Trials@uspto.gov
Tel: 571-272-7822

Paper 58
Entered: September 25, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SK INNOVATION CO., LTD.,
Petitioner,

v.

CELGARD, LLC,
Patent Owner.

Case IPR2014-00679
Patent 6,432,586 B1

Before FRANCISCO C. PRATS, DONNA M. PRAISS, and CHRISTOPHER L. CRUMBLEY, *Administrative Patent Judges*.

PRATS, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

A. Statement of the Case

SK Innovation Co., Ltd. ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting *inter partes* review of claims 1–12, all of the claims, of U.S. Patent No. 6,432,586 B1 (Ex. 1001, "the '586 patent"). Celgard, LLC, ("Patent Owner") filed a Preliminary Response. Paper 8 ("Prelim. Resp."). We instituted trial on the following grounds of unpatentability:

Reference[s]	**Basis**[1]	**Claim[s] challenged**
Tojo[2]	§ 102(b)	1–3, 5, 6, and 11
Tojo and Lundquist[3]	§ 103	4, 7–9, 11, and 12
Tojo and Kejha[4]	§ 103	10

Paper 11, 24–25 ("Decision to Institute," or "Dec.").

After trial was instituted, Patent Owner filed a Response (Paper 33, "PO Resp."), and Petitioner filed a Reply (Paper 40, "Reply").

---

[1] The application which issued as the '586 patent was filed on April 10, 2000. Ex. 1001, cover page. Accordingly, the versions of §§ 102 and 103 in effect before the Leahy-Smith America Invents Act ("AIA") apply to the claims of the '586 patent. *See* AIA, Public Law 112-29, § 3, 125 Stat. 288.

[2] JP H11-80395 (published Mar. 26, 1999) (Ex. 1006) (as translated, Ex. 1007).

[3] U.S. Patent No. 4,650,730 (issued Mar. 17, 1987) (Ex. 1008).

[4] U.S. Patent No. 5,705,084 (issued Jan. 6, 1998) (Ex. 1009).

Both parties filed Motions to Exclude Evidence (Paper 44, "Pet. Mot. to Exclude"; Paper 47, "PO Mot. to Exclude"), Oppositions to the Motions to Exclude Evidence (Paper 49, "Pet. Opp."; Paper 50, "PO Opp."), and Replies to the Oppositions to the Motions to Exclude Evidence (Paper 53, "Pet. Reply Opp."; Paper 55, "PO Reply Opp.").

Petitioner supported its Petition with a Declaration by Craig B. Arnold, Ph.D. (Ex. 1004, "Arnold Decl.").

In support of its Response, Patent Owner relied on Declarations by Ralph E. White, Ph.D., P.E., (Ex. 2002, "White Decl."), C. Glen Wensley, Ph.D. (Ex. 2015, "Wensley Decl."), and William J. Paulus (Ex. 2915, "Paulus Decl.").

Oral Hearing was held on June 29, 2015, and the Hearing Transcript has been entered in the record. Paper 57 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a).

"In an inter partes review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence." 35 U.S.C. § 316(e). We conclude that Petitioner has proved by a preponderance of the evidence that claims 7–10 of the '586 patent are unpatentable, based on the obviousness grounds on which trial was instituted. We conclude, however, that Petitioner has not proved by a preponderance of the evidence that claims 1–6, 11, and 12 of the '586 patent are unpatentable.

Petitioner's Motion to Exclude Evidence is granted-in-part, denied-in-part, and dismissed-in-part as moot. Patent Owner's Motion to Exclude Evidence is denied.

B. Related Proceedings

Concurrently with the Petition under consideration herein, Petitioner filed a petition advancing additional challenges to the claims of the ’586 patent. Pet. 4; *SK Innov. Co.. Ltd. v. Celgard, LLC*, Case IPR2014-00680, Paper 2 (May 9, 2014). The claims of the ’586 patent were challenged also by Mitsubishi Plastics, Inc. and LG Chem Ltd. in IPR2014-00524 and IPR2014-00692, respectively. Pet. 4. IPR2014-00524 was recently terminated after settlement between the parties.

Previously, the ’586 patent was subject to an *inter partes* review, IPR2013-00637, which was terminated after petitioner Sumitomo settled the related litigation, as noted below. *Id.* at 3–4. Claims 1–6 and 11 of the ’586 patent have also been challenged in *Ube Maxell Co. v. Celgard, LLC*, Case IPR2015-01511, Paper 1 (June 25, 2015).

The ’586 patent has been asserted in the U.S. District Court for the Western District of North Carolina in *Celgard, LLC v. SK Innovation Co., Ltd.*, Case No. 3:13-cv-00254; *Celgard, LLC v. LG Chem, Ltd.*, Case No. 3:13-cv-00043; and *Celgard, LLC v. Sumitomo Chemical Co., Ltd.*, Case No. 3:13-cv-00122. Pet. 3. The Sumitomo Chemical Co., Ltd. case has settled. Pet. 3.

C. The ’586 patent

The ’586 patent discloses that commercializing lithium-containing high-energy rechargeable batteries has been difficult, mainly because of “dendrite growth that occurs after repetitive charge-discharge cycling.” Ex. 1001, 1:21–22. Specifically, “[w]hen lithium dendrites grow [from the lithium-containing anode] and penetrate the separator [between the electrodes], an internal short circuit of the battery occurs (any direct contact

between anode and cathode is referred to as ‘electronic’ shorting, and contact made by dendrites is a type of electronic shorting).” *Id.* at 1:27–31. “Some shorting . . . may result in thermal runaway of the lithium battery, a serious safety problem for [a] lithium rechargeable battery.” *Id.* at 1:31–35.

To address those issues, the ’586 patent describes an improved electrode separator for a high-energy rechargeable lithium battery. *Id.* at 1:40–53. The separator includes two specific layers: “[1] at least one ceramic composite layer and [2] at least one polymeric microporous layer.” *Id.* at 1:46–47.

The ’586 patent explains that the ceramic composite layer “is, at least, adapted for preventing electronic shorting (e.g. direct or physical contact of the anode and the cathode) and blocking dendrite growth.” *Id.* at 2:54–57.

The ’586 patent explains that the ceramic composite layer is composed of a mixture of two types of components: “[1] a matrix material having [2] inorganic particles dispersed therethrough.” *Id.* at 3:9–10 (drawing reference numerals removed). The ’586 patent explains that the “[c]eramic composite layer is nonporous (it being understood that some pores are likely to be formed once in contact with an electrolyte, but ion conductivity of [that] layer is primarily dependent upon choice of the matrix material and particles).” *Id.* at 3:10–14 (drawing reference numerals removed).

The ’586 patent explains that, although the matrix material may also perform the function of carrying the battery electrolyte, the matrix material is “that component of a separator which, in part, prevents electronic shorting by preventing dendrite growth.” *Id.* at 3:18–20.

The ’586 patent explains that the matrix component of the ceramic composite layer can be “any gel forming polymer suggested for use in lithium polymer batteries or in solid electrolyte batteries.” *Id.* at 3:32–34. The ’586 patent discloses that a variety of inorganic particles may be used in the ceramic composite layer, including, “for example, silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), calcium carbonate ($CaCO_3$), titanium dioxide (TiO_2), SiS_2, $SiPO_4$, and the like, or mixtures thereof. The preferred inorganic particle is SiO_2, Al_2O_3, and $CaCO_3$.” *Id.* at 3:53–57.

Turning to the polymeric microporous layer of the ’586 patent’s separator, the patent explains that that layer “is, at least, adapted for blocking (or shutting down) ionic conductivity (or flow) between the anode and the cathode during the event of thermal runaway.” *Id.* at 2:58–60.

In contrast to the substantially non-porous ceramic composite layer discussed above, the ’586 patent explains that the polymeric microporous layer “consists of any commercially available microporous membranes (e.g. single ply or multi-ply), for example, those products produced by Celgard Inc. of Charlotte, North Carolina, Asahi Chemical of Tokyo, Japan, and Tonen of Tokyo, Japan.” *Id.* at 3:60–64.

Claims 1 and 7 illustrate the claimed subject matter, and read as follows:

> 1. A separator for a high energy rechargeable lithium battery comprises:
>
> at least one ceramic composite layer, said layer including a mixture of inorganic particles in a matrix material; ***said layer being adapted to at least block dendrite growth and to prevent electronic shorting***; and
>
> at least one polyolefinic microporous layer, said layer being adapted to block ionic flow between an anode and a cathode.
>
> 7. A separator for a high energy rechargeable lithium battery comprises:
>
> at least one ceramic composite layer or coating, said layer including a mixture of 20–95% by weight of inorganic particles selected from the group consisting of SiO_2, Al_2O_3, $CaCO_3$, TiO_2, SiS_2, $SiPO_4$, and mixtures thereof, and 5–80% by weight of a matrix material selected from the group consisting of polyethylene oxide, polyvinylidene fluoride, polytetrafluoroethylene, copolymers of the foregoing, and mixtures thereof; and
>
> at least one polyolefinic microporous layer having a porosity in the range of 20–80%, an average pore size in the range of 0.02 to 2 microns, and a Gurley Number in the range of 15 to 150 sec.

Ex. 1001, 4:39–47, 4:66–5:13 (emphasis added).[5]

[5] The phrase "and the like" was removed from claim 7 by Certificate of Correction, entered April 23, 2013. Ex. 1001, 6.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, the Board interprets claims in an unexpired patent using the "broadest reasonable construction in light of the specification of the patent in which [they] appear[]." 37 C.F.R. § 42.100(b); *In re Cuozzo Speed Tech., LLC*, 793 F.3d 1268, 1276 (Fed. Cir. 2015). Under that standard, the Board applies to claim terms their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

"ceramic composite layer . . . adapted to at least block dendrite growth and to prevent electronic shorting"

In the Decision to Institute, we concluded that the broadest reasonable construction of the claim recitation, "ceramic composite layer . . . adapted to at least block dendrite growth" (Ex. 1001, 4:41–44 (claim 1), 6:9–19 (claim 12)), encompasses any such layer capable of blocking dendrite growth with any degree of effectiveness. Dec. 7–8.

Patent Owner contends that our construction is unreasonably broad, and proposes instead that we construe the claim term to mean "ceramic composite layer . . . capable of preventing dendrites from growing all the way through the ceramic composite layer during the specified, stated, or intended number of repetitive charge-discharge cycles of a rechargeable battery." PO Resp. 18.

Patent Owner contends that its construction is consistent with the language in the claims, as well as an ordinary artisan's understanding of the claimed invention. *Id.* Specifically, Patent Owner contends that the

separator, as claimed, must be suitable for use in a high energy rechargeable lithium battery, and such a battery, by definition, must be capable of undergoing a certain number of charge-discharge cycles without experiencing an electrical short, as shown by extrinsic evidence of industry standards. *Id.* (citing Ex. 2002 ¶¶ 56, 74–77 (White Decl.), Ex. 2009, 78:22–79:8 (Deposition of Craig B. Arnold ("Arnold Depo."))); *id.* at 20–21.

Patent Owner contends that its proposed construction is consistent also with the Specification of the '586 patent, because the primary goal of the '586 patent is to improve prior art separators by manufacturing them such that they block dendrite formation and prevent electronic shorting. *Id.* at 18. Patent Owner contends that, given the '586 patent's focus on solving the dendrite problem in rechargeable lithium batteries, "it is reasonable to consider blocking dendrites in the context of what would result in a useful rechargeable battery that could remain effective throughout the type of repetitive charge-discharge cycling that can cause dendrites." *Id.* at 20.

Petitioner, on the other hand, contends that we correctly construed the language at issue in the Decision to Institute. Reply 1. Petitioner contends that Patent Owner's proposed construction improperly incorporates an ill-defined time limit on the claim from the Specification, and ignores the ordinary dictionary meaning of the term "to block." *Id.* at 2. Petitioner contends that Patent Owner's construction improperly relies on extrinsic evidence, because such evidence may only be relied on where ambiguity remains after considering the intrinsic evidence of the claims' meaning. *Id.* at 3.

We agree with Petitioner that Patent Owner's proposed construction improperly imports limitations into the claims.

We acknowledge, as noted above in our discussion regarding the ’586 patent disclosure, that the objective of the ’586 patent is to control electronic shorts caused by lithium dendrite formation. We acknowledge also Patent Owner’s evidence that an ordinary artisan would have understood that a primary goal of the ’586 patent would have been to ensure that no dendrite-caused electronic shorting occurs during the specified, stated, or intended number of charge-discharge cycles of a rechargeable battery.

Our reviewing court, however, has “cautioned against reading limitations into a claim from the preferred embodiment described in the specification, even if it is the only embodiment described, absent clear disclaimer in the specification.” *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1369 (Fed. Cir. 2004).

Patent Owner does not direct us to any specific disclosure in the Specification of the ’586 patent clearly limiting or defining dendrite blocking as impeding dendrite growth for the entire intended life of a rechargeable battery. Accordingly, because the ’586 patent does not clearly disclaim the scope of dendrite blocking in the manner Patent Owner advances, we are not persuaded that we should limit the claims to the asserted primary goal, or preferred result, of the ’586 patent. We, therefore, decline to adopt Patent Owner’s proffered claim construction.

Although we decline to read limitations from the Specification into the claims, we must, nonetheless, take account of the relevant disclosures in the Specification in determining the reasonable scope of the claims.

The claim language at issue appears in independent claims 1 and 12, and recites, in full, that the ceramic composite layer must be “adapted to at

least block dendrite growth and to prevent electronic shorting." Ex. 1001, 4:43–44 (claim 1), 6:18–19 (claim 12).

As noted above, the Specification of the '586 patent discloses that dendrite growth, which results in electronic shorting, occurs after repetitive charge-discharge cycling of the battery. *Id.* at 1:20–31.

The '586 patent does not explain with any specificity, however, what structural or functional properties, for example hardness, must be possessed by a ceramic composite layer that is "adapted to" block dendrite growth. Nor does the Specification of the '586 patent require any particular degree of effectiveness in that respect. Nonetheless, as noted above, the '586 patent does disclose that a ceramic composite layer which is nonporous except for pores resulting from electrolyte contact, and which is composed of inorganic particles dispersed in a polymeric matrix, is adapted to block dendrite growth and prevent electronic shorting. *See id.* at 3:9–59.

In addition to the Specification, "dictionary definitions are also pertinent" in determining the broadest reasonable meaning of claim terms. *In re Trans Texas Holdings Corp.*, 498 F.3d 1290, 1299 (Fed. Cir. 2007).

As Petitioner points out, the ordinary meaning of "to block," is "to obstruct by placing obstacles in the way," and the ordinary meaning of "to obstruct," in turn, is "to hinder, interrupt, or delay the passage, progress, course, etc. of." Reply 2 (citing Ex. 1042 (RANDOM HOUSE WEBSTER'S COLLEGE DICTIONARY 144, 916 (2d ed. 2000))).

Accordingly, based on the evidence before us, we conclude that the broadest reasonable construction of a ceramic composite layer, adapted to at least block dendrite growth and prevent electronic shorting, encompasses any such layer capable of hindering, interrupting, or delaying the passage,

progress, or course of dendrite growth, with any degree of effectiveness sufficient to prevent electronic shorting.

Patent Owner contends that, by construing the language at issue to encompass dendrite blocking to any degree of effectiveness, we effectively rewrite the claim. PO Resp. 19. We are not persuaded. As noted above, we apply to the claims before us the broadest reasonable construction an ordinary artisan would give, in light of the Specification. In the instant case, as discussed above, Patent Owner does not direct us to any clear or specific disclosure in the Specification describing a minimum degree of dendrite growth blocking, other than electronic short prevention, to which an ordinary artisan would understand the claim to be limited.

Patent Owner contends that it is "unreasonable to have a construction that could be met by some slowing of dendrites, but would allow others to grow through and short out the battery potentially causing a fire or explosion." *Id.* at 20. As is evident, however, claims 1 and 12 expressly require the ceramic composite layer to prevent electronic shorting. The claims, therefore, do not encompass a ceramic composite layer that allows a dendrite to grow through the separator and cause a short.

In sum, for the reasons discussed, based on the evidence before us, we conclude that the broadest reasonable construction of a ceramic composite layer, adapted to at least block dendrite growth and prevent electronic shorting, encompasses any such layer capable of hindering, interrupting, or delaying the passage, progress, or course of dendrite growth, with any degree of effectiveness sufficient to prevent electronic shorting.

B. Anticipation by Tojo

1. Introduction

Petitioner contends that claims 1–3, 5, 6, and 11 of the ’586 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Tojo. Pet. 20–31.

Patent Owner contends that Tojo does not anticipate those claims because Tojo does not describe a separator with a ceramic composite layer “adapted to at least block dendrite growth and to prevent electronic shorting” as recited in claim 1, and required by its dependent claims 2, 3, 5, 6, and 11. PO Resp. 23; *see also id.* at 28 (“The only issue presented in Ground 1 on claims 1–3, 5–6 and 11 is whether the teaching of Tojo discloses a ceramic composite separator layer that is inherently adapted to block dendrite growth.”).

Given the parties’ contentions, the critical issue as to this ground of unpatentability is whether Petitioner has shown by a preponderance of the evidence that Tojo describes a separator for a high energy rechargeable lithium battery, the separator having a ceramic composite layer adapted to at least block dendrite growth and to prevent electronic shorting, as required by claim 1.

For the reasons below, we agree with Patent Owner that Petitioner has not shown by a preponderance of the evidence that Tojo describes a separator including that feature.

2. Overview of Tojo

Tojo addresses issues facing separators used in high energy density lithium batteries, the type of battery recited in claims 1 and 11 of the ’586 patent. Ex. 1007 ¶ 3. As required by claim 1, Tojo discloses that its separator includes two layers, a porous membrane base layer composed of a

polyolefin such as polypropylene or polyethylene, and a composite coating layer "which includes inorganic microparticles, such as aluminum oxide, silicon dioxide, or the like, and a resin that serves as a binder." *Id.* at Abstract.

As required by claim 1, the composite layer of Tojo's separator includes inorganic particles, which may be aluminum oxide or silicon dioxide. *Id.* ¶ 18. As claim 1 also requires of its ceramic composite layer, the composite layer of Tojo's separator includes a matrix material, termed a "binder," which is "not particularly limited, as long as [it is] conventionally in use, and examples include various polyesters, polyolefins, rubbers, acrylic resins, or the like, which can be used singly or in combination." *Id.* ¶ 22.

3. Analysis

To show that Tojo meets claim 1's dendrite-blocking requirement, Petitioner directs us to Tojo's disclosure that its separators have high surface hardness and mechanical strength, which inhibit tearing and penetration by microparticles of electrode material produced during manufacture or storage, ultimately resulting in a reduced internal short circuit rate. Pet. 22 (citing Ex. 1007 ¶ 8). Petitioner contends that the "protective surface layer" of Tojo's separator, which corresponds to the ceramic composite layer of claim 1,

> is a physical barrier, which will necessarily result in blocking at least some dendrite growth. Ex. 1004, ¶ 46 [Arnold Decl.]. Hence, the protective surface layer is adapted to block at least some dendrite growth and to prevent electronic shorting. *Id.* Under the broadest reasonable construction, nothing more should be expected of the layer.

Id.

As Patent Owner contends, however (PO Resp. 23, 26–27), Tojo describes its ceramic composite layer as being "permeable" and "porous." Ex. 1007 ¶ 8. Regarding the pores, Tojo discloses:

> The size of the openings is not particularly limited, but 0.1 µm to 1 mm is appropriate, and 5 µm to 20 µm is preferable, when used as a battery separator, considering the size of the conductive particles that can cause internal short circuits. Moreover, the openings preferably make up about 40 to 80% of the total surface area of the protective surface layer.

Id. ¶ 25.

Tojo discloses that the pores can be produced by "form[ing] a mesh protective surface layer or the like by screen printing so as to have openings." *Id.* Alternatively, Tojo discloses:

> [B]y ultrasonicating in a poor solvent relative to the resin constituting the protective surface layer after forming the protective surface layer by any of the aforementioned coating methods, the fine pores can be formed in the protective surface layer in accordance with the pore structure of the membrane base.

Id. ¶ 26. Tojo discloses further that pores may be produced by "extraction, drawing, or addition of a foaming agent." *Id.* at 27. Tojo exemplifies using ultrasonication to produce pores in its ceramic composite layer. *Id.* ¶¶ 43, 46.

Patent Owner contends that dendrites are softer than the microparticles Tojo sought to block, and that dendrites "can adapt in size and direction and grow over time through openings in a separator under the right conditions. . . . A dendrite could certainly grow through the open holes of the size and created in the manner taught by Tojo." PO Resp. 29 (citing

Ex. 2002 ¶¶ 89–90, 99–107 (White Decl.); Ex. 2009, 73:5–74:3, 120:6–122:19, 190:18–192:12 (Arnold Depo.)).

Moreover, Patent Owner contends, "there is greater current density where ionic flow occurs through pores, and dendrite growth will be created by and likely follow that current." *Id.* (citing Ex. 2002 ¶¶ 43–47, 89–90, 99–101; Ex. 2009, 100:7–101:17).

Given Dr. White's experience in the field of battery technology, we credit his testimony on this issue. Ex. 2002 ¶¶ 3–16 (White Decl.); Ex. 2003 (Curriculum Vitae of Dr. White). Moreover, to support his opinion, Dr. White cites (Ex. 2002 ¶ 99) to the Handbook of Battery Materials (Ex. 2007, "the Handbook"),[6] a reference to which Petitioner also cites (Reply 12 (citing Ex. 1041)).

The Handbook discloses:

> [E]ven these small pores [in microporous separators] cannot prevent the formation of so-called "microshorts", arising by metal deposition (e.g., dendrites) from the solution phase. The pores of modern separators have a diameter of about 0.1 µm, equal to 100 nm, while metal ions have a diameter of few angstroms, equal to 0.5–1 nm. On an atomic scale even micropores are barn doors!

Ex. 2007, 247.

As Patent Owner contends, the testimony of Petitioner's expert, Dr. Arnold, also supports Patent Owner's contention dendrites could grow through Tojo's porous ceramic composite layer:

[6] HANDBOOK OF BATTERY MATERIALS (Jürgen O. Besenhard ed., Wiley-VCH 1999) (Ex. 2007) (also cited by Petitioner as Ex. 1041).

> Q. Specifically in the particular surface layer of Tojo we're discussing, could a dendrite grow through the pores that are in the Tojo protective surface layer?
>
> A. Yes. I would say a dendrite could grow through it. It doesn't mean it would or would not, but in principle it could.

Ex. 2009, 191:6–12.

As discussed above, the broadest reasonable construction of a ceramic composite layer, adapted to at least block dendrite growth and prevent electronic shorting, encompasses any such layer capable of hindering, interrupting, or delaying the passage, progress, or course of dendrite growth, with any degree of effectiveness sufficient to prevent electronic shorting. As also discussed above, Tojo discloses that the pores in its ceramic composite layer can range from 0.1 µm to 1 mm in size. Ex. 1007 ¶ 25.

Viewing the record as a whole, including the testimony of Dr. White and Dr. Arnold, as well as the Handbook's disclosure that separator pores as small as 0.1 µm are effectively barn doors, which cannot prevent electronic shorts caused by dendrite growth, we find that Tojo's porous ceramic composite layer is not capable of hindering, interrupting, or delaying the passage, progress, or course of dendrite growth, with any degree of effectiveness sufficient to prevent electronic shorting. That is, we find that Tojo's separators do not include a ceramic composite layer that is adapted to at least block dendrite growth and to prevent electronic shorting, as recited in claim 1 of the '586 patent.

Petitioner does not persuade us that the preponderance of the evidence supports a contrary finding.

As noted above, Petitioner bears the burden of proving unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e). In the instant case,

Petitioner contends that Tojo necessarily describes a ceramic composite layer adapted to at least block dendrite growth, and that Tojo's ceramic composite layer inherently blocks dendrite growth, despite the pores discussed above. Reply 4–6, 8–12.

It is well settled that the "very essence of inherency is that one of ordinary skill in the art would recognize that a reference *unavoidably* teaches the property in question." *Agilent Techs., Inc. v. Affymetrix, Inc.*, 567 F.3d 1366, 1383 (Fed. Cir. 2009) (emphasis added); *see also In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981) ("Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.").

Given the evidence discussed above that the pores in Tojo's ceramic composite layer would allow dendrite growth, Petitioner does not persuade us that, because Tojo's ceramic composite layer contains the inorganic particles and matrix material required by claim 1, Tojo unavoidably teaches that its ceramic composite layer is adapted to block dendrite growth enough to prevent electronic shorting. *See* Reply 4–6. Moreover, even assuming for argument's sake that larger dendrites would be blocked by Tojo's pores (*see id.* at 8), Petitioner concedes that dendrites may grow at an atomic scale (*id.* at 7), and the evidence discussed above supports a finding that Tojo's pores would not block dendrites of that size from producing an electronic short.

As Petitioner argues (Reply 10), and as noted above, the '586 patent discloses that the ceramic composite layer may have some pores. *See* Ex. 1001, 3:10–14 ("Ceramic composite layer is nonporous (it being understood that some pores are likely to be formed once in contact with an electrolyte, but ion conductivity of [that] layer is primarily dependent upon

choice of the matrix material and particles).") (drawing reference numerals removed).

Petitioner does not direct us, however, to any clear or specific evidence suggesting that the properties of a ceramic composite layer having "some pores" as described in the '586 patent, would be in any way comparable to the properties of Tojo's porous ceramic composite layer. Accordingly, we do not find, particularly given the evidence discussed above, that a ceramic composite layer having the permeability, porosity, and pore size described in Tojo, would necessarily meet the dendrite-blocking feature of claim 1, based on the '586 patent's disclosure of a dendrite-blocking layer that is nonporous except for pores resulting from electrolyte contact.

We acknowledge Petitioner's argument that Dr. White's testimony in one of the related district court proceedings is inconsistent with his testimony in the instant proceeding. Reply 10 (citing Ex. 2903). As noted above, however, his testimony here, that dendrites can grow through Tojo's porous ceramic composite layer (*see, e.g.*, Ex. 2002 ¶ 99), is supported by the Handbook, a reference upon which Petitioner itself relies. Reply 12 (citing Ex. 1041). Moreover, also as noted above, Petitioner's expert, Dr. Arnold, conceded that dendrites could grow through Tojo's porous ceramic composite layer. Ex. 2009, 191:6–12.

Petitioner contends that Dr. White testified inconsistently as to the size and growth pattern of dendrites. Reply 10–11. Petitioner does not direct us, however, to specific credible evidence controverting the evidence, discussed above, that Tojo's pores would allow dendrite growth. Nor does Petitioner direct us to clear or specific evidence supporting its assertion that

Tojo's ceramic composite layer necessarily blocks dendrite growth, as claim 1 requires.

To that end, Petitioner contends that Tojo's preferred ultrasonication pore forming technique "leads to a 'fine pore' structure similar to the microporous membrane, where the presence of 'open holes' is not expected." Reply 12 (citing Ex. 1007 ¶¶ 15, 26 (Tojo); Ex. 1041, 247–48 (the Handbook)).

We acknowledge Tojo's disclosure that ultrasonication can produce "fine pores." Ex. 1007 ¶ 26. We acknowledge also the following disclosure in the Handbook regarding separator pore structure:

> Pores generally are not of a hose-like configuration of constant diameter, in a straight-line direction from one electrode to the other. In practice, separators pores are formed as void between fibers (Fig. 1), or spherical bodies in amorphous agglomerates (Fig. 2), thus being very different in their form and size. . . .
>
> The path taken by an ion from one electrode to the other will not be a straight one, as it has to evade the solid structures by making detours. The ratio of the mean actual path in comparison with the direct distance is called the tortuosity factor *T*. For plastic bodies consisting essentially of spherical, interconnected particles with voids in between, with a porosity of about 60 percent this value is roughly 1.3; for higher porosities it decreases to approach a value of 1.0 at very high porosities.

Ex. 1041, 247–48.

This disclosure, explaining that separator pores often have an indirect tortuous pathway, rather than straight-through, is closely preceded, however, by the disclosure, cited above, that "even these small pores [in microporous separators] cannot prevent the formation of so-called 'microshorts', arising

by metal deposition (e.g., dendrites) from the solution phase." *Id.* at 247. The Handbook, moreover, does not explain whether Tojo's ultrasonication will necessarily result in pores with a tortuosity sufficient to block dendrite growth. Accordingly, the Handbook does not establish that the ceramic composite layer having the fine pores described in Tojo will necessarily block dendrite growth, as claim 1 requires.

Petitioner also does not persuade us (Reply 12) that Dr. White's deposition testimony establishes that Tojo's ultrasonication technique would necessarily produce pores with a tortuosity sufficient to block dendrite growth. As to whether Tojo's ultrasonication would produce tortuous pores, Dr. White testified as follows:

> Q. Okay. What kind of pores would be formed by using ultrasonics to form pores, straight through or tortuous?
>
> A. I think it would depend on the characteristics of the ultrasound that you're – you're using. It's probable that you could form a pore of desired shape, straight through to a non-straight through.

Ex. 1040, 78:25–79:8. Dr. White also testified: "I think it's a possibility that the process described in paragraph 26 [of Tojo] could result in tortuous pores." *Id.* at 86:8–10.

As to whether tortuous pores would block dendrite growth, Dr. White testified as follows:

> Q. Okay. Under what circumstances would a separator having pores be able to block a dendrite from growing through the pores?
>
> A. The answer to that question would depend upon the characteristics of the separator as a whole. If the separator as a whole has characteristics such that the path for the dendrite through the pores and the separator would be long and tortuous,

> for example, it could be a very thick separator, it could be a separator with pores that are not straight-through pores, then it would be possible for such a separator to block dendrite growth.

Id. at 40:2–14.

Thus, Dr. White's deposition testimony advanced by Petitioner establishes, at best, that it is *possibl*e that tortuous pores could form using Tojo's ultrasonication technique, and that it is also *possible*, under the proper circumstances, that those pores could be sufficiently tortuous to block dendrite growth. As discussed above, however, inherency may not be established by possibilities or probabilities. *In re Oelrich*, 666 F.2d at 581.

In sum, for the reasons discussed, Petitioner has not proven, by a preponderance of the evidence, that Tojo describes inherently a separator with a ceramic composite layer adapted to at least block dendrite growth and prevent electronic shorting, as claim 1 requires. Because we determine that Petitioner has not shown that Tojo describes a separator having all of the features required by claim 1 and its dependent claims 2, 3, 5, 6, and 11, we find that Petitioner has not established that claims 1–3, 5, 6, and 11 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Tojo.

C. Obviousness over Tojo and Lundquist

1. Prior Art Evidence of Obviousness

Petitioner challenges claims 4, 7–9, 11, and 12 as obvious under 35 U.S.C. § 103(a) over Tojo and Lundquist. Pet. 34–47.

As the Supreme Court has stated, when evaluating claims for obviousness, "the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved."

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)). Secondary considerations, if present, also must be considered. *Id.*

As to the level of ordinary skill in the pertinent art, the parties' experts advance slightly different opinions. *See* Ex. 1004 ¶¶ 26–27 (Arnold Decl.); Ex. 2002 ¶¶ 74–75 (White Decl.). Nonetheless, neither party asserts error in the opinion of the other party's expert, and neither party asserts specifically that the ultimate conclusion of obviousness turns on adoption of a particular level of ordinary skill. In that regard, both experts generally agree that an ordinarily skilled artisan at the critical time would have had a degree in chemistry, physics, material science, or chemical engineering; at least two to three years of experience in the battery industry or research and development of lithium batteries; and knowledge of the components and problems of lithium batteries, including dendrite growth, electronic shorting, and separators. *See id.*

When evaluating the parties' contentions regarding the scope and content of the prior art, and the differences between the prior art and the challenged claims, we take into consideration both parties' assertions regarding the level of ordinary skill. We note also that the level of ordinary skill in the art may be evidenced by the cited references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Petitioner contends that Tojo describes separators and batteries having all of the features required by claims 4, 7–9, 11, and 12, except for the matrix materials recited in claims 4, 7, and 12, which include polytetrafluorethylene ("PTFE") and copolymers thereof. *See id.* To address that deficiency, Petitioner cites Lundquist as evidence that materials

containing PTFE and its copolymers were known in the art to be useful as matrix materials when preparing lithium battery separators containing inorganic particles. *See id.* at 34–36, 39–40.

Given Lundquist's teachings, Petitioner contends that an ordinary artisan would have considered it obvious "to select the PTFE-copolymers taught in [Lundquist] for the resin binder (matrix material) of [Tojo]. Ex. 1004 ¶ 83. Indeed, this is a simple substitution of one known material for another to obtain predictable results." Pet. 35; *see also id.* at 39–40 (discussing claim 7, cross-referencing discussion as to claim 4). Further, Petitioner reasons:

> Since [Tojo] was trying to solve the problem of electric shorting due to dendrite growth with its protective surface layer (Ex. 1007, ¶¶ [0005], [0008]), a person of ordinary skill in the art would have been motivated with a reasonable expectation of success to select a polymer that was also well known to accommodate inorganic particles and be able to block at least some dendrite growth and to prevent electric shorting, such as the PTFE-copolymers taught in [Lundquist]. Ex. 1004, ¶ 83.

Id. at 37.

Patent Owner contends that Petitioner failed to show that Tojo and Lundquist teach or suggest the dendrite-blocking feature required by claims 4, 11, and 12. PO Resp. 36–37. Other than the claimed dendrite-blocking feature, however, Patent Owner does not contend that Petitioner incorrectly characterized Tojo as describing a separator having all of the features of claims 4, 7–9, 11, and 12, except for the matrix materials recited in claims 4, 7, and 12. Nor does Patent Owner contend that Petitioner inaccurately characterized the teachings of Lundquist. Rather, Patent Owner contends that an ordinary artisan would not have looked to combine the teachings of

Tojo and Lundquist in the manner posited by Petitioner, and that selection of a binder material would not have been a simple substitution. *Id.* at 38–40.

Having reviewed Petitioner's analysis and supporting evidence in light of Patent Owner's arguments and evidence, a preponderance of the evidence supports Petitioner's position that an ordinary artisan would have been prompted to substitute Lundquist's PTFE-containing copolymers for the polymeric binder material used in the ceramic composite layer of Tojo's separator.

As Petitioner discusses, Tojo discloses that a variety of classes of materials may be used as a binder for the inorganic particles in its ceramic composite layer. Pet. 35; Ex. 1007 ¶ 22 ("[I]t is preferable to mix the inorganic microparticles with a resin, which serves as a binder, before using. The binders are not particularly limited, as long as they are conventionally in use, and examples include various polyesters, polyolefins, rubbers, acrylic resins, or the like . . . .").

As Petitioner also discusses (Pet. 36), Lundquist discloses a lithium battery separator similar to that described by Tojo, including two layers, or plies, "at least one first ply of an unfilled microporous polyolefin composition . . . with at least one second ply of a higher viscosity profile polyolefin composition (most preferably a filled polyolefin composition)." Ex. 1008, 5:44–50. Like Tojo's separator, the filler material in Lundquist's composite layer may be particles of silicon or aluminum oxide. *Id.* at 7:39–42. As Petitioner discusses, Lundquist discloses that the polymeric component of its inorganic particle-containing layer can be made using PTFE-propylene copolymers. Pet. 36; Ex. 1008, 5:25–32.

Because Tojo teaches that essentially any conventional polymeric material used in batteries can be used as its inorganic particle binder material, and because Lundquist, in turn, teaches that PTFE copolymers are useful as a binder material for inorganic particles in a battery separator containing the same two layers contained in Tojo's separator, we find that that an ordinary artisan would have been prompted to use Lundquist's PTFE copolymers as the binder material in Tojo's separator.

Patent Owner's arguments and evidence do not persuade us to the contrary.

Patent Owner contends that, because Tojo identifies fluoropolymers as a class of compound often used to form separators (Ex. 1007 ¶ 2), but then omits fluoropolymers from the list of appropriate binder compounds for its ceramic composite layer (*id.* ¶ 22), "Tojo teaches a POSITA [person of ordinary skill in the art] not to use fluoropolymers like PTFE as a binder material." PO Resp. 38 (citing Ex. 2002 ¶ 119 (White Decl.)).

A reference does not teach away, however, "if it merely expresses a general preference for an alternative invention but does not 'criticize, discredit, or otherwise discourage' investigation into the invention claimed." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (citing *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)).

Patent Owner does not direct us to disclosures in Tojo that clearly or specifically criticize or discredit the use of fluoropolymers as the matrix material in its ceramic composite layer. Moreover, as noted above, and as Petitioner points out (Reply 13–14), Tojo's teaching regarding its matrix material is rather expansive. *See* 1007 ¶ 22 ("*The binders are not particularly limited*, as long as they are conventionally in use, and examples

include various polyesters, polyolefins, rubbers, acrylic resins, *or the like* . . . .") (emphases added). Given this expansive disclosure, we agree with Petitioner that an ordinary artisan would not have viewed Tojo's failure to include fluoropolymers in its list of binder materials as a teaching away, even in light of the earlier mention of fluoropolymers as known separator materials.

Patent Owner contends that, because Tojo teaches that the compounds used in its separators should be hard, whereas PTFE is a soft compound that when cured in the manner described in Tojo would yield a pliable material that is not hard, "a POSITA would not look to use PTFE as the binder in Tojo's protective surface layer. In fact, Tojo teaches away from such use." PO Resp. 39 (citing Ex. 2015 ¶ 27 (Wensley Decl.); Ex. 2002 ¶ 120 (White Decl.))

We acknowledge Patent Owner's evidence that PTFE is a soft compound that, when cured, produces a pliable product that is not hard. Nonetheless, as Petitioner points out (Reply 15), Tojo does not use its binder material by itself, but instead as one component of a composite, which includes a significant proportion of inorganic particles. *See* Ex. 1007 ¶¶ 22, 44, 45. Moreover, as Petitioner points out also (Reply 15), Tojo characterizes polyolefins as "soft materials" (Ex. 1007 ¶ 5), yet states expressly that polyolefins are suitable as its binder material. *Id.* ¶ 22. Given this disclosure that soft materials can be used as a binder in Tojo's ceramic composite layer, and yield a layer having acceptable surface hardness, we agree with Petitioner that an ordinary artisan would not have been dissuaded from using Lundquist's PTFE as the binder material in Tojo's ceramic composite layer.

Patent Owner contends that, because Lundquist is concerned with the composition of the battery separator itself, and addresses the thermal runaway issue, whereas Tojo is concerned with maintaining separator membrane integrity during assembly and storage of a secondary lithium ion battery, an ordinary artisan "would have no reason to make the substitution as asserted because the two references address different problems. Indeed, the addition of Lundquist does not improve on any identified problem or deficiency considered in Tojo." PO Resp. 39 (citing Ex. 2002 ¶¶ 116–118.)

Even if the references do not address precisely the same problems, both Tojo and Lundquist are in the field of lithium battery separators, as Petitioner contends (Reply 15), and both describe similar multi-layer separators that include organic particles in one of the layers to provide added strength to the separator. *See* Ex. 1007 ¶ 3; *id.* at Abstract; Ex. 1008, 2:44–50, 5:44–50, 7:39–42. Accordingly, we find that an ordinary artisan would have looked to Lundquist when determining binder materials suitable for use in Tojo's ceramic composite layer.

Patent Owner contends that using Lundquist's PTFE as the binder/matrix material in Tojo's ceramic composite layer would not have been a simple substitution because

> [s]electing a compound suitable for use in the environment of a lithium ion battery involves several steps, for example choosing the appropriate solvent system, determining the appropriate mechanism for developing the binder and inorganic compound mix, and the matrix material's suitability for use in a battery. Each candidate compound must be evaluated and manipulated in different ways to determine whether it is a suitable matrix material.

PO Resp. 40 (citing Ex. 2015 ¶¶ 14–28 (Wensley Decl.); Ex. 2002 ¶¶ 121–22 (White Decl.)).

We are not persuaded. As noted above, Lundquist discloses that the polymeric component of its inorganic particle-containing layer can include PTFE-propylene copolymers. Ex. 1008, 5:25–32. That using Lundquist's PTFE copolymers as the matrix component of Tojo's ceramic composite layer would have required consideration of the factors outlined by Patent Owner and its experts does not persuade us that those references would have failed to prompt an ordinary artisan to make the substitution posited by Petitioner.

To the contrary, as Petitioner points out (Reply 16), Patent Owner's expert on this issue, Dr. Wensley, states that the considerations involved in using a particular polymer as a matrix material for inorganic particles in a separator were factors that an ordinary artisan would have been aware of in making a composite layer. *See* Ex. 2015 ¶ 19 (discussing polymer/inorganic combinations "a person having ordinary skill in the art would not use"); *see also* Ex. 2002 ¶ 122 (Dr. White citing to ¶¶ 14–24 of Dr. Wensley's Declaration).

In sum, having considered the prior art advanced by Petitioner in light of Patent Owner's arguments and evidence regarding the cited references' teachings, we find, based on the teachings in those references, that an ordinarily skilled artisan would have been prompted to substitute Lundquist's PTFE copolymers for the matrix materials used in the ceramic composite layer of Tojo's separator. Accordingly, Petitioner persuades us that an ordinary artisan would have been prompted to prepare a separator having all of the features of claims 7–9.

Claims 4, 11, and 12 stand on a different footing, however. Claims 4 and 11, because they depend from claim 1, include claim 1's requirement that the separator be adapted to at least block dendrite growth and prevent electronic shorting. Claim 12 recites that limitation expressly. Ex. 1001, 6:18–20.

As discussed above, Petitioner has not established that Tojo's separator includes that feature, because of the pores in Tojo's ceramic composite layer. Thus, even if an ordinary artisan were to substitute Lundquist's PTFE copolymers for the polymeric binder material used in Tojo's ceramic composite layer, the resulting layer would, nonetheless, have the pores that Tojo teaches should be present in that layer. Therefore, for the reasons discussed above as to Tojo alone, Petitioner has not proven that the posited combination of Tojo and Lundquist would result in a separator having the dendrite-blocking feature required by claims 4, 11, and 12.

Accordingly, because Petitioner has not shown that the combination of Tojo and Lundquist teaches or suggests all of the features required by claims 4, 11, and 12, we conclude that Petitioner has not established by a preponderance of the evidence that claims 4, 11, and 12 are unpatentable under 35 U.S.C. § 103 as obvious over Tojo and Lundquist.

2. Secondary Considerations/Objective Indicia

Before concluding whether the challenged claims would have been obvious, in addition to the teachings in the prior art, the objective indicia of nonobviousness must be considered "as part of all the evidence, not just when the decision maker remains in doubt after reviewing the art." *Eurand, Inc. v. Mylan Pharm. Inc. (In re Cyclobenzaprine Hydrochloride Extended–*

Release Capsule Patent Litig.), 676 F.3d 1063, 1076–77 (Fed. Cir. 2012) (citation omitted).

Although Petitioner bears the ultimate burden of persuasion under 35 U.S.C. § 316(e), as Petitioner contends (Reply 18), "[f]or objective evidence to be accorded substantial weight, its proponent [Patent Owner] must establish a nexus between the evidence and the merits of the claimed invention." *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). In particular, the objective indicia "must be tied to the novel elements of the claim at issue" and must "'be reasonably commensurate with the scope of the claims.'" *Institut Pasteur & Universite Pierre Et Marie Curie v. Focarino*, 738 F.3d 1337, 1347 (Fed. Cir. 2013) (quoting *Rambus Inc. v. Rea*, 731 F.3d 1248, 1257 (Fed. Cir. 2013)).

As noted above, Petitioner has not shown that the prior art evidence of obviousness teaches or suggests separators having all of the features required by claims 4, 11, and 12. Accordingly, we need only consider the objective evidence of nonobviousness as it relates to claims 7–9, the remaining claims challenged as obvious over Tojo and Lundquist.

Patent Owner contends that objective evidence of nonobviousness shows that the claimed separator solved a long-felt need (PO Resp. 44–46); was copied by LG Chem, the alleged infringer in one of the copending district proceedings (*id.* at 46–49); achieved wide industry acceptance (*id.* at 49–51); and experienced significant commercial success (*id.* at 51–56).

Petitioner replies, essentially, that Patent Owner has failed to establish adequately a nexus between the objective indicia advanced by Patent Owner and the subject matter recited in the claims. Reply 16–25. Petitioner also

contends that Patent Owner has incorporated excessive argument into its Response from its supporting documents. *Id.* at 17.

As to incorporation by reference, 37 C.F.R. § 42.6(a)(3) states that "[a]rguments must not be incorporated by reference from one document into another document."

To show a nexus between the claims and the objective evidence of nonobviousness, Patent Owner relies on testimony by Dr. White from one of the copending district court proceedings noted above, to establish that LG Chem's allegedly infringing product contains all of the features of the claims. *See* PO Resp. 48, 52. Specifically, in addition to the declaration by Dr. White prepared for this proceeding (Ex. 2002), Patent Owner cites to a declaration by Dr. White submitted in support of Patent Owner's motion for preliminary injunction in the copending district court litigation (Ex. 2903 ("White PI Declaration")). PO Resp. 48, 52.

Patent Owner cites to numerous paragraphs of the White Declaration prepared for this proceeding, but does not, in its Response, discuss with any specificity the information and arguments presented in that Declaration. *See* PO Resp. 48 (citing Ex. 2002 ¶¶ 161–204); *id.* at 52 (same). The White Declaration itself, in turn, cites extensively to additional evidence, including a Declaration by Premanand Ramadass (Ex. 2907), which was also prepared to support Patent Owner's motion for preliminary injunction in the copending infringement proceeding. Ex. 2002 ¶¶ 183, 185–190, 192, 196.

Patent Owner also cites to Exhibits 13, 17, and 21 of the White PI Declaration. PO Resp. 48, 52. Exhibits 13, 17, and 21 of the White PI Declaration contain extensive claims charts and analysis. *See* Ex. 2903 at Exhibit 13, 1–8; *id.* at Exhibit 17, 1–11; *id.* at Exhibit 21, 1–20. As to

claims 7–9 at issue here, only claim 7 is discussed, which occurs at pages 3–7 of Exhibit 17 of the White PI Declaration, and at pages 6 through 13 of Exhibit 21 of the White PI Declaration.

In its Patent Owner Response, however, Patent Owner does not discuss with any specificity the information or arguments presented in the two declarations by Dr. White, the accompanying claim charts, or the accompanying declaration by Mr. Ramadass. Accordingly, Petitioner persuades us that Patent Owner's Response improperly incorporates by reference the arguments and claims analysis from both of Dr. White's declarations, as well as the declaration by Mr. Ramadass.

Even disregarding the procedural infirmities in Patent Owner's Response, however, Petitioner persuades us that the evidence of secondary considerations is not entitled to substantial weight, because Patent Owner has not established a sufficient nexus between the merits of the claimed subject matter and that evidence. Petitioner persuades us also that the evidence of secondary considerations is not reasonably commensurate in scope with the claimed subject matter.

As evidence of nexus, Patent Owner relies on the district court's order granting a preliminary injunction to show that LG Chem's allegedly infringing product, on which Patent Owner bases most of its contentions regarding secondary considerations of obviousness, includes all of the features of the challenged claims. PO Resp. 48, 52 (citing Ex. 2904 ("PI Order")).

As Petitioner contends (Reply 20), the PI Order mentions only claim 1 of the '586 patent. *See* Ex. 2904, 8 ("Having reviewed [the] description of the claims detailed [in] the claim charts, it appears likely that the SRS sold,

offered for sale, used, and imported into this country by defendants infringes at least claim 1 of the '586 patent."). In contrast, as noted above, the objective evidence of nonobviousness is pertinent only to claims 7–9. Moreover, on appeal of the PI Order, the Federal Circuit found that the district court had not made adequate findings of fact regarding infringement, and remanded the case back to the district court. *Celgard, LLC v. LG Chem, Ltd.*, No. 2014-1675, 2015 WL 4757745, at *3, *6 (Fed. Cir. Aug. 12, 2015). Having been reversed, the PI Order does not support Patent Owner's claim of nexus.

As to the issue of long-felt but unsolved need, Patent Owner focuses entirely on the problem of dendrite growth. PO Resp. 44–46. Claims 7–9 do not recite the dendrite-blocking feature, however.

Accordingly, even if there was a long-felt need for a separator that overcame the dendrite growth problem, we agree with Petitioner that Patent Owner has not explained adequately how the separators recited in claims 7–9 meet that need, given that none of those claims requires the separator to be capable of blocking dendrite growth. That is, we agree with Petitioner that Patent Owner has not shown a sufficient nexus between the claimed subject matter and the evidence of long-felt but unsolved need. Nor has Patent Owner shown that claims 7–9 recite subject matter commensurate in scope with an embodiment that solves that need.

As to the issue of copying, Patent Owner contends that it had a business relationship with LG Chem, in which Patent Owner provided base separator material to LG Chem, and LG Chem applied a ceramic coating to that material, thereby practicing the claimed invention. PO Resp. 47–48

(citing Ex. 2915 ¶¶ 6–10, 12, 15, 16 (Paulus Decl.)).[7] Patent Owner contends that, after switching to a different base film supplier, "[r]ather than develop a new product, LG Chem merely copied its old SRS [safety reinforced separator] products it developed with Celgard and which infringe the '586 patent. Thus, this secondary consideration favors a finding of nonobviousness." *Id.* at 49.

As to Patent Owner's contentions regarding copying, we find that Petitioner has the better position as well. The Federal Circuit has explained that "[n]ot every competing product that arguably falls within the scope of a patent is evidence of copying; otherwise, 'every infringement suit would automatically confirm the nonobviousness of the patent.'" *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010) (quoting *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004)). Rather,

> copying requires evidence of efforts to replicate a specific product, which may be demonstrated through internal company documents, direct evidence such as disassembling a patented prototype, photographing its features, and using the photograph as a blueprint to build a replica, or access to the patented product combined with substantial similarity to the patented product.

Id.

As Petitioner contends (Reply 21), in testifying that the product asserted as infringing claim 7 includes all of the claimed features, Dr. White noted that the ceramic composite layer of the allegedly infringing product is

[7] Mr. Paulus testifies that he is Patent Owner's Vice President, Product Development, and that until April of 2014 he was Patent Owner's Director of Marketing, Electric Vehicles. Ex. 2915 ¶ 2.

expressly described as being porous. Ex. 2903 at Exhibit 17, 3 (White PI Decl.). In contrast, as noted above, the ’586 patent describes its ceramic composite layer as nonporous, except for some pores that may result from contact with electrolyte. Ex. 1001, 3:10–12.

Given this significant difference in the description of the ceramic composite layer of the ’586 patent, as compared to that of LG Chem’s allegedly infringing product, Petitioner persuades us that Patent Owner has not advanced evidence adequate to support a finding that LG Chem copied the product described in the ’586 patent.

As to the issue of industry praise and acceptance, Patent Owner advances the testimony of Mr. Paulus as evidence that, as of 2013: (1) about 46% of all plug-in electric vehicles in the United States used batteries with ceramic coated separators; (2) that figure was 70.8% when calculated by megawatt hour; (3) about 56% of all plug-in electric vehicles sold in the United States having a ceramic-coated battery separator were supplied by LG Chem; and (4) LG Chem supplies batteries to 26% of all plug-in vehicles sold in the United States that use a lithium-ion battery. PO Resp. 49–50 (citing Ex. 2915 ¶¶ 21–24 (Paulus Decl.)). Moreover, Patent Owner contends, “[i]ndustry participants have adopted advertising materials touting the benefits of and importance of ceramic coating on safety and more specifically in the prevention of dendrite growth.” *Id.* at 50–51 (citing Ex. 2002 ¶¶ 156, 158, 210–215; Ex. 2901; Ex. 2902; Ex 2903 at Exhibit 11; Ex. 2912).

For the reasons discussed above, Petitioner persuades us that the granting of the preliminary injunction in the related district court proceeding does not demonstrate a nexus between the subject matter recited in claims 7–

9 and the evidence of industry praise and acceptance. As noted above, moreover, claims 7–9 do not require the ceramic composite layer to be adapted to at least block dendrite growth and prevent electronic shorting, the safety features that Patent Owner contends provide the basis for the cited advertising documents, as well as the alleged industry praise and acceptance.

Further, as Petitioner contends (Reply 23), certain of the advertising documents advanced by Patent Owner point to a number of features, aside from the dendrite blocking and short prevention, as desirable properties of the advertised lithium ion batteries. *See* Ex. 2903 at Exhibit 11 (LG Chem website noting that the "lithium-ion batteries of LG Chem's Mobile Battery Division have outstanding competitiveness in terms of high capacity, ultra slimness, and safety"); Ex. 2912, 1–2 (LG Chem Power Inc. website noting the reliability, cost, power density, energy density, light weight, and environmental friendliness of its lithium-ion batteries). Accordingly, viewing the totality of the record on this issue, Patent Owner has not advanced evidence adequate to establish a sufficient nexus, or commensurateness of scope, between the subject matter recited in claims 7–9, and the evidence of industry praise and acceptance.

As to commercial success, Patent Owner again relies on evidence relating to LG Chem. Specifically, Patent Owner contends it saw "a huge increase in sales once LG Chem started practicing the '586 patent." PO Resp. 53. More specifically, Patent Owner contends, before its relationship with LG Chem, it sold only $10,000,000 worth of base separator material, whereas from 2009 to mid-2013, Patent Owner sold $100,000,000 worth of separator material to LG Chem for ceramic coating and use in electric vehicles. PO Resp. 52–53 (citing Ex. 2915 ¶ 21 (Paulus Decl.)). Patent

Owner contends that LG Chem has stated that it annually sells approximately $2.4 billion of infringing batteries worldwide. *Id.* at 53 (citing Ex. 2002 ¶ 208). Patent Owner reiterates its contentions, noted above, regarding LG Chem's share of the plug-in hybrid battery market. *Id.* at 53–54 (citing Ex. 2915 ¶¶ 23, 24).

Patent Owner contends that the asserted commercial success of LG Chem's allegedly infringing products "is attributable, at least in part to the novel feature of the '586 patent – the ability of the ceramic layer to block dendrite growth." PO Resp. 54. As evidence, Patent Owner directs us to marketing and other statements by LG Chem, which Patent Owner contends advertise the safety of LG Chem's separators. *Id.* at 54–56 (citing Ex. 2002 ¶¶ 211–16; Ex. 2903 at Exhibit 11; Ex. 2912; Ex. 2913). Moreover, Patent Owner contends, "that the commercial success of LG Chem's products is attributable at least in part to the SRS technology is shown by the fact that the ceramic coating increases cost of the total battery and adds mass to the battery and thus decreases driving range," which are negatives that LG would not add to its separators absent some economic benefit. *Id.* at 56.

As noted above, however, claims 7–9 do not require the ceramic composite layer to be adapted to block dendrite growth and prevent shorting. Claims 7–9, therefore, do not include the asserted novel feature to which Patent Owner at least partly attributes LG Chem's commercial success. Patent Owner, moreover, does not explain with any specificity how a separator having the features recited in claims 7–9 would necessarily provide the dendrite-blocking and short-preventing features that Patent Owner alleges provide the improved safety that forms the basis of the asserted commercial success.

We acknowledge Patent Owner's contention that the "extremely high amount of nanoceramic used in [LG Chem's] SRS products leads to tiny, tortuous pores and a layer that is adapted to block dendrite growth—a key element for safe lithium-ion batteries." PO Resp. 55 (citing Ex. 2002 ¶ 215). Patent Owner does not explain with any specificity, however, how or why claims 7–9 require the recited separators to contain ceramic particles of the type and concentration required to provide the dendrite-blocking functionality asserted as the basis for LG Chem's commercial success.

Moreover, as noted above, and as Petitioner contends (Reply 24–25), the advertising documents advanced by Patent Owner point to a number of features, aside from dendrite blocking and short prevention, as desirable properties of the advertised lithium ion batteries. *See* Ex. 2903 at Exhibit 11 (LG Chem website noting that the "lithium-ion batteries of LG Chem's Mobile Battery Division have outstanding competitiveness in terms of high capacity, ultra slimness, and safety"); Ex. 2912, 1–2 (LG Chem Power Inc. website noting the reliability, cost, power density, energy density, light weight, and environmental friendliness of its lithium-ion batteries).

In sum, viewing the totality of the record on this issue, we agree with Petitioner that Patent Owner has not advanced evidence adequate to establish a sufficient nexus, or commensurateness of scope, between the subject matter recited in claims 7–9, and the evidence of commercial success.

3. Ultimate Conclusion of Obviousness

As discussed above, having considered the prior art advanced by Petitioner in light of Patent Owner's arguments and evidence regarding the cited references' teachings, Petitioner persuades us, based on the teachings

in Tojo and Lundquist, that an ordinary artisan would have been prompted to prepare a separator having all of the features of claims 7–9. As also discussed above, having considered Patent Owner's evidence and arguments regarding objective indicia of nonobviousness, Petitioner persuades us that Patent Owner's evidence does not show a sufficient nexus, or commensurate scope, between the subject matter recited in claims 7–9 and the objective indicia.

Accordingly, under these circumstances, taking into consideration the record as a whole, we conclude that Petitioner has shown by a preponderance of the evidence that an ordinary artisan would have considered the separators recited in claims 7–9 obvious in view of Tojo and Lundquist.

As discussed above, however, because Petitioner has not shown that the combination of Tojo and Lundquist teaches or suggest all of the features required by claims 4, 11, and 12, we conclude that Petitioner has not established by a preponderance of the evidence that claims 4, 11, and 12 would have been obvious over those references.

D. Obviousness over Tojo and Kejha

1. Prior Art Evidence of Obviousness

We instituted trial as to claim 10 based on Petitioner's challenge to that claim for obviousness under 35 U.S.C. § 103(a) over Tojo and Kejha. Dec. 25; Pet. 57–58.

Claim 10 recites "[t]he separator according to claim 7 wherein said matrix material is selected from the group consisting of polyvinylidene fluoride and/or polyethylene oxide, their copolymers, and mixtures thereof." Ex. 1001, 5:20–23.

Petitioner contends that Tojo describes a separator having all of the features of claim 10, except for a matrix material composed of polyvinylidene fluoride ("PVDF"), polyethylene oxide ("PEO"), or copolymers thereof. *See* Pet. 51–57. To address that deficiency, Petitioner cites Kejha as evidence that it was known to use those materials in lithium battery separators. *Id.* at 56–58. Thus, Petitioner contends, an ordinary artisan would have considered it obvious to use Kejha's PVDF and PEO "as the resin binder in the protective surface layer taught in [Tojo]," and that "such a use constitutes a simple substitution of one known material for another to obtain predictable results." *Id.* at 50.

Patent Owner contends that an ordinary artisan would not have looked to combine the teachings of Tojo and Kejha in the manner posited by Petitioner, and that selection of a binder material would not have been a simple substitution. PO Resp. 41–43.

Having reviewed Petitioner's analysis and supporting evidence in light of Patent Owner's arguments and evidence, a preponderance of the evidence supports Petitioner's position that an ordinary artisan would have been prompted to substitute Kejha's PVDF and PEO for the polymeric binder material used in the ceramic composite layer of Tojo's separator.

As Petitioner discusses, and as noted above, Tojo provides an expansive teaching regarding the variety of materials that may be used as the binder material in its inorganic particle-containing composite layer. Pet. 53; 1007 ¶ 22.

As Petitioner discusses, Kejha describes using PVDF, PEO, and their copolymers, as battery electrolytes. Pet. 56; *see also* Ex. 1009, 2:45–50 ("The principal object of the invention is to provide a solid state polymer

alloy electrolyte for electrochemical devices which contain mixtures of polyethylene oxide and polyvinyldienefluoride or polyethylene oxide and polyvivyldienefluoride/hexafluoropropylene and which is highly ion conductive.”).

As Petitioner discusses, Kejha discloses that its electrolytes may be combined with inorganic fillers, and may be used as electrode separators. Pet. 50, 56; *see also* Ex. 1009, 5:5–8 (“The electrolytes may be combined with a fibrous woven or non-woven, or expanded film net or mesh to provide a composite electrolyte . . ., *or may be combined with ceramic fillers* . . . .) (emphasis added, citations omitted); Ex. 1009, 5:11–13 (“The electrolyte may be also made as free-standing films, with or without the net, and then laminated into an electrolytic device assembly as a separator.”).

Given Tojo’s expansive teaching regarding materials suitable as the binder component in the inorganic particle-containing layer of its battery separators, and given Kejha’s teaching that PVDF, PEO, and copolymers thereof were binder materials suitable for combination with inorganic particles, as well as being suitable for use as battery separators, we find that an ordinary artisan would have been prompted to use PVDF, PEO, and their copolymers, as the binder material in Tojo’s composite layer.

Patent Owner’s arguments and evidence do not persuade us to the contrary.

Similar to the argument discussed above, Patent Owner contends that, because Tojo identifies fluoropolymers as a class of compound often used to form separators (Ex. 1007 ¶ 2), but then omits fluoropolymers from the list of appropriate binder compounds for its ceramic composite layer (*id*. ¶ 22), “Tojo teaches a POSITA not to use fluoropolymers like polyvinylidene

fluoride [PVDF] as a binder material." PO Resp. 41 (citing Ex. 2002 ¶¶ 119, 133–135 (White Decl.)).

For essentially the reasons discussed above, we find that Tojo does not teach away from using PVDF as a binder material. Patent Owner does not direct us to disclosures in Tojo that clearly or specifically criticize or discredit the use of fluoropolymers as the matrix material in its ceramic composite layer.

Moreover, as noted above, and as Petitioner points out (Reply 13–14), Tojo's teaching regarding its matrix material is rather expansive. *See* 1007 ¶ 22 ("*The binders are not particularly limited*, as long as they are conventionally in use, and examples include various polyesters, polyolefins, rubbers, acrylic resins, *or the like* . . . .") (emphases added).

Given this expansive disclosure, we agree with Petitioner that an ordinary artisan would not have viewed Tojo's failure to include fluoropolymers in its list of binder materials as a teaching away, even in light of the earlier mention of fluoropolymers as known separator materials. We acknowledge Patent Owner's argument that Kejha's PEO does not fall within the compound classes specifically mentioned by Tojo. PO Resp. 41. In view of the breadth of Tojo's teaching regarding its binder, however, and given Kejha's disclosure, discussed above, that PEO was suitable for combination with inorganic particles to yield a product suitable for use as a battery separator, an ordinary artisan would have been prompted to use PEO as Tojo's binder.

Patent Owner contends that, because PVDF and PEO are soft compounds that when cured in the manner described in Tojo would yield pliable materials that are not hard, neither PVDF nor PEO would achieve the

surface hardness required of Tojo's separators. *Id.* at 41–42 (citing Ex. 2015 ¶ 27 (Wensley Decl.); Ex. 2002 ¶ 136 (White Decl.))

We acknowledge Patent Owner's evidence that PVDF and PEO are soft compounds that, when cured, produce pliable products that are not hard. Nonetheless, as Petitioner points out (Reply 15), Tojo does not use its binder material by itself, but instead as one component of a composite, which includes a significant proportion of inorganic particles. *See* Ex. 1007 ¶¶ 22, 44, 45. Moreover, as Petitioner points out also (Reply 15), Tojo characterizes polyolefins as "soft materials" (Ex. 1007 ¶ 5), yet states expressly that polyolefins are suitable as its binder material. *Id.* ¶ 22. Given this disclosure that soft materials can be used as a binder in Tojo's ceramic composite layer, and yield a layer having acceptable surface hardness, we agree with Petitioner that an ordinary artisan would not have been dissuaded from using Kejha's PVDF and PEO as the binder material in Tojo's ceramic composite layer.

Patent Owner contends that, because Tojo is concerned with the composition of the battery separator itself, and addresses the thermal runaway issue, whereas Kejha is concerned with a type of electrolyte for use in a lithium cell, an ordinary artisan would have had "no reason to make the substitution as Petitioner asserts because the two references are addressing different problems." PO Resp. 42 (citing Ex. 2002, ¶¶ 129–33.)

Even if the references do not address precisely the same problems, both Tojo and Kejha are in the field of lithium batteries, as Petitioner contends (Reply 15), and, as discussed above, both describe polymer/inorganic particle blend materials suitable for use in battery separators. Accordingly, we find that an ordinary artisan would have looked

to Kejha when determining binder materials suitable for use in the ceramic composite layer of Tojo's separator.

Patent Owner contends that an ordinary artisan could not select PVDF or PEO, based solely on the teachings of Tojo and Kejha, because

> [t]he process that a person of ordinary skill in the art who is evaluating a matrix material that could be mixed with inorganic microparticles and used in a battery involves several steps. These steps may include choosing the appropriate solvent system, determining the appropriate mechanism for developing the binder and inorganic compound mix, and the matrix material's suitability for use in a battery. Each candidate compound must be evaluated and manipulated in different ways to determine whether it is a suitable matrix material.

PO Resp. 42–43 (citing Ex. 2015 ¶¶ 14–24 (Wensley Decl.); Ex. 2002 ¶ 137–38 (White Decl.)).

We are not persuaded. As noted above, Kejha discloses that the polymeric component of its electrolyte films may be PVDF, PEO, or copolymers thereof, and that the polymer component may be combined with inorganic fillers. *See* Ex. 1009, 2:45–50, 5:5–8. That using Kejha's PVDF and/or PEO as the matrix component of Tojo's ceramic composite layer would have required consideration of the factors outlined by Patent Owner and its experts does not demonstrate that the substitution posited by Petitioner would have been unobvious to an ordinary artisan.

To the contrary, as Petitioner points out (Reply 16), Patent Owner's expert on this issue, Dr. Wensley, states that the considerations involved in using a particular polymer as a matrix material for inorganic particles in a separator were factors that an ordinary artisan would have been aware of. *See* Ex. 2015 ¶ 19 (discussing polymer/inorganic combinations "a person

having ordinary skill in the art would not use"); *see also* Ex. 2002 ¶ 138 (Dr. White citing to ¶¶ 14–24 of Dr. Wensley's Declaration).

In sum, having considered the prior art advanced by Petitioner in light of Patent Owner's arguments and evidence regarding the cited references' teachings, we find, based on the teachings in the references, that an ordinarily skilled artisan would have been prompted to substitute Kejha's polymers for the matrix materials used in the ceramic composite layer of Tojo's separator. Accordingly, Petitioner persuades us that an ordinary artisan would have been prompted to prepare a separator having all of the features of claim 10.

2. Secondary Considerations/Objective Indicia

As discussed above, Patent Owner contends that objective evidence of nonobviousness shows that the claimed separator solved a long-felt need (PO Resp. 44–46), was copied by LG Chem, the alleged infringer in one of the copending district proceedings (*id.* at 46–49), achieved wide industry acceptance (*id.* at 49–51), and experienced significant commercial success (*id.* at 51–56).

Also as discussed above, Petitioner contends that Patent Owner has failed to establish adequately a nexus between the objective indicia advanced by Patent Owner and the subject matter recited in the claims. Reply 16–25.

We find Petitioner's arguments persuasive.

Claim 10 depends from claim 7 and does not require the claimed separator to at least block dendrite growth and prevent electronic shorting. Accordingly, for the reasons discussed above, we are not persuaded that the

separator recited in claim 10 solves the asserted long-felt need of blocking dendrites.

As to the issues of copying, industry praise, and commercial success, as noted above, Patent Owner relies on allegedly infringing products made by LG Chem to show a nexus between the claims and those secondary considerations. PO Resp. 47–52. Patent Owner does not direct us, however, to any clear or specific comparison between the allegedly infringing product and claim 10. As discussed above, moreover, the order granting the preliminary injunction in the district court proceeding did not mention claim 10, and was ultimately overturned by the Court of Appeals for the Federal Circuit. *See* Ex. 2904; *Celgard*, 2015 WL 4757745, at *3, *6.

Accordingly, Petitioner persuades us that Patent Owner has not established that the allegedly infringing product, upon which Patent Owner bases its contentions of copying, industry acceptance, and commercial success, includes all of the features of the separator recited in claim 10. Patent Owner, therefore, has not established an adequate nexus between its evidence of secondary considerations and the subject matter recited in claim 10.

3. Ultimate Conclusion of Obviousness

As discussed above, having considered the prior art advanced by Petitioner in light of Patent Owner's arguments and evidence regarding the cited references' teachings, Petitioner persuades us that an ordinary artisan would have been prompted by the teachings in Tojo and Kejha to prepare a separator having all of the features of claim 10. As also discussed above, having considered Patent Owner's evidence and arguments regarding objective indicia of nonobviousness, Patent Owner's evidence does not show

a sufficient nexus, or commensurate scope, between the subject matter recited in claim 10 and the objective indicia.

Accordingly, under these circumstances, taking into consideration the record as a whole, we conclude that Petitioner has shown by a preponderance of the evidence that an ordinary artisan would have considered the separator recited in claim 10 obvious in view of Tojo and Kejha.

E. Motions to Exclude Evidence

1. Petitioner's Motion to Exclude

a. Dr. White's Deposition Testimony (Ex. 1040)

Petitioner moves to exclude portions of Dr. White's redirect testimony (Ex. 1040, 150:2–154:13 (White Deposition)) as being substantially more prejudicial than probative under Federal Rule of Evidence ("FRE") 403 because Dr. White's testimony in those portions was the result of improper coaching. Pet. Mot. to Exclude 2–6; Pet. Reply Opp. 1–2.

Patent Owner contends that Dr. White was not coached, but was instead instructed not to answer questions involving allegedly privileged subject matter that was discussed during a witness conference between cross-examination and redirect examination. PO Opp. 1–5.

We deny Petitioner's motion to exclude the disputed testimony. That Dr. White's testimony in the disputed portion of his deposition might be inconsistent with his testimony elsewhere in his deposition, or inconsistent with his declaration testimony, goes to his credibility and to the ultimate weight to be accorded to the disputed testimony.

b. Exhibits 2013 and 2016

Petitioner moves to exclude Exhibits 2013 and 2016 as irrelevant under FRE 401 and 402 because Patent Owner did not rely on these documents with any particularity during this proceeding. Pet. Mot. to Exclude 6–7.

Patent Owner responds that, "[w]hile Exhibits 2013 and 2016 were not cited by Patent Owner with regard to this petition, they provide useful background regarding the knowledge of one of ordinary skill in the art and are thus relevant under 401 and 402." PO Opp. 5.

Because Patent Owner did not cite Exhibits 2013 and 2016 in this proceeding, we grant Petitioner's Motion to Exclude Exhibits 2013 and 2016.

c. Wensley Declaration (Ex. 2015)

Petitioner moves to exclude the Wensley Declaration under FRE 602 because Patent Owner presented no evidence that Dr. Wensley had any firsthand knowledge regarding the properties of polymers to which he testified in ¶¶ 27 and 28. Pet. Mot. to Exclude 7.

Patent Owner responds that FRE 602 rule does not apply to a witness's expert testimony under FRE 703, and that Dr. Wensley qualifies as an expert, as well as having firsthand experience, in the subject matter of the disputed testimony, as demonstrated by his Declaration and CV (Ex. 2017). PO Opp. 5–6.

Given Dr. Wensley's experience (*see* Ex. 2015 ¶¶ 2–7; Ex. 2017), we agree with Patent Owner that Dr. Wensley qualifies to testify as an expert regarding the subject matter at issue and, therefore, deny Petitioner's motion to exclude his declaration.

d. Exhibits 2900–2903, 2905, and 2911–2913

Petitioner moves to exclude as hearsay under FRE 801 and 802 Exhibits 2900–2903, 2905, and 2911–2913, which include materials from the websites of Avicense, MTI, Ube, LG Chem, and Green Car Congress, advanced by Patent Owner as evidence of commercial success of ceramic composite separators. Pet. Mot. to Exclude 7–10.

Patent Owner responds that under FRE 703 it is proper for its expert, Dr. White, to rely on otherwise inadmissible evidence in forming his opinion. PO Opp. 7. Patent Owner contends, moreover, that FRE 703 allows the proponent of the expert opinion to disclose the evidence underlying the opinion to the jury if the probative value of the evidence outweighs its prejudicial effect. *Id.* In that regard, Patent Owner contends, Petitioner has identified no prejudice in admitting the disputed exhibits. *Id.*

Petitioner replies that FRE 703 is not intended to be a vehicle for evading the prohibition against hearsay evidence. Pet. Reply Opp. 2–3.

We agree with Patent Owner on this issue. As Patent Owner contends, FRE 703 allows the proponent of the expert opinion to disclose the evidence underlying an expert opinion to the jury if the "probative value in helping the jury evaluate the opinion substantially outweighs [its] prejudicial effect."

As evidenced by the discussion on the merits above, we find that these exhibits have substantial probative value in helping us to evaluate Dr. White's opinion. Moreover, because the Board is not a lay jury, and has significant experience in evaluating expert testimony, the danger of prejudice in this proceeding is considerably lower than in a conventional district court trial.

In sum, for the reasons discussed, we deny Petitioner's motion to exclude Exhibits 2900–2903, 2905, and 2911–2913.

e. Ramadass Declaration (Ex.2907)

Petitioner moves to exclude under FRE 403 the Declaration of Mr. Premanand Ramadass, which was prepared by Patent Owner in support of its motion for preliminary injunction in the copending district court infringement proceeding, and which was cited by Dr. White at ¶¶ 183, 185–190, 192, and 196 of his declaration (Ex. 2002). Pet. Mot. to Exclude 10–14. Among other things, Petitioner asserts prejudice in that Mr. Ramadass failed to agree to appear at a deposition. *Id.* at 12.

Patent Owner, among other things, contends that Petitioner was not prejudiced, as evidenced by Petitioner's submission of a subsequent declaration by Mr. Ramadass. PO Opp. 10–11 (citing Ex. 1052).

Paragraphs 183, 185–190, 192, 196 of the White Declaration were advanced by Petitioner to show that LG Chem's allegedly infringing product contained all of the features of claims 1 and 4 of the '586 patent, and that a nexus therefore existed between those claims and the secondary evidence of nonobviousness. *See* Ex. 2002 ¶ 198 (concluding based on the previous paragraphs citing the Ramadass Declaration, that "it is my opinion that the LG Chem-coated Celgard base films have each and every element of claims 1 and 4 of the '586 patent").

As discussed above, however, the secondary evidence of nonobviousness is pertinent only to claims 7–10 of the '586 patent. Accordingly, because the disputed testimony in the Ramadass Declaration relates to claims 1 and 4 of the '586 patent, and therefore, is not pertinent to

claims 7–10, we dismiss Petitioner's motion to exclude the Ramadass Declaration as moot.

f. Paulus Declaration (Ex. 2915)

Petitioner moves to exclude under FRE 602 certain paragraphs of the Paulus Declaration because the declaration does not adduce any evidence that Mr. Paulus had any firsthand knowledge of the matters asserted in those portions of the declaration. Pet. Mot. to Exclude 15. Petitioner moves to exclude under FRE 701 certain other paragraphs of the Paulus Declaration because Mr. Paulus does not qualify as an expert in this field.

As Patent Owner contends, however (PO Opp. 13), Mr. Paulus states expressly in his declaration that he has "personal knowledge of the matters set forth in this declaration, except where otherwise indicated, and if called to testify I could and would competently testify to them." Ex. 2915 ¶ 1.

Petitioner provides no clear basis for refuting Mr. Paulus's express statement. Moreover, Paulus testified based on his personal knowledge, not as an expert. That Mr. Paulus might not have provided documentary support for all of his testimony goes to his credibility and to the ultimate weight to be accorded to the disputed testimony, and is not an adequate basis for exclusion. Accordingly, we deny Petitioner's motion to exclude the Paulus Declaration.

2. Patent Owner's Motion to Exclude

a. Dr. Arnold's Testimony

Patent Owner moves to exclude under FRE 402 and 702 the entirety of Dr. Arnold's testimony in both his declaration (Ex. 1004) and deposition (Ex. 2009). PO Mot. to Exclude 1. We deny Patent Owner's motion.[8]

As to Dr. Arnold's alleged failure to understand the legal concepts involved in determining anticipation and obviousness (PO Mot. to Exclude 3–5), as Petitioner contends (Pet. Opp. 3–7), Dr. Arnold ultimately opined as to technical issues rather than legal issues, as evidenced by his declaration's concluding statement, to which Patent Owner directs us. Ex. 1004 ¶ 142 ("[I]t is my opinion that [Tojo], either individually or in combination with other references, discloses or suggests the features recited in claims 1–12 of the '586 patent.").

We are not persuaded, moreover, that any potential deficiencies in Dr. Arnold's understanding of the legal concepts of unpatentability warrant excluding his testimony entirely. *See Nutrition 21 v. United States*, 930 F.2d 867, 871 n.2 (Fed. Cir. 1991) ("An expert's opinion on the ultimate legal conclusion is neither required nor indeed 'evidence' at all.") (citing *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 767 (Fed. Cir. 1988)).

As to the issue of whether Dr. Arnold authored his declaration (PO Mot. to Exclude 4–5), Dr. Arnold signed his declaration, and it includes the proper averment regarding the truth of the statements contained therein. Ex. 1004, 63–64.

---

[8] Because we deny Patent Owner's motion on the merits, we decline to decide whether Patent Owner's objections were identified with sufficient particularity. *See* Pet. Opp. 1–2.

Because his testimony was directed ultimately to technical issues, Patent Owner also does not persuade us that Dr. Arnold's alleged failure to apply a claim construction consistent with the Board's (PO Mot. to Exclude 5–8) warrants exclusion of all of his testimony. Indeed, Patent Owner does not explain adequately how adoption of a particular claim construction would have changed the technical aspects of his testimony. Moreover, the alleged deficiencies in Dr. Arnold's analysis of Tojo (*id.* at 7–8) go to the weight to be accorded his testimony rather than its admissibility.

Patent Owner also does not persuade us that Dr. Arnold fails to qualify as an expert in the art at issue. *See* PO Mot. to Exclude 8–10.

As Petitioner contends (Pet. Opp. 11–12), in addition to his Ph.D. in physics (Ex. 1004 ¶ 4), Dr. Arnold testifies that he has co-authored at least eleven articles relating to lithium batteries, at least three of which involve lithium battery separators, and at least three of which involve dendrite growth. Ex. 1004 ¶ 7. Accordingly, that most of Dr. Arnold's research areas as a professor might not involve lithium batteries (PO Mot. to Exclude 9–10), and that Dr. Arnold testified that he was not an industry insider (*id.* at 10), do not persuade us that he is not qualified to testify as an expert under FRE 702. Lastly, as noted above, because the Board, unlike a lay jury, has significant experience in evaluating expert testimony, the danger of prejudice in this proceeding is considerably lower than in a conventional district court trial.

In sum, for the reasons discussed, we deny Patent Owner's motion to exclude Dr. Arnold's testimony.

b. The Translation of Tojo (Ex. 1007)

Patent Owner moves to exclude the translation of Tojo presented in this proceeding (Ex. 1007), because that document allegedly differs in many respects from the translation of Tojo (Ex. 2012) presented in the copending challenge to the claims of the ’586 patent in IPR2014-00692. PO Mot. to Exclude 10–12.

The translation of Tojo in the instant proceeding was accompanied by the required translator affidavit, as Petitioner contends (Pet. Opp. 14; Ex. 1007, 1), and Patent Owner directs us to no clear or specific evidence suggesting that the translation presented in this proceeding is inaccurate. The fact that certain terms might not have been translated in precisely the same manner in the copending proceeding (*see* PO Mot. to Exclude 11–12 (“openings” versus “open holes”)) does not persuade us that the translation of record in this proceeding is substantively inaccurate. Accordingly, we deny Patent Owner’s motion to exclude the Tojo translation (Ex. 1007).

III. CONCLUSION

For the foregoing reasons, Petitioner has shown by a preponderance of the evidence that claims 7–10 of the ’586 patent are unpatentable based on the following grounds of unpatentability:

(1) Claims 7–9 under 35 U.S.C. § 103(a) for obviousness over Tojo and Lundquist; and

(2) Claim 10 under 35 U.S.C. § 103(a) for obviousness over Tojo and Kejha.

For the foregoing reasons, Petitioner has not shown by a preponderance of the evidence that claims 1–6, 11, and 12 of the ’586 patent are unpatentable based on the following grounds of unpatentability:

(1) 1–3, 5, 6, and 11 under 35 U.S.C. § 102(b) as anticipated by Tojo; and

(2) Claims 4, 11, and 12 under 35 U.S.C. § 103(a) for obviousness over Tojo and Lundquist.

IV. ORDER

It is ORDERED that claims 7–10 of the ’586 patent have been shown by a preponderance of the evidence to be unpatentable;

FURTHER ORDERED that Petitioner’s Motion to Exclude is granted-in-part, denied-in-part, and dismissed-in-part as moot;

FURTHER ORDERED that Exhibits 2013 and 2016 are excluded from the record;

FURTHER ORDERED that Patent Owner’s Motion to Exclude is denied; and

FURTHER ORDERED that, because this is a final written decision, parties to this proceeding seeking judicial review of our Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

For PETITIONER:

Charles Suh
Anthony Hartmann
Finnegan, Henderson, Farabow, Garrett & Dunner, LLP
charles.suh@finnegan.com
anthony.hartmann@finnegan.com

For PATENT OWNER:

Cyrus Morton
Bryan Vogel
Robins Kaplan LLP
camorton@rkmc.com
BVogel@RobinsKaplan.com