely void is not compatible with the claim element "pores at least comprises a part of the inorganic particles." If the pore is just void space, then how can a pore (i.e., void space) be comprised (i.e., made up of) of inorganic particles? It cannot. Dr. Wheeler confirmed that "the particle is obviously

not void” as it is “a solid.” EX1037, 51:6-7. And while PO argues that the annotated SEM images from the ’148 Patent illustrate that the inorganic particles “extend[.]...into [those] pore[s],” Dr. Wheeler admitted that the identified particles are part of the pore wall. *Id.*, 21:17-22:2. In my opinion, Dr. Wheeler is correct. This directly contradicts PO’s position that “a ‘pore’ and its ‘wall’ are distinct elements.” POR, 25; EX2034, ¶¶116-117. And while Dr. Wheeler refused to admit that the identified particles defined the geometry of the void space, he admitted that “[i]t has some effect.” EX1037, 22:3-11. The particle(s) necessarily define(s) the geometry of the void space because the particle is *not* part of the void space. Therefore, the only way that a pore can at least comprise a part of the inorganic particles is if “pores” include the pore walls.

19. With pores defined as the void space and the pore walls, the rest of this claim term is straightforward: the pores must be, at least partially, made up of at least part of the inorganic particles. Or as the district court stated, the particles must be part of the pores. EX2056, 32-33.

1. Alleged Inconsistent positions

20. It is my opinion that a POSA would have a hard time understanding the precise meaning of “the porous film comprises pores formed by the binder, the pores at least comprises a part of the inorganic particles.” However, while this claim language does not specify the full outer limits of the metes and bounds regarding

such parameters as the required relative amount of binder in a pore wall to have “pores formed by the binder,” or the number of pores that need to *include* some part of a particle (and how big of a part of the particle it needs to be), I was still able to determine that the prior art anticipated or rendered these claim elements obvious. This is because the prior art is so squarely in the middle of any reasonable interpretation of the claim element that it is remote from the uncertain boundaries of the element. I therefore was able to determine that the prior art was within the “boundaries” of the claims without needing to “fully understand the absolute metes and bounds” of the claim terms, as I previously testified. EX2033, 29:3-22.

B. Pores “formed by the binder”

21. It is my understanding that this term was not proposed for construction in the district court case, but that the district court characterized this term as the “binder forms the structure.” EX2056, 32-33. I agree that this is the plain and ordinary meaning of the term. PO and Dr. Wheeler offer two conflicting constructions of “formed by the binder,” neither of which are correct, in my opinion.

1. PO’s construction

22. In the POR, PO argues that the pores must be “formed by the binder itself” and not “other components like inorganic particles.” POR, 6; EX2034, ¶¶44-50. PO explains that the “outer geometry” of the pores must be “defined by binder” in the “same way that a circle’s perimeter defines the circle.” POR, 6-8; EX2034,

¶¶20-26, 44-52, 54. Taken together with PO’s definition of “pores,” the construction offered in the POR requires that the outer geometry of the void space be defined solely by binder. See EX2034, ¶98 (arguing that Murakami’s pores are not formed by binder because there is “not enough binder...to surround the empty spaces...nor to fully surround the inorganic particles” and that the claim requires that the “voids [be] formed between pore walls of binder.”). But the claims do not state the pores are formed *entirely* or *exclusively* by the binder. Neither does the specification indicate this requirement.

23. PO points to the SEM imaging from the ’148 Patent, but that confirms that inorganic particles also define the outer geometry of the void spaces. EX1037, 22:3-11; EX2034, ¶181 (identifying particle interacting with – and thus defining geometry of – void space). PO argues that the use of NIPS process confirms its construction. But Dr. Wheeler testified otherwise. EX1037, 27:15-28:21 (“Q....the [NIPS] process doesn’t guarantee that the pores must be formed by binder, correct? A. Right.”). Further, the ’148 Patent does not require the NIPS process. “NIPS” is absent from any claim. EX1001. In fact, NIPS is mentioned only once as part of “a method for preparing a porous film” – not the *only* method. EX1001, 5:61-62, 6:16-19 (emphasis added unless otherwise specified). It is my understanding that an example from the specification does not dictate claim meaning.

24. PO argues that the “high ratio of binder” disclosed by the ’148 Patent requires the outer geometry be defined solely by binder. The ’148 Patent teaches using as low as 17 vol% of binder (EX1001, 5:50-52), well below the 50% number PO quotes from my prior testimony in a separate proceeding. POR, 9-10. A POSA would know that the 83 vol% of inorganic particles would likely form significant portions of the pore walls, including defining the shape of the pores and void spaces.

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

2. Dr. Wheeler’s modified construction

26. Dr. Wheeler agreed with PO’s construction in his declaration, but he modified his opinion when deposed. Instead of the outer geometry of the void being defined *solely* by binder, Dr. Wheeler testified that the binder need only be the *primary* definer of the void’s geometry – meaning that inorganic particles can partially define the void’s geometry. EX1037, 11:15-12:11. Like above, the claims

do not state the pores must be formed primarily by binder. And for the same reasons PO's arguments above fail, they fail too in supporting Dr. Wheeler's construction.

27. Making matters worse, Dr. Wheeler could not explain his own construction. How would a POSA know if a pore's geometry is defined *primarily* by binder? Dr. Wheeler did not know. EX1037, 12:15-15:14. In my opinion, Dr. Wheeler's undefined, unsupported construction should not be adopted.

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

A. Murakami Pores are "Formed by the Binder"

1. PO and Dr. Wheeler's claim construction is wrong.

28. PO and Dr. Wheeler's argument hinges on their construction requiring that the outer geometry of the void be defined – either exclusively or primarily – by binder. Specifically, they argue Murakami's void spaces are "gaps between filler particles." POR, 20; EX2034, ¶¶81-89. Dr. Wheeler opines that Murakami's pore walls are the particles themselves, with binder acting as glue between the particles. EX2034, ¶¶93, 117. Thus, under their construction, the geometry of Murakami's void space is not defined entirely or primarily by binder, but instead by particles. But it is my opinion that PO and Dr. Wheeler's constructions are wrong. Section II.B.

29. In my opinion, Murakami discloses this element – even in Examples 1 and 2 where the binder acts as glue holding the inorganic particles together. By

gluing particles together, pore walls and void space between the walls are formed, creating pores. Without the binder, the inorganic particles would be a loose powder. The interparticle interstices in such a powder do not constitute a stable or permanent porous structure suitable for use in a battery separator. The configurations and pores would not be permanent without the binder to glue the particles in place. Thus, when gluing together the inorganic particles, the binder makes the pores, through a process of “forming.”

2. Murakami discloses this limitation under PO’s construction.

30. PO and Dr. Wheeler’s argument also hinges on narrowing Murakami’s disclosure to just two examples. They argue that because Examples 1 and 2 are 93% by volume filler particles, the gaps/voids must be defined by the particles. POR, 21; EX2034, ¶¶90-94. First, Dr. Wheeler admitted that even at that filler volume percentage, it is still possible the particles are fully coated and therefore the pores would be “formed by the binder.” EX1037, 36:1-37:10. I agree with Dr. Wheeler. As Dr. Wheeler stated, SEM imaging would be required to confirm one way or the other. *Id.*, 67:4-12. Without such imaging, they cannot conclude that Murakami’s particles are not coated by binder.

31. Second, Murakami is not limited to two examples. Murakami teaches that “In a case where the porous layer contains a filler, a filler content is preferably

1 volume % to 99 volume %, more preferably 5 volume % to 95 volume %, relative to the porous layer.” EX1005, ¶[0069]. Since the two main components of Murakami’s porous layer are binder and particles (filler) and their amounts add up to 100%, this teaching is equivalent to teaching that the porous layer contains a binder in the amount of 1 volume % to 99 volume % or more preferably 5 volume % to 95 volume %. Murakami also discloses embodiments with filler content by mass of 60%, 70%, 80% and 90%. EX1005, ¶[0070]. These correspond to binder contents by mass of 40%, 30%, 20% and 10%.

32. Murakami teaches a range of binders (EX1005, ¶¶[0053]-[0056]) and a range of inorganic particles (EX1005, ¶[0060]). Polyvinylidene fluoride (PVDF) is a common binder material taught by Murakami (EX1005, ¶[0053]) which has a density of 1.8 g/cm³. Carboxymethyl cellulose (CMC) is another common binder material taught as particularly preferable by Murakami, (EX1005, ¶[0056]) and used in Murakami’s examples, (EX1005, ¶¶[0140], [0161], [0185], [0196]) which has a density of 1.6 g/cm³. Murakami teaches a particular preference for using alumina for the inorganic particles (EX1005, ¶[0061]), which have a density (α -alumina) of 3.99 g/cm³. Using these densities, with PVDF as the binder, to convert the mass percentages of binder taught by Murakami (40%, 30%, 20% and 10%) to volume percentages, a POSA would find that Murakami discloses specific embodiments with the binder content by volume of 60%, 49%, 36% and 20%. Using these

densities, with CMC as the binder, to convert the mass percentages of binder taught by Murakami (40%, 30%, 20% and 10%) to volume percentages, a POSA would find that Murakami discloses specific embodiments with the binder content by volume of 62%, 52%, 38% and 22%.

33. It is the volume percentage of binder, rather than its mass or weight percentage, that is more relevant to the amount of space occupied by the binder relative to particles in the pore structure. Murakami very clearly teaches embodiments where the pore structure is composed of 60% binder and thus binder necessarily forms the pores and defines the boundaries of the pore structures.

34. Additionally, the '148 Patent discloses up to 83% inorganic particles by volume. EX1001, 5:50-52. If the '148 Patent can have voids defined by binder (as construed by Dr. Wheeler and PO) using only 17% binder by volume, then even Murakami's embodiments discussed above that use 20%, 22%, 36% and 38% binder by volume can have pores defined by binder.

35. In my opinion, PO and Dr. Wheeler stretch out-of-context quotes to improperly limit Murakami's disclosure. Murakami does state that "gaps formed by contacts of particles of the fillers are less likely to be blocked by a resin," but it does not state that all pores are formed by contacts of particles. A POSA would understand this, as a porous layer with merely 1vol% of filler particles, or 5 vol% of filler particles, or the volume percentages of filler particles corresponding to the higher

binder volume percentage embodiments I calculated above, would necessarily have pores formed in the binder. PO and Dr. Wheeler cite Murakami's statement that having "a filler dispersed in a resin...is not suitable," (EX1005, ¶[0070]) but mispresent what Murakami is actually teaching with this statement. A POSA would understand clearly that Murakami is teaching that it would be unsuitable to have a non-porous or low porosity structure in which binder particles are mixed throughout a resin. Such composites of filler blended into a resin to form a solid, non-porous or low porosity, structure are exceedingly common and comprise a very large fraction of all commercial applications of plastics and rubbers. By this statement, Murakami is simply teaching that a solid, non-porous or low porosity mixture of filler and resin is not suitable.

36. PO and Dr. Wheeler also ignore that this statement is merely describing a preferred embodiment. EX1005, ¶[0070] ("The porous layer...is *preferably*..."). It is my understanding that prior art, such as Murakami, is not limited to even its most preferred embodiment but instead is prior art for everything it discloses. As I explained above, Murakami discloses as low as 1% by volume filler as well as 5% by volume filler, and embodiments where the amount of filler is 38 vol.% (100%-62%), 40 vol.% (100%-60%), 48 vol.% (100%-52%), and 51 vol.% (100% - 49%). In such embodiments, the filler particles would be dispersed in binder. But even in the cited preferred embodiment, up to 40% (by weight) of the porous layer is binder,

(EX1005, ¶[0070]), which I have calculated above corresponds to 60% by volume of PVDF binder or 62% by volume of CMC binder. These amounts of binder are within the range of binder volume percentage claimed by the '148 Patent: Claim "9. 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." This claimed ratio range corresponds to binder volume percentage range of 17% to 83%. Above, I have shown that Murakami at least teaches embodiments with 20%, 22%, 36%, 38%, 49%, 52%, 60% and 62% binder by volume, which are in the range claimed by the '148 Patent. EX1001, Claim 9.

37. PO and Dr. Wheeler again rely on the '148 Patent's use of NIPS process to differentiate Murakami. As I explained above, NIPS is not required by the '148 Patent; it is optional. EX1001, 5:61-62, 6:16-19. Regardless, Murakami discloses the use of solvent substitution (EX1005, ¶[0087]), which Dr. Wheeler confirmed NIPS is a species of (EX1037, 86:6-8). He is correct. He further confirmed that Murakami does not teach away from NIPS, and that NIPS could be used even at higher filler content percentages. EX1037, 28:16-29:6, 86:9-87:6. Again, he is correct. Third, Murakami is not limited to Examples 1 and 2 but instead is prior art for everything it discloses. Murakami teaches a range of potential embodiments, and a POSA would recognize that solvent substitution (including NIPS) could be used with at least some, if not all, disclosed embodiments.

38. My opinion is also supported by the fact that Murakami's process for coating the porous layer onto the porous film is similar to the process described in the '148 Patent. In Murakami, "a coating liquid for forming the porous layer is prepared by dissolving the resin in a solvent and, if needed, dispersing the filler. Here, the resin can be dispersed in the solvent." EX1005, ¶[0071]. 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]. The process ultimately leaves the porous resin layer. *See, e.g.*, EX1005, ¶¶[0016], [0023], [0052], [0058], [0071], [0088].

39. As I discussed in my first declaration in this proceeding, the process Murakami describes, involving the addition of a second non-solvent for the resin, is a phase inversion or coagulation process. EX1003, ¶93; EX1017, 9:57-10:2. This type of coagulation process was a widely-used method to obtain porosity in coating layers containing particles and resin binder and is particularly useful for obtaining porosity in layers with higher binder content. The NIPS (non-solvent induced phase separation) 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. This mixed solvent is made up of a second and third solvent, and the third solvent is a nonsolvent (or coagulating liquid) for the polymer binder resin. EX1001, 6:16-32. This extracts the first solvent, coagulating the binder to form pores. *Id.*

40. Similarly, in Murakami, “it is possible to carry out drying after the solvent (dispersion medium) contained in the coating liquid is substituted by another solvent,” which “does not dissolve the resin contained in the coating liquid,” (EX1005, ¶[0087]) and subsequently “the coating liquid is dried so as to form a porous layer.” EX1005, ¶[0088]; *see also id.*, ¶¶[0016], [0023], [0058], [0071], [0087] (discussing the process of forming the resin porous layer and characteristics of the porous layer). The '148 Patent and Murakami, both 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 of a non-solvent, *i.e.*, another solvent that does not dissolve the binder resin. I discuss this in my original declaration as well. EX1003, ¶94.

41. Applying Murakami’s non solvent (“solvent X”) coagulation process to embodiments taught by Murakami containing 49%, 52%, 60%, and 62% binder by volume, would certainly produce a porous film comprising “pores formed by the binder,” since it is the binder which is coagulating from the addition of the non-solvent, and this is the process that forms the pores.

B. Murakami's "Pores at Least Comprises a Part of the Inorganic Particles"

42. PO and Dr. Wheeler's argument hinges on its incorrect claim construction of "pore" that excludes the pore walls. As I explained above, that construction must be rejected. Specifically, they argue that the particles in Murakami form the pore walls – which are "distinct" from the pore – and therefore the particles cannot "extend" from the wall into the void space. In my opinion, this argument does not hold up to scrutiny.

43. First, in my opinion, PO and Dr. Wheeler's construction is incorrect. The pore walls are part of the pore, and therefore even if the particles form the pore walls, this meets the claim element.

44. Second, Murakami discloses a wide range of embodiments, including embodiments where the binder content is 62% by volume, which would necessitate the pore walls being predominantly binder and allow particles to extend from the binder wall into the void space.

45. Third, Dr. Wheeler admitted that, even in the '148 Patent, the inorganic particles are part of the pore wall. Based on Dr. Wheeler's testimony, his position is that if the pore wall is primarily binder, then the binder defines some hypothetical void shape. And he asserts this hypothetical void shape has some sort of separate existence from other components, such as particles, which may be in the void or may

be in the walls protruding into the void. According to Dr. Wheeler, any particles in the pore wall that extend into this theoretical void shape are considered to be part of the theoretical void and not the pore wall. EX1037, 50:7-53:6. This has zero basis in the '148 Patent, the scientific community, or the lithium-ion battery art. A POSA understands that a pore is defined by all the solid surfaces that bound, and thus give shape to, its void space. A POSA does not do a survey of the internal walls of a pore and say, "this material counts, and this material does not count," as far as defining what is the pore.

C. Murakami Discloses the Claimed Particle Size Distribution

46. As I explained in my prior declaration, the particle size distribution disclosed in Murakami meets this claim element. EX1003, ¶¶109-121. PO and Dr. Wheeler argue that in Murakami's examples, a SUGINO Star Burst™ device was used to disperse the particles which would have drastically altered the particle size distribution. POR, 26-27; EX2034, ¶¶120-145. In my opinion, this is wrong and does not make sense in the context of Murakami and what it teaches.

47. Murakami is clear that the disclosed particle size distribution applies to the particles in the finished porous layer:

The porous layer of the present invention preferably contains a filler in which, in terms of average particle diameter obtained based on a volume, (i) D10 is 0.005 um to 0.4 um, D50 is 0.01

um to 1.0 um, and D90 is 0.5 um to 5.0 um and (ii) a difference between D10 and D90 is 2 um or less.

EX1005, ¶[0018]. Murakami discusses the benefits of using particles in this range: “it is consequently possible to form a laminated body that is excellent in ion permeability, has a light weight, and is suitable as a separator for a non-aqueous electrolyte secondary battery.” *Id.*, ¶[0066]. Murakami also discloses that if the particles in the porous layer are outside the specified range, there are undesirable effects: if too small, “dispersibility tends to be decreased”; if too large, “filler is more likely to precipitate” and “ion permeability is [] decreased” while “weight per unit area is [] increased.” *Id.* These effects – good or bad – depend on the particle size distribution *in the porous layer*. The specific distributions for Examples 1 and 2 are within the prescribed ranges and thus provide the above benefits. *Id.*, ¶¶[0140], [0161]. PO and Dr. Wheeler’s argument that the particle sizes in the porous layer are unknown is at direct odds with Murakami’s disclosure. If they were correct that the prescribed particles were pulverized into drastically smaller sizes, then Murakami’s examples would suffer from the dispersibility issues Murakami seeks to avoid. This is illogical. A POSA would understand that Murakami teaches that the particle size distribution applies to the porous layer, as that is what matters.

48. Nevertheless, PO and Dr. Wheeler argue that the Star BurstTM machine would significantly alter the prescribed particle size distributions. There is no

support for this conclusion. First, Murakami states that the Star Burst™ machine “dispersed” the inorganic particles. EX1005, ¶[0141]. In the context of batteries, it is my opinion that that “disperse” means to mix particles uniformly in a slurry, including loosening agglomerated particles (i.e., particles that have gotten stuck together) into their primary particles. This is confirmed on the Star Burst™ website. EX1032, 6. In contrast, “pulverization” would crush primary particles into smaller particles by colliding the primary particles together. EX1032, 6. PO contends I admitted that “if particles are ‘smashing into each other’ or ‘run into each other,’ then that ‘certainly would smash them up and that – and that’s what those dispersion modes are.’” POR, 29 (citing EX2033 at 156:13-20). But I corrected this misstatement in my errata – I meant to say, “pulverization modes,” not dispersion modes. EX1038, 128.

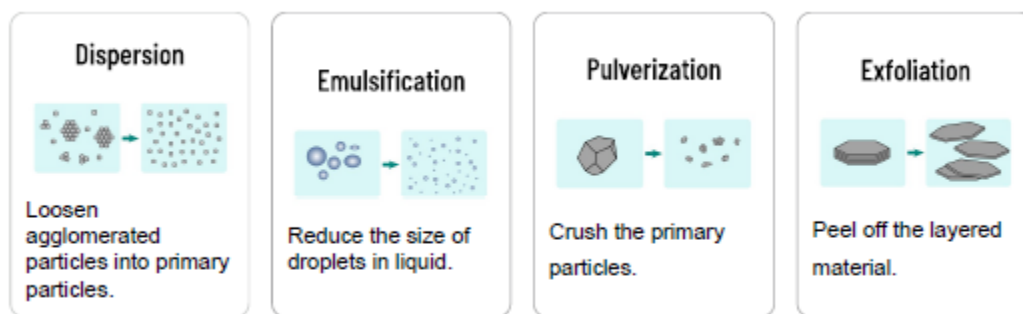
49. While Murakami’s particle size distribution is for the starting material, any argument that high-pressure dispersion would alter these values such that they would fall outside the claimed range is speculative. While dispersion may break up agglomerates, there is no evidence that individual particle sizes would be reduced below the claimed ranges. First and foremost, a POSA would take the teachings of Murakami regarding particle size at face value. A POSA does not read a reference and then imagine every possible way to second guess what the reference, on its face,

is teaching, concocting theories as to why the numbers reported by this reference are different from some imagined alternate reality that can never be known.

50. Reading Murakami, a POSA would observe that the inventors made a series of example separators (Examples 1, 2 and 4), in which the only thing that changes is the particle size distribution. Examples 1: “As a filler, α -alumina (D10: 0.22 μm , D50: 0.44 μm , D90: 1.03 μm) was used.” EX1005, ¶[0140]. Example 2: “A 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.” EX1005, ¶[0161]. Example 4: “A coating liquid 4 was prepared by carrying out operation similar to that of Example 1, except that α -alumina (D10: 0.39 μm , D50: 0.77 μm , D90: 2.73 μm) was used as a filler.” EX1005, ¶[0185]. Murakami then proceeds to evaluate, report and compare test results, such as air permeability and discharge capacity retention, for these examples in order to investigate the influence of the particle size distribution on these properties of interest. EX1005, Tables 1 and 2. It makes absolutely no sense for Murakami to go to the trouble of using different-sized particles and testing how this influences properties if they were using a particle dispersion method that changed the particle size distribution and, according to PO and its expert, rendered all particle size distributions more or less the same. First of all, this assumes without evidence that the Murakami inventors were incompetent. Secondly, if a pulverization machine was

reducing all the particles size distributions to the same narrow result, what explains the significant difference in air permeability and discharge capacity retention between, for instance Example 1 and Example 4, when the only difference between these examples is the particle size distribution reported by Murakami?

51. PO's and its expert's assertions about the Star Burst dispersion machine intentionally misrepresent this machine as only capable of pulverizing particles, when the machine's own literature (which PO itself produced as an exhibit) shows that it can be used in different modes and with different attachments (chambers), some of which are exclusively for dispersion and not for pulverization. EX2029. On its website, the maker of the Star Burst machine that Murakami uses for dispersion illustrates the different modes of operation available:



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52. "Dispersion," which is what Murakami says it is doing, (EX1005, ¶[0141]) is seen to be a process that is separate and distinct from "Pulverization" in

¹ EX1032, 6.

terms of the available modes of operation of this machine. A POSA is not in the habit of reading a teaching that says it is doing one thing and then deciding without evidence that they are doing something different. The fact that Murakami discloses particle sizes in the claimed range shows that a POSA had ample guidance, even when applying high-pressure dispersion, to achieve the particle sizes in the claimed range.

53. PO and Dr. Wheeler muddy the waters by conflating Murakami's disclosure of a "wet grinding device" to reach a desired particle size distribution with its separate disclosure of the Star BurstTM machine for dispersion in particular examples. POR, 27; EX2034, ¶127. But Murakami is clear that dispersion and wet grinding are separate. Murakami discloses that "filler can be *dispersed* in the solvent...by the use of a conventionally known dispersing device such as a three-one motor, a homogenizer, a medium type dispersing device, or a *pressure type dispersing device*." EX1005, ¶[0073] (emphasis added). Star BurstTM is a pressure type dispersing device. EX1037, 100:2-9. In the same paragraph, Murakami states that filler can be "wet ground in order to obtain a filler having an intended average particle diameter." EX1005, ¶[0073]. It would have been clear to a POSA that Murakami distinguishes between dispersion and methods for altering particle sizes. And as Murakami only discusses Star BurstTM (or any of the listed dispersing

devices) for *dispersion* – not altering particle sizes – a POSA would understand that Star Burst™ as used by Murakami disperses, not pulverizes.

54. PO and Dr. Wheeler rely on a Sugino brochure (EX2029) as proof that Star Burst™ always pulverizes the particles. POR, 28; EX2034, ¶¶129-130. But the Star Burst™ machine has “many chamber configurations” that allow for different applications. EX2029, 2; EX1034, 2 (“Star Burst™ can be customized based on the client’s requirements...Customization options include several chamber types that perform different functions for processing raw materials.”). The materials cited by PO refer to the results of a Star Burst™ configured with an “Oblique collision type chamber” which is designed to “collide obliquely” particles “with each other to achieve powerful pulverization.” But the brochure discloses that the “Single nozzle chamber” can be used to “disperse[]” particles using “cavitation force” on the pressurized slurry. Importantly, the single nozzle chamber does **not** pulverize. EX2029, 4 (“Pulverization” is grayed out); EX1034, 5 (listing only “Dispersion, exfoliation” as applications of single nozzle chamber). As explained above, Murakami states it uses Star Burst™ for dispersion. Therefore, a POSA would understand that the single nozzle chamber – the chamber designed for dispersion – would be used.

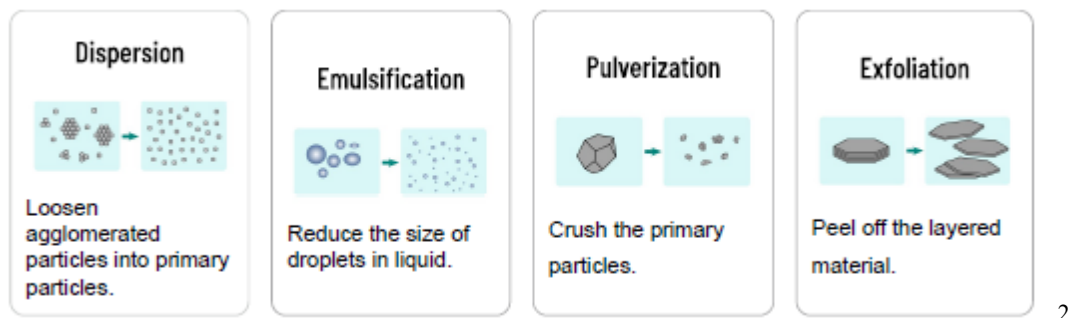
55. PO and Dr. Wheeler assert that the oblique-type collision chamber would be used. This is unsupported and contradicted by Murakami’s stated purpose

of dispersing, not pulverizing. PO notes that Murakami prefers the difference between Dv90 and Dv10 to be less than 1 micron, and therefore a POSA would assume the Star BurstTM should be used to pulverize the particles into uniformity. POR, 28; EX2034, ¶¶129-130. The prescribed Dv90 and Dv10 of Example 1 have a difference of 0.81 microns and therefore satisfy Murakami's preferred difference between Dv90 and Dv10. EX1005, ¶[0140]. Further, Murakami allows for larger differences, "preferably 2.5 μm or less." EX1005, ¶[0066]. A POSA would not assume that the particle size distribution in Examples 1 and 2, which fit within the ranges Murakami states have the desired beneficial effects, would need to be pulverized into smaller particles. In fact, Murakami expressly teaches away from further reducing the particle sizes. EX1005, ¶[0066].

56. PO and Dr. Wheeler also argue dispersion would break up agglomerated particles, altering the particle size distribution. POR, 31; EX2034, ¶¶128, 144. This argument is based on multiple incorrect assumptions.

57. First, there is no support that the prescribed particle size distribution is based on the size of agglomerated particles. A POSA would understand that particle size distributions are based on the individual particle sizes, not agglomerated sizes. In fact, this is a reason a device like Star BurstTM would be used to disperse the particles – to ensure that the particle size distribution in the porous layer is as prescribed and not thrown off by any agglomerated particles. As shown below, the

Sugino Corporation specifically states that its Dispersion mode is to “Loosen agglomerated particle into primary particles.”



58. Second, it is likely that agglomeration of particles, if it occurs at all, would occur primarily in the production of the slurry, not in dry storage. Particles prior to going into the slurry – which PO argues are at the distribution prescribed by Murakami – do not contain agglomerated particles.

59. Third, Dr. Wheeler alleges that breaking up of agglomerated particles would “cause a significant shift in the D10, D50, and D90 values” but cites no support. EX2034, ¶144 (citing nothing). In my opinion, even if there were agglomerated particles that needed to be broken up, and those agglomerated particles contributed to the prescribed particle size distribution of Murakami, there is no reason to conclude that there are so many agglomerated particles that dispersing them into their primary particles would significantly shift the particle size distribution.

² EX1032, 6.

60. Finally, PO and Dr. Wheeler argue (1) Murakami's authors believed it was easier to give a starting particle size distribution and then specific instructions to allegedly end up at the secret particle size distribution that is actually desirable; or (2) Murakami's authors did not realize the Star BurstTM machine pulverized the particles. POR, 32-34; EX2034, ¶¶129-132. In my opinion, both arguments are wrong. If PO were correct that Star BurstTM pulverizes particles into narrow size distributions, then it is illogical for Murakami to give such exact starting particle size distributions. One could start with any particle size distribution and pulverize it into uniformity. But Murakami discloses other methods of dispersion besides Star BurstTM, and Dr. Wheeler confirmed those other methods would not necessarily pulverize. EX1005, ¶[0073]; EX1037, 98:6-100:1. Dr. Wheeler is correct.

61. All of PO and Dr. Wheeler's theories about particle pulverization are unsupported conjecture. As shown above, Star BurstTM is capable of dispersing without pulverizing. Likewise, the other methods of dispersing do not pulverize. Moreover, Murakami says "disperse," not "pulverize." EX1005, ¶¶[0073], [0141]. A POSA would assume Murakami is accurate and that the particles were dispersed, not pulverized.

62. Finally, I reiterate that this Star BurstTM machine controversy is isolated to Murakami's Examples 1, 2, 4, and 5. It is specific to these embodiments. While it is my opinion that the PO and Dr Wheeler are wrong in their assertions regarding

the use of the Star BurstTM machine, even if substantiated, these assertions do not change the fact that Murakami clearly teaches particle size distributions in the final porous layer which overlap the ranges claimed by the '148 Patent. Murakami provides this teaching, separate and independent of Examples 1, 2, 4, and 5, and before a POSA reading the patent gets to these examples. EX1005, ¶[0018].

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

A. Motivation to Combine

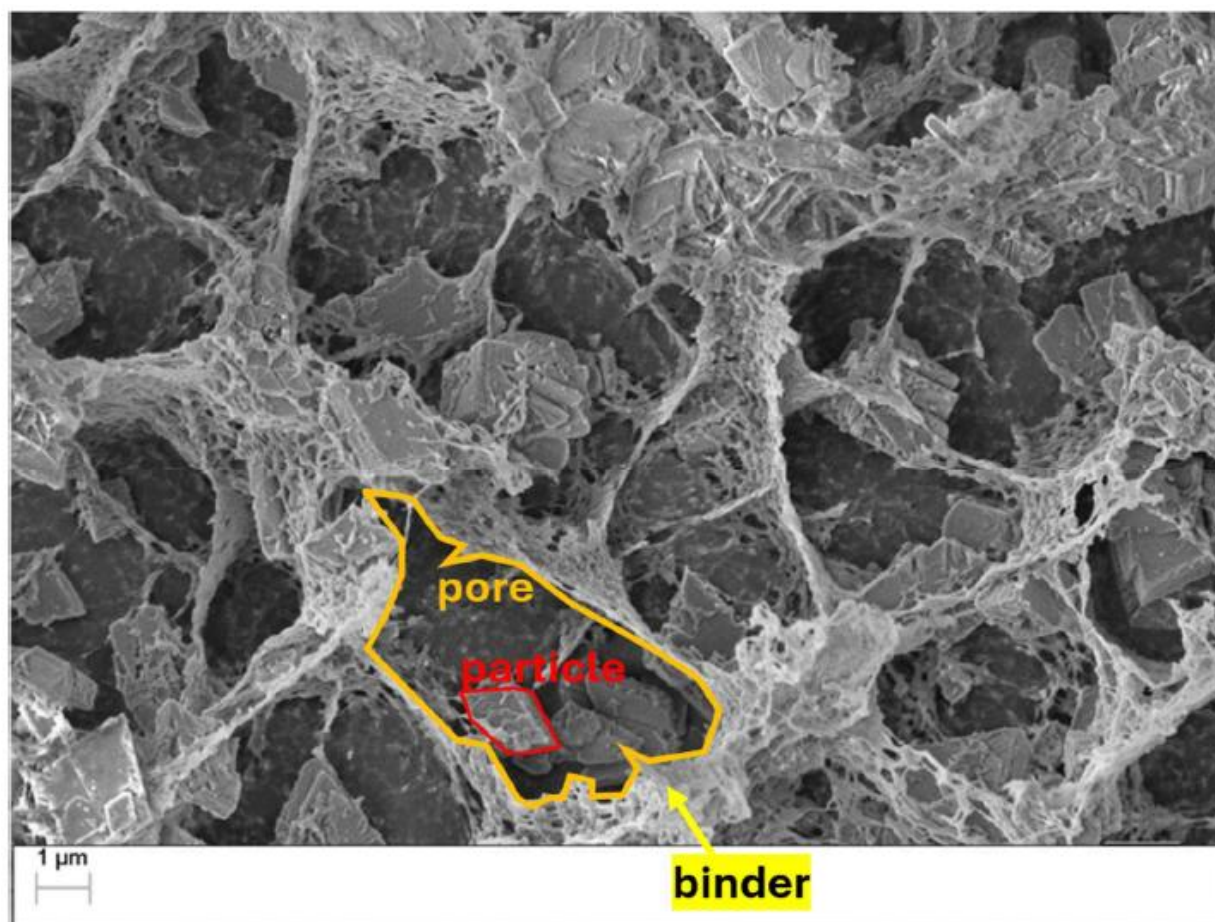
63. In my previous declaration, I explained that Honda and Murakami are analogous art as they both relate to porous films used as separators for lithium-ion batteries. EX1003, ¶¶144-147. Honda teaches that its thin pore walls increase porosity, and Murakami prefers the voidage to be as high as 90 vol%, thus motivating a POSA to use Honda's thin walls with Murakami. *Id.*

64. PO and Dr. Wheeler argue Murakami and Honda are incompatible because Murakami does not have binder walls (like Honda), instead the pore walls are particles. POR, 35; EX2034, ¶¶151-153. As I explained above, they mischaracterize Murakami. Neither are they correct that Murakami's particle sizes would need to be adjusted to fit Honda's pore wall thickness. Honda discloses a thickness range of 0.1-2.0µm. EX1007, ¶[0045]. Example 1 of Murakami has a D90 of 1.03µm, and Murakami more generally claims a preferred D90 range of 0.8-

2.5 μ m. EX1005, ¶¶[0066], [0140]. Murakami's particles would plainly fit in Honda's pore walls. Even if Murakami's particles were larger than the pore walls, that does not render them incompatible. In fact, the '148 Patent claims the use of particles that can exceed the thickness of its claimed pore walls. EX1001, Claims 1, 3, 10, 12. So does Honda, which preferably uses particles as large as 5 μ m – over twice the size of its largest pore walls and of Murakami's preferred D90. EX1007, ¶[0058].

65. Under a construction in which “the pores at least comprises a part of the inorganic particles” means that the particles need to at least poke out of the walls into the pores, it is helpful, if not necessary, that at least some of the particles are bigger than the wall thickness, thus necessitating them to poke out of the walls into the pore space. Consequently, PO and Dr. Wheeler's arguments that prior art that discloses particles bigger than wall thicknesses disqualifies that prior art are self-defeating. Shown below is Dr. Wheeler's own annotation of Figure 2 of the '148 Patent. EX2034, ¶181. Dr. Wheeler has highlighted one particle, but there are numerous other particles in the image, some bigger than the one indicated. The particles are recognizable as the blocky structures with sharp edges and rectangular corners. Clearly, the particles in this image, which the inventors assert is representative of their alleged invention, have sizes (diameters) that greatly exceed the wall thicknesses (bright lines in the image). Therefore, if the PO and Dr.

Wheeler's arguments that particles bigger than the wall thickness are incompatible with the claims of the alleged invention, then this example shown in the patent does not practice the invention.



66. PO argues that Honda uses a surfactant to create its porous structure, whereas Murakami does not. First of all, this assertion is false, as Murakami does teach the use of a surfactant as part of its coating liquid. EX1005, ¶[0073] (“The coating liquid can contain, as a component other than the resin and the filler, a dispersing agent, and/or an additive such as a plasticizer, a *surfactant*, or a pH adjuster, as long as the purpose of the present invention is not impaired. Note that

an added amount of the additive can be determined within a range that does not impair the purpose of the present invention.”) (emphasis added). PO asserts undue experimentation would be required to confirm compatibility. It is my understanding that some experimentation is permissible, as long as it is not unduly extensive. The quotation above shows that Honda understand that determining the amount of additive (i.e., surfactant) to add is routine: “can be determined with in a range that does not impair the purpose of the present invention.”

67. To the extent that Honda utilizes a surfactant to achieve its porous structure, including wall thicknesses, a POSA would understand that surfactants are commonly used and would not render Honda incompatible with Murakami, which also teaches use of a surfactant.

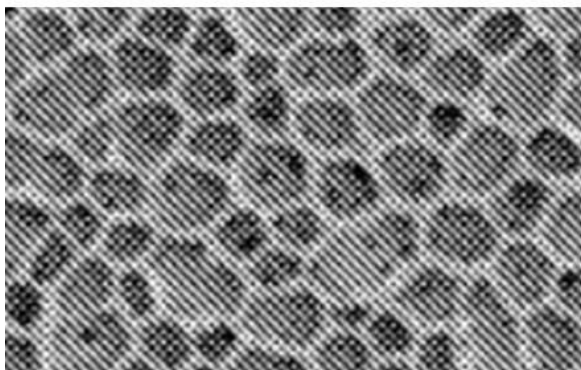
68. The use of a small amount of surfactant to fine tune the wetting properties of solutions and coatings is well established and commonly used in battery separators, as is evident from the fact that surfactants are taught in other prior art as well. EX1011, ¶¶[0113]-[0117]. In my opinion, to the extent any experimentation would be required, it would be routine and minimal.

69. A POSA would have been motivated to combine the teachings of Honda with the Murakami with a reasonable expectation of success because they are both directed to a porous films containing a binder and inorganic particles.

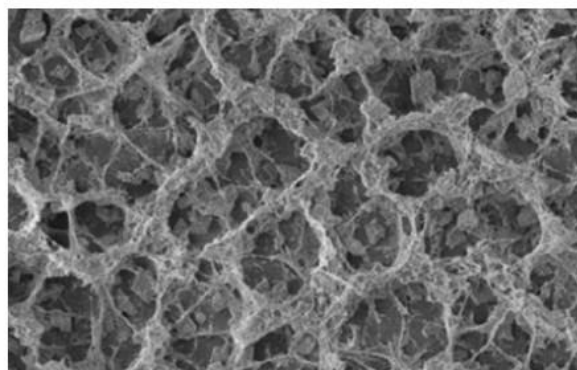
70. A POSA would have been motivated by Honda to produce pores formed by the binder, the pores at least comprises a part of the inorganic particles, with a reasonable expectation of success by implementing Honda's "honeycomb" structure in the porous layer of Murakami. To the extent that implementation of Honda's honeycomb structure requires a substantial amount of binder, I have shown above that Murakami teaches binder-rich embodiments of its porous layer including embodiments where the binder is 49%, 52%, 60%, and 62% binder by volume. Applying Murakami's non solvent ("solvent X") coagulation process to embodiments taught by Murakami containing 49%, 52%, 60%, and 62% binder by volume, a POSA would have produced the honeycomb structure of Honda.

71. Murakami does not show any SEM images of its porous layer. However, when a high binder content embodiment of Murakami is combined with Honda as described above, a POSA would obtain a porous layer that has similar structure to the honeycomb taught by Honda. Below is a comparison of an SEM image from Honda, which is representative of a Murakami and Honda combination using higher binder contents taught by Murakami, and the alleged invention of the '148 Patent. A POSA would find these structures to be very similar, and clearly the pores of this Murakami plus Honda combination are formed by the binder, under any construction of that term.

Honda Fig. 1



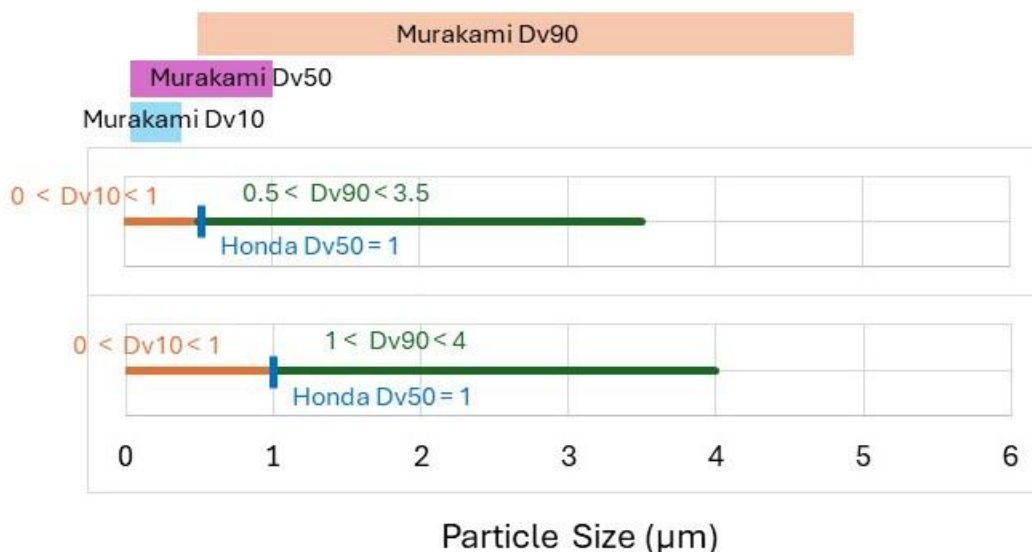
'148 Patent Fig. 1



72. Additionally, a POSA would have been motivated to combine Murakami and Honda because they teach overlapping particle sizes. Honda (EX1007) teaches: ¶[0058] (“The average particle size of the filler is preferably 0.01 μm to 10 μm . A lower limit of 0.1 μm or more is more preferable, and an upper limit of 5 μm or less is more preferable.”); ¶[0059] (“The particle size distribution of the filler is preferably $0.1 \mu\text{m} < d_{90} - d_{10} < 3 \mu\text{m}$. Here, d_{10} represents a 10% cumulative average particle size (μm) in a weight cumulative particle size distribution derived from a small particle side, and d_{90} represents a 90% cumulative average particle size (μm). Examples of measurement of particle size distribution include a method using a laser diffraction type particle size distribution measurement device (Master Sizer 2000 made by Sysmex).”) Honda says that its sizes are based on a “weight cumulative particle size distribution.” EX1007, ¶[0059]. Given that the particles are all of the same material, and so have the same density, Honda’s weight distribution is the same as a volume distribution. Weights are converted directly into

volume by dividing by density. The fraction of particles that comprises the smallest 10% by weight, for instance, is the same fraction that comprises the smallest 10% by volume, and so forth for the 50% and 90% weight or volume fractions of the distribution. Also, because Honda's particle sizes were measured by laser diffraction, a POSA would understand them to be reported on a volume basis, so: $d_{10} = D_{10} = Dv_{10}$, average particle size = $d_{50} = D_{50} = Dv_{50}$, and $d_{90} = D_{90} = Dv_{90}$. Honda's preferred range for Dv_{50} (average particle size) of 0.1 to 5 μm , corresponds almost exactly with the claimed range of 0.2 to 5 μm .

73. Moreover, for the reasons discussed in my opening declaration, Dv_{10} cannot be greater than Dv_{50} in Honda. EX1003, ¶114. Because Dv_{10} cannot exceed Dv_{50} , it follows that Honda necessarily and inherently discloses Dv_{10} values that are less than or equal to Dv_{50} . For similar reasons, Dv_{50} cannot exceed Dv_{90} . Combining the conditions on Dv_{10} , Dv_{50} , and Dv_{90} with the size and difference values provided by Honda, a POSA would understand Honda to be teaching ranges for Dv_{10} , Dv_{50} and Dv_{90} as illustrated below for two example average particle sizes, Dv_{50} , which are in the range taught by Honda, namely 0.5 μm and 1.0 μm .



74. This graph was produced by combining the range of differences between D90 and D10 taught by Honda with the fact that $D_{10} < D_{50}$ and $D_{50} < D_{90}$, and the fact that particle sizes cannot be smaller than 0, the possible ranges for Dv10 and Dv90 are shown for these three cases. For instance, if $D_{v50} = 1 \mu\text{m}$, then according to the teachings of Honda, $0 < D_{v10} < 1$, and $1 < D_{v90} < 4$. If $D_{v50} = 0.5 \mu\text{m}$, then according to the teachings of Honda, $0 < D_{v10} < 0.5$, and $0.5 < D_{v90} < 3.5$. Also, illustrated above, these particle size ranges taught by Honda overlap the particle size ranges taught by Murakami, making it simple and logical for a POSA to combine these teachings.

B. Reasonable Expectation of Success

75. In my prior declaration, I explained that Honda's porous structure is formed preferably via a method similar to Murakami's and the '148 Patent's phase separation methods, thus a POSA would reasonably expect that Honda's structure

could be obtained in Murakami's porous layer. EX1003, ¶¶145-146. PO and Dr. Wheeler argue that examples 1 and 2 of Murakami do not use a phase separation method, but as explained above that is not required. Further, as explained above, Murakami does disclose a similar phase separation or coagulation process brought about by a non-solvent (Solvent X).

76. PO and Dr. Wheeler argue that Honda's wall thickness is incompatible with Murakami's particle sizes, and that "Murakami's large particle sizes could not be effectively held in place by the thin pore walls required by Honda and the claims." POR, 37; EX2034, ¶165. In my opinion, that is wrong. Murakami's particle sizes are the sizes claimed by the '148 Patent, and Honda's "thin pore walls" are likewise within the '148 Patent's claimed range. EX1001, claims 1, 3. Put differently, PO and Dr. Wheeler argue that the '148 Patent's claimed particle sizes and pore walls are incompatible. The '148 Patent contradicts their contention.

77. Moreover, Honda makes it clear that Murakami's particles would be effectively held by Honda's pore walls. Honda discloses its particles can be up to 10µm. EX1007, ¶[0058]. Murakami's D90 is at most 5µm, with examples 1 and 2 having D90's of 1.03µm and 1.53µm, respectively. EX1005, ¶¶[0066], [0140], [0161]. Dr. Wheeler cites Honda's use of Kisuma 5P as filler, providing its D50 value: 0.72µm. EX2034, ¶163. This too is lower than Murakami's examples 1 and 2: 0.44µm and 0.66µm, respectively. EX1005, ¶¶[0140], [0161].

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

78. In combining Murakami with Tanaka, a POSA would recognize that the polyolefin porous layer taught by Tanaka is similar to or the same as the polyolefin base layer in the Murakami's separator, which Murakami calls the Porous Film (EX1005, ¶¶[0030]-[0048]), or Layer A, in its examples. In this combination, the POSA would substitute Tanaka's polyolefin porous layer for the porous film of Murakami. When doing this, the POSA would potentially need to make adjustments to properties of the overlaying particle and binder porous layer of Murakami in order for it to work with and complement the properties of Tanaka's polyolefin porous base layer. The polyolefin porous layer and the adjacent particle and binder porous layer produce resistance to ion flow in a series arrangement. In order to prevent uneven resistance to ion transport, the two layers need to be matched in their resistance. For each layer this depends on its porosity and pore structure as well as its thickness. For two layers of comparable thickness, as would be the case in a combination of Murakami's porous layer with the polyolefin layer of Tanaka, a POSA would strive for similar pore structure between the two layers to avoid problems such as non-uniform ion transport and polarization. Thus, in my opinion, a POSA would take the teaching about pore structure, including the pore size

distribution coefficient, in the polyolefin porous layer of Tanaka and apply them to the porous film, containing particles and binder, of Murakami.

79. PO and Dr. Wheeler argue Tanaka is non-analogous art because it is useful for applications other than batteries. POR, 38; EX2034, ¶170. It is my opinion that Tanaka is analogous art, as it explicitly teaches “[t]he polyolefin porous sintered compact obtained by the present embodiment can be used as...*a separator for a lithium ion secondary cell* or a lead storage cell.” EX1009, ¶[0069]. Tanaka and the ’148 Patent pertain to the same field of endeavor (separators for lithium-ion batteries).

80. PO and Dr. Wheeler argue there would not have been a motivation to combine because Tanaka is a polymer with no inorganic particles, while Murakami has a high amount of inorganic particles. POR, 39; EX2034, ¶¶170-171. Murakami is not limited to high particle loading. As discussed above, Murakami discloses particle loadings as low as 1% or 5% by volume and teaches embodiments where the amount of filler is 38 vol.%, 40 vol.%, 48 vol.%, and 51 vol.%. Regardless, a POSA would understand that the logical way to combine Tanaka with Murakami is to use Tanaka’s polyolefin porous layer to replace the polyolefin porous film substrate of Murakami and then match the ion transport characteristics of the two layers. Murakami’s polyolefin porous substrate layer does not contain particles

anyway, so the combination where it is replaced by Tanaka's polyolefin porous layer is not impeded by the lack of particles in Tanaka's layer.is

81. PO and Dr. Wheeler provide no support for why Tanaka's pore size distribution coefficient would not be compatible with Murakami other than Dr. Wheeler's conclusory statement that "it would not be clear to a POSA" that it would work. EX2034, ¶171. Dr. Wheeler's statements about maintaining "pore sizes" or minimizing voidage are distractions. Pore sizes and pore size distribution coefficients while related can be varied independently of one another. Likewise, voidage (porosity) is separate from pore size distribution coefficient. A POSA understands how to turn the knobs of formulation and processing conditions to adjust porosity and pore size distribution coefficient independently. And as stated before, Murakami does not "minimize voidage" and instead teaches that voidage of up to 90vol% is possible and voidage up to 70% is more preferable.

82. PO and Dr. Wheeler argue that Tanaka's use of sintering renders it incompatible with Murakami. POR, 40; EX2034, ¶172. It is my opinion that they are wrong. I relied on Tanaka for its teachings on pore size distribution coefficients and the benefits thereof. Sintering is not necessary to achieve the distribution coefficient, as evidenced by the '148 Patent. When the porous layer of Tanaka is used as the porous film base layer in the combination with the Murakami separator, there is no problem using the sintering technique taught by Tanaka to produce the

pore size distribution coefficient in this layer. In fact, this is common in the production of this type of polyolefin porous layer, which is commonly used as the base or substrate for porous films like that taught by Murakami and by the '148 Patent. The POSA would then be free to utilize other methods, well known to them, to adjust the pore structure and pore size distribution coefficient of the adjacent porous film of binder and particles taught by Murakami. For instance, the non-solvent substitution methods (Solvent X) (EX1005, ¶¶0087) is well understood to provide for control of the resulting pore structure through variation of such variables as the solvent quality, the ratio of solvent and non-solvent, and temperature.

83. Last, PO and Dr. Wheeler argue there would not have been a reasonable expectation of success. They point to Tanaka's pore size distribution coefficient being in its porous substrate, not porous film. POR, 40; EX2034, ¶¶173-174. This is irrelevant. As I stated in my previous declaration, Tanaka's pore size distribution coefficient balances membrane strength and permeability – the same balance would be desired in the porous film as would be the desire to match the pore structure of Tanaka's layer with the porous layer of Murakami. EX1003, ¶¶156-159. PO and Dr. Wheeler argue that Murakami's particle size distribution is incompatible with Tanaka's "pore sizes" and pore size distribution coefficient. These arguments are based on PO and Dr. Wheeler's unfounded insistence that Murakami is confined to the high particle loadings of Examples 1 and 2 rather than encompassing the full

range of compositions taught by Murakami. Murakami also teaches higher binder content embodiments and a non-solvent coagulation process fully capable of adjusting both particle size and pore size distribution coefficient.

84. Although pores size distribution coefficient is calculated from pore sizes, it is independently variable and not dependent on absolute values of pore sizes. Pore size distribution coefficient is a ratio of R90/R10, which provides information about the breadth of the distribution or the relative sizes of particles to one another. However, because this coefficient is a ratio it is possible to get the same pore size distribution coefficient in particle distributions differing widely in average particle size. Therefore, it is misleading for PO and Dr. Wheeler to conflate pore sizes with the pore size distribution coefficient – the two are independent measures. And to the extent Dr. Wheeler argues that the pore size distribution coefficient requires Tanaka's pore sizes, that is wrong. As an example, the '148 Patent achieves the claimed pore size distribution coefficient with larger pore sizes. EX1001, Claims 2, 4, 11, 13.

85. Neither Petitioner nor I suggested using Tanaka's pore sizes. However, Tanaka's pore sizes, median pore diameter between 1 and 15 μm (EX1009, Claim 2) is compatible with that taught by Murakami. EX1005, ¶[0093] (“A pore diameter of pores in the porous layer is preferably 3 μm or less.”).

VI. GROUND 4: MURAKAMI AND BEARD RENDER OBVIOUS CLAIMS 1, 2, 5-11, AND 14-19

A. Beard's Pores at least Comprises a Part of the Inorganic Particles

86. First, all of PO's and Dr. Wheeler's arguments hinge on their incorrect claim construction, requiring the inorganic particles to contact/extend into the void. As explained above, that construction is incorrect, thus rendering PO's and Dr. Wheeler's arguments invalid. Section II.A. But even under their incorrect claim construction, it remains my opinion that Beard discloses this element because it discloses particles extending into the void space of the pore. EX1003, ¶176.

87. PO and Dr. Wheeler argue that the inorganic particles in Beard are fully encapsulated by binder and therefore are "only part of the pore walls—the particles do not contact or extend into the pores themselves." POR, 41; EX2034, ¶¶179-194. They argue that encapsulation must occur because (1) there is a high amount of binder, (2) Beard teaches away from filler blocking or interfering with the pores, and (3) the embodiment in Figure 3 is fully encapsulated. POR, 42-46; EX2034, ¶¶187-188, 190-191. In my opinion, none of these require that the particles be encapsulated. PO and Dr. Wheeler focus in on Beard's Figure 3 because it is the only one of Beard's figures that supports their unjustified assertion that Beard is exclusively teaching particles completely coated with binder. Figure 3 is a special case of Beard where an additional heating process was used after the practice of the basic Beard

invention. It is this additional heating process that produces the structure shown in Figure 3 with particles coated by binder, not the basic teaching of Beard. Beard's Figures 1 and 2 are more representative of Beard's basic teaching.

88. First, Beard discloses unincorporated filler particles. These particles are, by definition, not encapsulated and therefore at least contact the void space. Dr. Wheeler agreed that Beard has unincorporated filler particles that "are not encapsulated." EX1037, 135:2-137:5. While Dr. Wheeler explained that there is no evidence Beard teaches that unincorporated filler particles are preferred, that is irrelevant. Beard teaches that, as part of its invention of packing particles into pore walls, at least some particles will not be fully incorporated or encapsulated. EX1010, ¶[0036].

89. Beard discloses that its binder amount is as low as 33vol%. EX1010, ¶[0029]. The '148 Patent discloses as high as 83vol% of binder. EX2015, ¶80 (citing EX1001, 5:50-52). And since the '148 Patent's inorganic particles must not be fully encapsulated (under PO's claim construction at least), it is axiomatic that Beard's binder amount is not so high as to guarantee full encapsulation of all particles. Moreover, Beard explicitly states that the particles are not fully encapsulated, as the particles can be "contained exclusively or *largely* within the pore walls." EX1010, ¶[0086] (emphasis added). If the particles were encapsulated, they would be

exclusively within the pore walls. As they are only *largely* within the pore walls, at least portions of the particles are not encapsulated by binder.

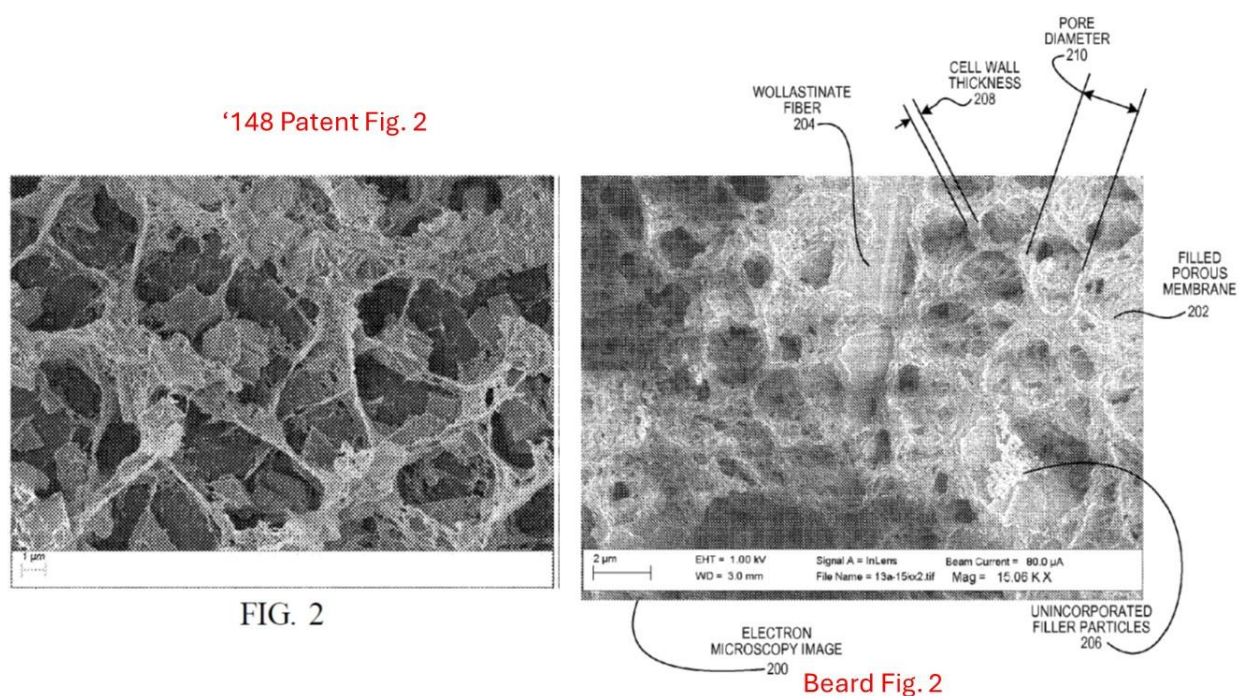
90. Particles contacting or peeking into the void space as illustrated in Figure 1 of Beard do not interfere or block the pore pathways. In fact, Beard states that “[g]ood results may be achieved when the solid particles are contained...largely within the pore walls” (EX1010, ¶[0086]) – meaning that Beard’s goal is still achieved if some particles extend into the void space. Moreover, whether the particles are encapsulated or exposed to the void space would not affect whether the particles interfere or block the pores, as that is a geometric issue that would be unaltered by a thin coating of binder.

91. Beard’s pore voids comprise – under PO and Dr. Wheeler’s construction – at least some filler material. The Court’s Claim Construction Order provides some clarity on this claim term. EX2065 at 30 (“A person of skill in the art would understand this to mean that the claimed porous film must have multiple pores that partially contain portions of the inorganic particles.”). The Order goes on to say:

The practical implementation of the claimed invention, as disclosed in the specification, is that the pores in the binder are at least in part made up of (or contain) inorganic particles. This is consistent with the plain and ordinary meaning of the claim language. Moreover, as shown in Figure 2 of the ’148 Patent,

the inorganic particles inside the pore structure are visibly distributed throughout the observable pores.

Id. at 31-32. Figure 2 of the '148 Patent, which the court is referring to, is just a zoomed in smaller section of Figure 1 of the '148 Patent which I have already analyzed. Shown below is a comparison of the '148 Patent's Figure 2 with Beard's Figure 2, which is also an SEM image of one of Beard's example embodiments. EX1010, ¶[0034].



92. Both of these SEM images show a pore structure defined by walls composed of binder. In the Beard figure (right) the inorganic particles are bright round structures. While they are smaller than in the figure from the patent, they are still within the size range claimed by the patent. The image reproduction in published

patents is very poor, but one can still see that the particles in the image of the Beard porous layer are distributed in the pore walls and in the pore voids. Unlike light microscopy which projects an image through a material, SEM can only see the surface topography of a sample. The fact that the bright round particles are visible is proof that they are not subsumed by the binder but are either poking out of the binder wall into the pore space or are attached to the pore wall while sitting in the pore void. The “Unincorporated Filler Particles 206” labeled in Beard’s Figure 2 are particles that are sitting on the pore wall in the pore void, just as claimed by the ’148 Patent and as construed by the Court. PO might contend that these “Unincorporated Filler Particles 206” are not attached to the layer and could fall off. It is not clear how this would impact the claim element either way. However, as an expert in electron microscopy, I can unequivocally say that unattached particles would not have stayed in place during the sample preparation process and pump-down to ultra-high vacuum used in the SEM imaging. Without a doubt, those “Unincorporated Filler Particles 206” are permanently affixed to the inside of the pore and therefore “the pores at least comprises a part of the inorganic particles”.

93. Comparing Figure 2 for the ’148 Patent, which the inventors assert represents their alleged invention, to Figure 2 of Beard, which shows an embodiment of prior art, the similarities are obvious. The bright edges are the walls of pores composed mostly of binder and the bright particles are distributed on the pore walls

and within the pores. If PO contends that this Figure from Beard does not show “pores formed by the binder, the pores at least comprises a part of the inorganic particles,” then the alleged invention of the ’148 patent does not show this either.

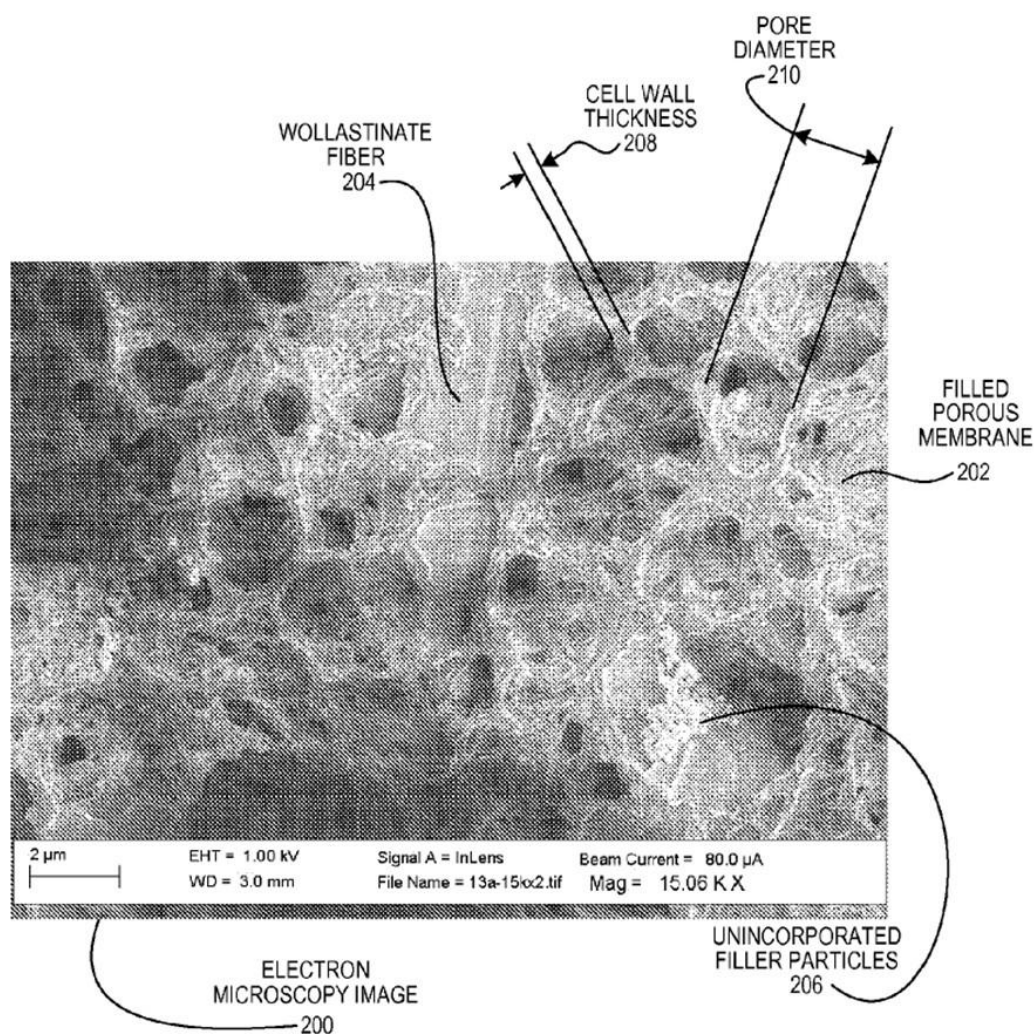
94. Beard explains that “larger fibrous particles, greater than 1 micron may extend through, across or between the pores creating a porous fibrous network independent of the fillers deployed within the polymer membrane walls that surround the larger fibrous particles.” EX1010, ¶[0025]. This is referring to the “Wollastinate Fiber 204” labeled in the Beard Figure 2 image reproduced above. I note that the claim language of the ’148 Patent recites generic inorganic particles and thus does not require the inorganic particles to be fibrous or non-fibrous. The term “fibrous” implies a rod-like particle shape, which is considerably longer than it is wide. Beard teaches that the particles may be “glass.” EX1010, ¶[0013]. Glass generally refers to an inorganic silica material, which is a particle material claimed by the ’148 Patent. See EX1001, Claim 14. A common form of glass used as a filler are finely chopped glass fibers, which are fibrous. In view of all this, it is my opinion that Beard discloses “pores formed by the binder, the pores at least comprises a part of the inorganic particles.”

B. Motivation to Combine

95. In my previous declaration, I presented motivation to combine Beard and Murakami. EX1003, ¶¶176, 178-181. I understand that the Board agreed the motivation was sufficient. Decision, 36-38.

96. PO and Dr. Wheeler argue that Beard's pore structure requires extremely small particles, and in particular particles smaller than the maximum pore wall thickness. POR, 47-48; EX2034, ¶¶197-202. In my opinion, this is not true. While Beard teaches satisfactory results are achieved when the particles are largely within the pore walls, that does not require a specific particle size. If larger particles are used, the pore wall thickness can be increased while maintaining Beard's pore structure. Beard has done that itself. Beard's Figure 2, shown below is illustrative of Beard's teachings. Beard indicates a "cell wall thickness" measurement on this SEM image. By comparing the width of the measurement indicated to the scale bar in the lower left of this image, I found that the pore wall thickness in this embodiment of Beard is about 0.5 μm . Murakami teaches particle size ranges of D_{v10} is 0.005 to 0.4 μm , and D_{v50} is 0.01 to 1.0 μm . Therefore, Murakami teaches many particle sizes suitable for incorporation into Beard's pore walls. To the extent that larger particles in Murakami's distributions are larger than this pore wall thickness, this would necessitate that some of them poke out into the pore void, which is necessary for them to satisfy the '148 claim element of "the pores at least comprises a part of

the inorganic particles” under PO’s construction. Thus, the pore wall thickness is not an absolute limit on the particle size.



97. PO and Dr. Wheeler argue that Beard and Murakami have “vastly different binder ratios.” POR, 47; EX2034, ¶198. This is not true and is based on PO and Dr Wheeler mischaracterizing Murakami’s teachings as being confined to Examples 1 and 2. Beard discloses 33%-67% binder by volume, which Dr. Wheeler admitted. EX2034, ¶207 (citing EX1010 ¶[0029]). Murakami discloses between 1%-

99% binder by volume, or 5% to 95% by volume. EX1005, ¶[0069]. More specifically, as discussed above Murakami also discloses embodiments with the following volume percentages of binder: 60%, 49%, 36% and 20%, 62%, 52%, 38% and 22%. Most of these fall within the range of binder composition taught by Beard. Thus, a POSA would understand that the two references are compatible and that a combination of the two would likely be successful.

98. PO and Dr. Wheeler state that the use of “Murakami’s broader size distribution...would instead make a different type of pore structure that does not satisfy the claims.” POR, 51; EX2034, ¶¶203-205. Dr. Wheeler states that this is because Murakami’s particles are too large and would necessarily form “pores formed by gaps between inorganic particles.” EX2034, ¶205. In my opinion, this is incorrect. Dr. Wheeler’s conclusion contradicts the teachings of the ’148 Patent – at least as interpreted by PO. The ’148 Patent uses particles even larger than those disclosed in examples 1 and 2 of Murakami, yet claims its pores are “formed by the binder.” EX1001, Claims 1, 10. Here again, PO and Dr. Wheeler mischaracterize Murakami’s Examples 1 and 2 as representing the totality of Murakami’s teachings, while Murakami also teaches more binder rich pore structures, produced by non-solvent coagulation, where the pore walls would be composed predominantly of binder. As stated above, the range of wall thicknesses and particle sizes available in the Murakami plus Beard combination would allow for particles to be contained

within the pore walls and would also necessitate that some larger particles poke out of the pore walls. This is not a problem for the combination, as it is consistent with the teachings of both Beard and Murakami and is also a requirement of the '148 patent.

99. PO and Dr. Wheeler argue that Murakami teaches away from solvent substitution (which Beard uses). As explained above, this is not true – Murakami teaches that solvent substitution may be used. EX1005, ¶[0087]. A POSA would recognize that when higher binder content is used (such as the amounts taught by Murakami that overlap with Beard), solvent substitution (Murakami's Solvent X) would be needed to remove the dispersion medium and form the desired porous structure.

100. PO and Dr. Wheeler argue that Beard would increase variability in voidage, which Murakami teaches against. POR, 53; EX2034, ¶212. In my opinion, this is wrong. First, they rely on Beard's Figure 2, which I did not. I understand the Board rejected this argument for that reason. Decision, 33-34. Second, it is impossible to determine variability in voidage from Beard's Figure 2. Variability in voidage is measured by dividing the separator into numerous sections, measuring the voidage in each section, and comparing said voidages. Dr. Wheeler confirmed this. EX1037, 143:9-144:3. Murakami teaches now to measure variability in voidage. EX1005, ¶¶[0094]-[0097] This procedure is not based on a single SEM

image like Figure 2. It actually requires a highly complex analysis of 4,000 different SEM images. Murakami teaches using a FIB (focused ion beam) to sequentially slice through the thickness of the porous layer. Slices are taken and SEM images recorded, every 20 nm to a depth of 2.5 μm (2500 nm). This is a total of 125 (2500 nm / 20 nm), which are used by a computer algorithm to do a three dimensional reconstruction of the pore structure, from which the voidage is determined. According to Murakami, this sequential slicing and imaging process is carried out 32 times, in 32 different locations in the porous film, which means that the total voidage variability analysis requires recording and analyzing 4,000 SEM images (32 $\times$ 125).

101. It is not possible for Dr. Wheeler to make a judgement about the voidage variability, by the standards required under Murakami, of the full scope of Beard's teaching by looking at one SEM image (Figure 2) of one example, when 4,000 images would be required to actually complete the analysis. Also, the method of Murakami for assessing voidage variability entails sequentially slicing into the interior of the porous layer and reconstructing a three-dimensional computer model of the internal structure. Beard's Figure 2 is simply a view of the outer surface of a layer. There is no way to determine, from this image, the kind of information about the interior structure that is required to assess voidage variability according to the teachings of Murakami.

102. Also, Figure 2 is a highly magnified image of a porous structure. Porous structures of this type are inherently irregular and random looking. This is a result of how they are formed, either by a NIPS type coagulation process (for binder-rich layers) or by packing of irregular particles (for particle-rich layers). The PO and Dr. Wheeler are seeking to exploit potential unfamiliarity of the Board with what these structures look like. Viewed objectively by a non-POSA (non-specialist) this structure looks irregular and chaotic. A POSA with experience looking at this type of structure would not think that Beard's Figure 2 is "highly irregular" by the standard of these types of structures.

103. PO and Dr. Wheeler argue that Murakami and Beard cannot be combined without altering the particle sizes of Murakami. POR, 54; EX2034, ¶¶214-217. As explained above, Beard's pore wall thickness can accommodate most of the particles in the size ranges taught by Murakami, and to the extent that some particles are bigger, they will not block pores and they will simply by practicing the '148 patent claim by peeking into the pore spaces. They argue thicker walls are not possible because this would require more binder than Murakami's preferred examples use. POR, 55; EX2034, ¶¶216-217. But Murakami discloses embodiments using high binder amounts of 49%, 52%, 60%, and 62%, and teaches ranges of binder content ranging up to as much as 95% or 99 vol% of binder. EX1005, ¶[0069].

104. PO and Dr. Wheeler also argue that walls thick enough to capture Murakami's particles would be "likely to swell" and "close the pores." POR, 55; EX2034, ¶216. This is incorrect. Beard does not need to use abnormally thick binder walls to accommodate Murakami's particles as indicated by the wall thickness in Figure 2, and by the fact that there is nothing wrong with some of the larger particles poking out of the binder walls. Further, this argument is contradicted by the '148 Patent itself, which discloses pore walls as thick as 0.5µm capable of capturing particles as large as 10µm. EX1001, Claims 1, 3.

VII. GROUND 5: MURAKAMI, BEARD, AND HONDA RENDER OBVIOUS CLAIMS 3 AND 12

105. Honda and Beard have overlapping pore wall thicknesses. Both allow for wall thicknesses of 0.1µm. EX1010, ¶[0022]; EX1007, ¶[0045]. Both are within the ranges of claims 3 and 12: 20nm (0.02µm) to 500nm (0.5µm). Therefore, a POSA would have known that, at a minimum a wall thickness of 0.1µm is compatible between Honda and Beard for a combination with Murakami.

VIII. GROUND 6: MURAKAMI, BEARD, AND TANAKA RENDER OBVIOUS CLAIMS 4 AND 13

106. I understand that PO and Dr. Wheeler do not raise any new arguments and instead argue that this Ground fails for the same reasons the earlier grounds fail. As stated above, it is my opinion that Ground 4 renders at least claims 1 and 10

obvious, and that the addition of Tanaka renders claims 4 and 13 obvious for the same reasons stated in my first declaration. EX1003, ¶¶148-161.

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

A. D10, D50, D90

107. PO and Dr. Wheeler argue Akiike does not disclose the claimed particle size distribution. Instead, they argue that the disclosed distributions are for all particles in the slurry because Akiike mentions measurement via laser diffraction. POR, 57-58; EX2034, ¶¶226-229. In my opinion, Akiike does disclose the claimed particle size distribution, for the same reasons stated in my first declaration.

108. PO and Dr. Wheeler are trying to assert that particle size distributions given in Akiike's examples are not directly comparable to the '148 Patent claims because they are measured on the entire slurry, which includes other types of organic particles, such as particulate polymer and organic filler particles. This is a misreading of Akiike. It ignores Akiike (EX1011) ¶[0233] which clearly says the inorganic particles are produced and measured by laser diffraction separately before being put into the slurry, where they might be combined with other types of particles. What Akiike ¶[0243] is actually saying is that a slurry is obtained using particles with D10, D50, and D90, and BET surface area, which were measured previously by aforementioned manners, i.e., the method given above at Akiike ¶[0233]. Also,

PO and Dr. Wheeler are concocting this argument to try and discount Akiike's teaching on particle sizes based on a misreading of Akiike's examples. Regardless of what happens in its examples, Akiike teaches particle sizes and that those sizes are computed based on a cumulative volume distribution at the beginning of the specification, as a completely separate matter from its examples. EX1011, ¶¶[0010]-[0013].

109. Akiike discloses that the particles can be purchased commercially at the prescribed particle size distribution. *Id.*, ¶[0037]; *see also* EX1037, 148:1-7. If the particles are to be made by the POSA, Akiike explains that the particles are crushed to the desired size and then measured to by laser diffraction to confirm the results. EX1011, ¶[0233]. (“The volume average particle diameter of the a-alumina particles was measured by a nanoparticle distribution measurement apparatus ("SALD-7100" manufactured by Shimadzu Corp.).”) The Shimadzu SALD-7100 is a laser diffraction particle size analyzing machine. It is multiple steps later that the particles are added to the slurry. *Id.*, ¶[0239]. Thus, the particle size distribution is measured alone, without any other particles. Finally, PO has no explanation as to why Akiike's plain disclosure should be ignored: “particle size distribution of the non-conductive particles...are as follows: D10 is 0.2 μm to 0.4 μm ; D50 is 0.5 μm to 0.9 μm ; and D90 is 1.0 μm to 3.0 μm .” EX1011, ¶¶[0010]-[0013]; *see also id.*, ¶¶[0033], [0036], [0037], [0048], [0049], [0194]. A POSA would take that disclosure for what it says

and not try to imagine a scenario where Akiike may have incorrectly determined the particle size distribution.

110. In the alternative, PO and Dr. Wheeler argue that Akiike's particle size distribution is not just inorganic particles, but also organic particles. POR, 59; EX2034, ¶¶242-243. They misinterpret Akiike. Akiike discloses that either inorganic or organic particles may be used. EX1011, ¶[0038]. Therefore, Akiike discloses using just inorganic particles, which would necessarily mean the particle size distribution applies to the inorganic particles only.

B. Motivation to Combine

111. PO and Dr. Wheeler argue that Beard already teaches a narrower distribution, so there is no motivation to use Akiike's distribution. This is not true. Beard teaches measuring particle size as either a "maximum size" or an "average or median particle size." EX1010, ¶[0022]. These disclosures do not provide a teaching about the particle size distribution, which is the breadth of the range of particle sizes, not simply a single average number. PO and Dr. Wheeler argue that the Beard's combination of an average particle size and a maximum size is equivalent to the particle distribution information provided by Akiike in terms of Dv10, Dv50 and Dv90. This is not the case. First of all, Beard simply mentions the maximum particle size one time in the specification, (EX1010, ¶[0022] ("In some embodiments, the particle size may be measured as a maximum size")) indicating that this is something

a POSA might do. The term “maximum filler size” is used repeatedly in Beard’s claims. Nowhere, however, does Beard ever provide a number or range of values for this maximum particle size. Consequently, a POSA reading Beard actually does not have any particle size distribution information to be conflicted about when looking to Akiike for additional teachings.

112. Additionally, even if Beard had provided numbers for the maximum particle size, it would not be reliable information about the particle size distribution of the type that the POSA would instead look to Akiike to learn. A maximum size does not specify how the sizes are distributed below this maximum. Are most of the particles at or near this maximum, or is there just one particle at this maximum? In order to understand these distribution details, a POSA would need to consult the disclosure of Akiike, which give a D10, D50, and D90. Moreover, Akiike discloses the benefits of its particle size distribution. Petition, 63-65 (citing EX1011, ¶¶[0031]-[0035]); EX1003, ¶¶[202-204]. Those benefits alone would motivate a POSA to incorporate Akiike’s particle size distribution into Beard’s pore structure.

113. PO and Dr. Wheeler argue that Beard and Akiike have incompatible goals. But both seek to improve high temperature robustness and safety, mechanical strength, and porosity. *Compare* EX1005, ¶[0102] *with* EX1011, ¶¶[0017]-[0020]. Dr. Wheeler’s statement that the use of Akiike’s “larger inorganic particles” would “likely block the pores” or decrease porosity is unsupported speculation, which

ignores the fact that a POSA would be able to turn knobs related to formulation and process conditions, within the teachings of Beard, to accommodate the particles of Akiike, while maintaining porosity. This is facilitated by the fact, as I have shown above, that Beard actually teaches pore wall thicknesses up to 0.5 μm , based on the embodiment shown in its Figure 2. Para. 98. Regardless, Akiike would impart other benefits that a POSA could be interested in, as stated in my prior declaration. EX1003, ¶¶202-204.

114. PO and Dr. Wheeler repeat their argument from Murakami that it is impossible to achieve the pore structure of Beard with larger particle sizes. But again, the '148 Patent does (and claims) exactly that. Their position that either the wall thickness would have to be increased beyond the claim range or Akiike's particles have to be reduced below the claimed range is untenable – the '148 Patent is proof that Akiike's particles are compatible with Beard's pore walls. To the extent Beard's pore walls have to be increased in thickness, Beard discloses a wide range of binder vol% (up to 67%) (EX1010, ¶[0029]) and there is no support that the walls would have to be increased beyond the claimed 500nm — which would equal Akiike's disclosed D50 of 0.5 μm (EX1011, ¶[0032]).

X. GROUND 8: BEARD, AKIIKE, AND TANAKA RENDER OBVIOUS CLAIMS 4 AND 13

115. I understand that PO and Dr. Wheeler do not raise any new arguments and instead argue that this Ground fails for the same reasons the earlier grounds fail. As stated above, it is my opinion that Ground 7 renders at least claims 1 and 10 obvious, and that the addition of Tanaka renders claims 4 and 13 obvious for the same reasons stated in my first declaration. EX1003, ¶¶236-241.

XI. CONCLUSION

For these reasons, it is my opinion that the Challenged Claims of the '148 Patent are unpatentable.

I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I could testify to the matters in this declaration competently if called upon to do so. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code.

Dated: 3/4/2026

By:



Samuel P. Gido, Ph.D.