

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHUHAI COSMX BATTERY CO., LTD.,
Petitioner,

v.

NINGDE AMPEREX TECHNOLOGY LIMITED,
Patent Owner.

IPR2025-00405
Patent 11,769,910 B2

Before DONNA M. PRAISS, JOHN G. NEW, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

DENNETT, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Zhuhai CosMX Battery Co., Ltd. (“Petitioner”) filed a Corrected Petition (Paper 3, “Pet.”) requesting *inter partes* review of claims 1–6 and 12–26 (the “challenged claims”) of U.S. Patent No. 11,769,910 B2 (Ex. 1001, “the ’910 patent”). Ningde Ampere Technology Limited (“Patent Owner”) filed a Preliminary Response. Paper 9 (“Prelim. Resp.”). Patent Owner requested discretionary denial of the Petition (Paper 8), which Petitioner opposed (Paper 10). The Director denied Patent Owner’s request for discretionary denial of the Petition and referred the Petition to the Board. (Paper 11).

We have authority to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2025). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted “unless the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least [one] of the claims challenged in the petition.”

For the reasons set forth below, upon considering the Petition, Preliminary Response, and the evidence of record as presently developed, we determine that Petitioner has established a reasonable likelihood of prevailing with respect to at least one challenged claim. Accordingly, we grant the Petition and institute an *inter partes* review.

This decision to institute trial is not a final decision as to patentability of claims for which *inter partes* review is instituted. Our final decision will be based on the full record developed during trial.

II. BACKGROUND

A. *Real Parties-in-Interest*

Petitioner identifies Zhuhai CosMX Battery Co., Ltd. as the real party-in-interest. Pet. 75. Patent Owner identifies Ningde Ampere Technology Ltd. as the real party-in-interest. Paper 4, 1.

B. *Related Proceedings*

The parties identify *Ningde Ampere Technology Limited v. Zhuhai CosMX Battery Co.*, No. 2:24-cv-00728 (E.D. Tex.) (“the parallel litigation”) as involving the ’910 patent. Pet. 75; Paper 4, 1. Patent Owner states that the ’910 patent is a continuation of U.S. Patent No. 10,833,363, which was involved in IPR2023-00586. Patent Owner states that the parallel litigation involves additional patents that are the subject of additional petitions by the same Petitioner for *inter partes* review of patents at issue in the proceedings listed below:

Proceeding No.	U.S. Patent No.
IPR2025-00385	10,964,927 B2
IPR2025-00389	11,923,498 B2
IPR2025-00432	11,575,148 B2

Patent Owner also identifies a Petition for Correction of Inventorship Under 37 CFR § 1.324 pending in U.S. Application No. 18/076,882 (which corresponds to U.S. Patent No. 11,769,910), which was filed on Oct. 8, 2024.

C. *Technology Overview*

The technology of the ’910 patent broadly relates to lithium-ion batteries. A typical lithium-ion battery has a positive electrode (cathode), a negative electrode (anode), a separator, and an electrolyte. Ex. 1003 ¶ 27. The cathode typically comprises a current collector and a layered active

material that in the discharged state contains lithium, while the anode typically comprises a current collector with a layered active material capable of receiving lithium ions. *Id.* The separator prevents physical contact between the cathode and anode, which would cause a short circuit. The electrolyte serves as the medium through which lithium ions travel between the cathode and the anode, and comprises lithium salt, solvent, and optional additives. *Id.*

Lithium ions shuttle back and forth between the anode (negative) and cathode (positive) electrodes during cycling. Ex. 2015 ¶ 41. During the first few cycles of the lithium-ion battery the electrolyte undergoes reduction at the anode, and oxidation at the cathode, forming a passive protective layer on the anode and cathode called the solid electrolyte interphase (SEI), comprising a mixture of inorganic and organic compounds and especially electrolyte decomposition or other reaction products. *Id.*

In contrast with primary batteries like alkaline batteries, which cannot be recharged because they irreversibly consume chemical energy in the cathode, lithium-ion and other secondary (rechargeable) batteries can be cycled many times. Ex. 1003 ¶ 30. The discharge reaction in lithium-ion batteries can be reversed by forcing a lithium ion to return to the anode, thereby returning the battery to its original, charged composition and structure for additional cycles. *Id.*

For lithium ions to travel between the cathode and anode, the electrolyte must remain stable. Ex. 1003 ¶ 31. The SEI aids in stability of the electrolyte by forming a passivating layer on the electrode through partial decomposition of the electrolyte, predominantly during the first cycle, that inhibits further electrolyte decomposition from side reactions during later

cycles. *Id.* It is electronically insulating but conductive to lithium ions, allowing lithium ions to pass through it but not electrons. *Id.* Higher energy density lithium-ion batteries increase stress on the SEI layer. *Id.* at 32.

D. The '910 Patent

The '910 patent, titled “Electrolyte and Electrochemical Device,” issued Sept. 26, 2023, from U.S. Application 18/076,882, filed Dec. 7, 2022. Ex. 1001, codes (45), (21), (22). The '910 patent is a continuation of U.S. Application No. 17/885,915, filed on Aug. 11, 2022, which is a continuation of U.S. Application No. 17/064,782, filed on Oct. 7, 2020, now U.S. Patent No. 11,522,222, which is a continuation of U.S. Application No. 16/211,853, filed on Dec. 6, 2018, now U.S. Patent No. 10,833,363. *Id.* at code (63). The '910 patent claims priority to China Application No. 201811108529, filed Sept. 21, 2018. *Id.* at code (30).

The '910 patent concerns electrolytes used in electrochemical devices with working voltages above 4.4V. Ex. 1001, 1:31–32. According to the '910 patent, “at high voltages, the oxidation activity of the positive electrode material increases, and the stability decreases which makes the electrolyte decompose on the surface of the positive electrode easily or cause[s] deterioration of the battery material, resulting in a decrease in battery capacity.” *Id.* at 1:33–40. The '910 Patent discloses an electrolyte for use in high voltage electrochemical devices comprising a mixture of a dinitrile compound, a trinitrile compound, and propyl propionate (“PP”), that forms a firm protective film that is not easily decomposed on the surface of the cathode at a high potential. *Id.* at 1:57–63.

The '910 patent discloses various weight percentages of dinitrile (*X*), trinitrile (*Y*), and propyl propionate (*Z*)—based on the total weight of the

electrolyte—that purportedly form a durable solid electrolyte interphase (SEI) film. Ex. 1001, 6:1–34. The '910 patent provides four parameters ($X+Y$, X/Y , Z , and Y/Z) whose values are specified by ranges. *Id.* at 6:1–67, 23:30–27:60. The '910 patent measured performance with three metrics: inhibiting rise in internal resistance, reducing expansion rate, and maintaining voltage capacity during high-temperature battery storage and cycling. *See* Ex. 1001, 24:9–25:7.

E. Illustrative Claim

Claim 1 illustrates the challenged claims in the '910 patent, and is reproduced below with Petitioner's annotations:¹

- [1.pre] An electrolyte, comprising
- [1.1] a dinitrile compound, a trinitrile compound, and propyl propionate,
- [1.2] wherein, based on a total weight of the electrolyte, a weight percentage of the dinitrile compound is X , a weight percentage of the trinitrile compound is Y ... ; wherein, about $2.2 \text{ wt}\% \leq (X+Y) \leq \text{about } 8 \text{ wt}\%$, about $0.1 \leq (X/Y) \leq \text{about } 2.3$, and
- [1.3] a weight percentage of the propyl propionate is Z ; wherein ... $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$ or $30 \text{ wt}\% \leq Z \leq 50 \text{ wt}\%$, and
- [1.4] about $0.02 \leq (Y/Z) \leq \text{about } 0.3$;
- [1.5] wherein the dinitrile compound is one or more compounds selected from the group consisting of butanedinitrile, adiponitrile, ethylene glycol bis(2-cyanoethyl) ether, and 1,4-dicyano-2-butene; and
- [1.6] the trinitrile compound is one or more compounds selected from the group consisting of 1,3,6-exanetricarbonitrile,

¹ For convenience, we adopt Petitioner's annotated claim format.

1,2,6-hexanetricarbonitrile and 1,2,3-tris(2-cyanoethoxy)propane;

[1.7] wherein the electrolyte further comprises a compound having a sulfur-oxygen double bond.

Ex. 1001, 34:17–38.

F. Asserted Grounds

Petitioner contends that the challenged claims are unpatentable under 35 U.S.C. § 103 based on the grounds presented below.

Ground	Claims	References
1A	1–6, 12, 16–26	• Zeng ²
1B	1–6, 12, 16–26	• Zeng, Matsuoka ³
1C	1–6, 12, 16–26	• Zeng, Matsuoka, Kim ⁴
2A	13, 14	• Zeng, Sunose ⁵
2B	13, 14	• Zeng, Sunose • Zeng, Matsuoka, Sunose
2C	13, 14	• Zeng, Kim, Sunose • Zeng, Matsuoka, Kim, Sunose
3A	15	• Zeng, Sunose, Su ⁶
3B	15	• Zeng, Sunose, Su • Zeng, Matsuoka, Sunose, Su
3C	15	• Zeng, Kim, Sunose, Su • Zeng, Matsuoka, Kim, Sunose, Su

² CN 106099187 A, published Nov. 9, 2016 (Ex. 1005). Petitioner relies on a certified English-language translation of Zeng (Ex. 1006, “Zeng”). Unless otherwise indicated, all citations herein are to the English translation of the corresponding foreign language document.

³ US 2013/0224535 A1, published Aug. 29, 2013 (Ex. 1007, “Matsuoka”).

⁴ US 2017/0288268 A1, published Oct. 5, 2017 (Ex. 1008, “Kim”).

⁵ JP 2009-252349 A, published Oct. 29, 2009 (Ex. 1009). Petitioner relies on a certified English-language translation of Sunose (Ex. 1010, “Sunose”).

⁶ CN 108023117 A, published May 11, 2018 (Ex. 1011, “Su”). Petitioner relies on a certified English-language translation of Su (Ex. 1012)

Ground	Claims	References
4A	1–6, 12, 16–26	• Zhou ⁷
4C	1–6, 12, 16–26	• Zhou, Kim
5A	13, 14	• Zhou, Sunose
5C	13, 14	• Zhou, Sunose • Zhou, Kim, Sunose
6A	15	• Zhou, Sunose, Su
6C	15	• Zhou, Sunose, Su • Zhou, Kim, Sunose, Su

Petitioner also relies on the Declaration of Brett Lucht, Ph.D. *See* Ex. 1003. Patent Owner relies on the Declaration of Dean R. Wheeler, Ph.D. *See* Ex. 2015.

III. ANALYSIS

A. Principles of Law

In an *inter partes* review, “the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

Obviousness is a question of law based on underlying determinations of fact. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966); *Richardson-Vicks, Inc. v. Upjohn Co.*, 122 F.3d 1476, 1479 (Fed. Cir. 1997). A claim is

⁷ CN 105552439 A, published May 4, 2016 (Ex. 1013); Petitioner relies on a certified English-language translation of Zhou (Ex. 1014).

unpatentable as obvious, under 35 U.S.C. § 103, if the differences between the claimed invention and the prior art are such that the claimed invention, as a whole, would have been obvious to a person having ordinary skill in the art, before the effective filing date of the claimed invention. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham*, 383 U.S. at 17–18. Consideration of the *Graham* factors “helps inform the ultimate obviousness determination.” *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1048 (Fed. Cir. 2016) (en banc) “Obviousness does not require absolute predictability of success[;] . . . all that is required is a reasonable expectation of success.” *In re O'Farrell*, 853 F.2d 894, 903–04 (Fed. Cir. 1988) (citations omitted). But a petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

B. Level of Ordinary Skill in the Art

We review the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art before the effective filing date of the claimed invention. *See Graham*, 383 U.S. at 17.

Petitioner contends that as of the effective filing date,

A person of ordinary skill in the art (“POSITA”) of the '910 patent would have had an advanced degree in chemistry, chemical engineering, materials science, or a related field, and

two or more years of experience related to the design, research, evaluation, preparation, and/or manufacture of electrochemical energy storage devices.

Pet. 11 (citing Ex. 1001, 1:19–21 (“the technical field of energy storage technologies, in particular to an electrolyte and an electrochemical device containing the electrolyte”)). Petitioner states that “[t]his level of skill is approximate, and more experience may compensate for less formal or different education, and vice versa.” *Id.* Patent Owner “adopts the definition proposed by Petitioner” for the purposes of the Preliminary Response. Prelim. Resp. 6.

In light of the record before us, and for purposes of this Decision, we adopt Petitioner’s proposal regarding the level of ordinary skill in the art. Based on our review of the ’910 patent and the prior art of record, we determine that the definition offered by Petitioner appears to comport with the qualifications of a person having ordinary skill in the art at issue. We will make any final determination pertaining to the level of ordinary skill in the art, however, on the full trial record.

C. Claim Construction

In interpreting the claims of the ’910 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” *See* 37 C.F.R. § 42.100(b) (2024). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art in light of the written description and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc).

Petitioner submits that “[n]o terms require express construction for purposes of granting the Petition.” Pet. 11. Patent Owner contends that no construction of any specific claim term or phrase is necessary. Prelim. Resp. 7.

As neither party proposes an express construction for our consideration and because we determine that claim construction is not necessary to decide whether to institute, we do not expressly construe any claim terms. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that “only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs.* in the context of an *inter partes* review).

Our determination that claim construction is not necessary is preliminary and we invite the parties to further brief claim construction issues—including alleged inconsistent positions—during trial, if desired. We will base any final claim constructions on the full trial record.

D. Ground 1A: Alleged Obviousness of Claims 1–6, 12, and 16–26 over Zeng

1. Overview of Zeng (Ex. 1006)

Zeng (Chinese Patent Publication CN 106099187 A), titled “Wide-temperature-range homogenous non-aqueous electrolyte solution,” was published on Nov. 9, 2016. Ex. 1006, code (54), (10), (43). Zeng discloses an electrolyte solution containing a non-aqueous organic solvent, electrolyte lithium salt, and additive combination, with the nonaqueous organic solvent being a multi-component homogeneous mixed solvent comprising:

15% ≤ ethylene carbonate (EC) ≤ 35%;

5 % ≤ propylene carbonate (PC) ≤ 15%;

20% ≤ diethyl carbonate (DEC) ≤ 40%;

10% ≤ ethyl propionate (EP) + propyl propionate (PP) ≤ 50%; and

3% ≤ fluorobenzene (FB) ≤ 10%.

Ex. 1006 ¶¶ 11–16. The additive combination comprises fluoroethylene carbonate (FEC), adiponitrile (ADN), and at least one other compound that is a dinitrile or a trinitrile (i.e., having structural formula I:



Id. ¶¶ 17–19, 24. Structural formula is a dinitrile wherein A₁ and A₂ are hydrocarbylenes or partially oxygen-substituted hydrocarbylenes, respectively, having 0–6 carbon atoms, R is a hydrogen atom, methyl, methylene, or cyano- (making the formula a trinitrile). *Id.* ¶ 19. Zeng discloses preferred mass percentages for EC, FEC, ADN, and the dinitrile or trinitrile compound. *Id.* ¶¶ 20–23. Zeng relates: “[e]xcellent high-voltage cycling performance of the battery is ensured by means of the good film-formation performance of” FEC. *Id.* ¶ 34.

Zeng teaches nine Embodiments (examples) and six Comparative Examples. Ex. 1006 ¶¶ 36–47. All of these examples are based on Embodiment 1, which is described as follows:

[0036] Embodiment 1

[0037] Electrolyte solution preparation steps: in a glove box filled with argon gas, ethylene carbonate, propylene carbonate, diethyl carbonate, fluorobenzene, ethyl propionate, and propyl propionate are mixed at a mass ratio of EC:PC:DEC:FB:EP:PP

= 25:10:30:5:10:20; *then, lithium hexafluorophosphate of a concentration of 1.0 mol/L is slowly added to the mixed solution*, finally, the following are added on the basis of the total weight of the electrolyte solution: 4wt% of fluoroethylene carbonate (FEC), 2wt% of adiponitrile (ADN), 1wt% of succinonitrile (SN), 0.5wt% of 1,2-bis(2-cyanoethoxy)ethane (DENE), 0.2wt% of vinylene carbonate (VC), and 4.0wt% of 1,3-propane sultone; after stirring well, the lithium-ion battery electrolyte solution of Embodiment 1 is obtained.

Id. ¶¶ 36–37 (emphasis added). Of significance to our Decision, Embodiment 1 is described as “lithium hexafluorophosphate of a concentration of 1.0 mol/L is slowly added to the mixed solution.” *See id.* Other Embodiments and Comparative Embodiments have alterations to the electrolyte solvent and/or additive composition and content, as shown in Table 1 below:

Embodiment	Solvent composition	FEC (%)	ADN (%)	Structural formula I additives (%)	Other additives (%)	Retention rate (%) after 500 cycles at 1C rate for 4.40 V at ambient temperature	Precipitation of crystals after storage for 10 days at -30°C
Embodiment 1	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	91.2	No precipitation
Embodiment 2	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	1	T ₁ : 2 T ₂ : 0.5	VC: 0.2 PS: 4	91.9	No precipitation
Embodiment 3	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	2	T ₃ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	90.8	No precipitation

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Embodiment 4	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	2	T ₄ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	91.0	No precipitation
Embodiment 5	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	5	2	T ₂ : 2	VC: 0.2 PS: 4	92.2	No precipitation
Embodiment 6	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	2	T ₄ : 1 T ₂ : 0.5	DTD: 0.5 PS: 3.5	91.6	No precipitation
Embodiment 7	EC: PC: DEC: FB: EP: PP =20: 15: 30: 5: 10: 20	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	90.3	No precipitation
Embodiment 8	EC: PC: DEC: FB: EP: PP =20: 10: 35: 5: 10: 20	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	91.5	No precipitation
Embodiment 9	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 15: 15	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	90.8	No precipitation
Comparison Example 1	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	2.5	2	/	VC: 0.2 PS: 4	82.1	Small amount precipitated, main component ADN
Comparison Example 2	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	2	/	VC: 0.2 PS: 4	84.3	Small amount precipitated, main component ADN
Comparison Example 3	EC: PC: DEC: FB: EP: PP =25: 10: 30: 5: 10: 20	4	3.5	/	VC: 0.2 PS: 4	86.9	Large amount precipitated, main component ADN
Comparison Example 4	EC: DEC: FB: EP: PP=35: 30: 5: 10: 20	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	87.5	Precipitated, main components EC and ADN
Comparison Example 5	EC: PC: DEC=30: 20: 50	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	79.9	Precipitated, main components EC and ADN

Comparison Example 6	EC: PC: DEC: FB=30: 15: 50: 5	4	2	T ₁ : 1 T ₂ : 0.5	VC: 0.2 PS: 4	81.1	Precipitated, main components EC and ADN
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Ex. 1006 ¶¶ 45–47. Zeng Table 1 shows a row for each embodiment and comparative embodiment, and a column for solvent composition, FEC (%), ADN (%), structural formula I additives (%) (T₁-T₄), other additives (%) (VC, PS, DTD), retention rate (%) after 500 cycles at 1C rate for 4.40 V at ambient temperature, and precipitation of crystals after storage for 10 days at -30 °C. In Table 1, the abbreviated names of the chemical substances correspond as follows:

EC (ethylene carbonate); PC (propylene carbonate); DEC (diethyl carbonate); FB (fluorobenzene); EP (ethyl propionate); PP (propyl propionate); FEC (fluoroethylene carbonate); ADN (adiponitrile); T1 (succinonitrile); T2 (1,2-bis(2-cyanoethoxy)ethane); T3 (1,4-dicyano-2-butene); T4 (1,3,6-hexanetricarbonitrile); VC (vinylene carbonate); PS (1,3-propane sultone); DTD (ethylene sulfate).

Id. ¶¶ 48–49.

2. Petitioner’s Position

Petitioner argues that Zeng discloses electrolytes containing X, Y, and Z in the claimed amounts. Pet. 14. According to Petitioner, Zeng Embodiments 4 and 6 have 20 wt% PP *before* adding LiPF₆ (T₄ in Table 1 above) as well as additives, thus suggesting or rendering obvious that the total electrolyte has less than 20 wt% PP (and more than 5 wt%). *Id.* (citing Ex. 1003 ¶ 65; *see* Ex. 1006 ¶¶ 45–49).

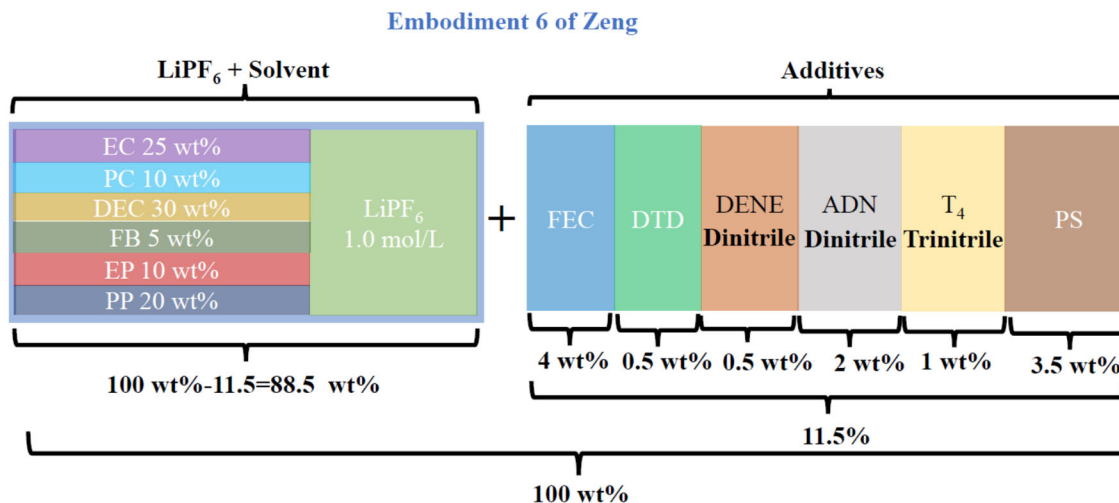
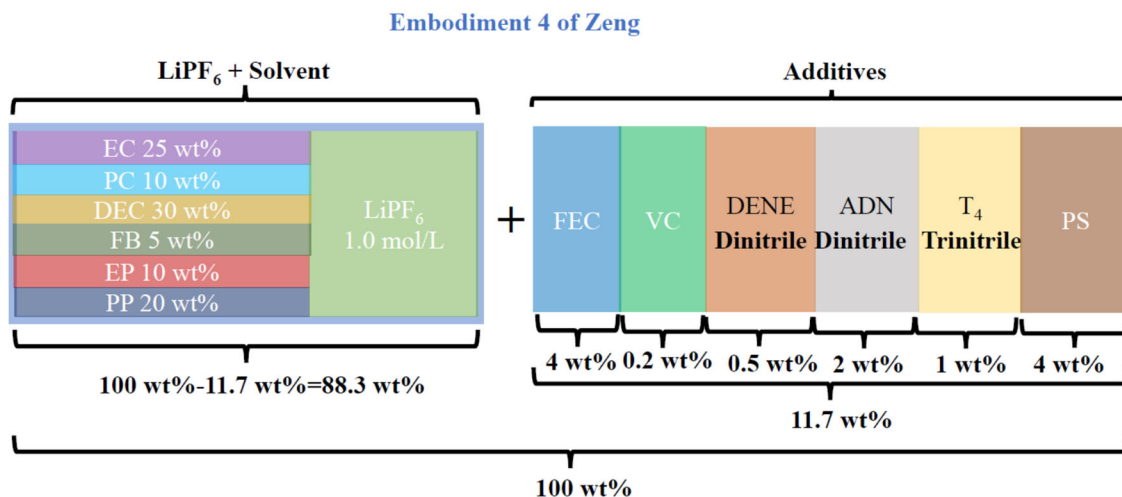
Petitioner contends that Zeng’s electrolytes have (1) a “multi-component homogeneous mixed solvent” (including PP); (2) fluoroethylene carbonate (FEC); (3) dinitrile compounds, adiponitrile (ADN) and 1,2-bis(2-

cyanoethoxy)ethane (DENE); and (4) at least one second nitrile “compound having the structure shown in structural formula I” which includes trinitriles. Pet. 14 (citing Ex. 1006 ¶¶ 11–18, 24). According to Petitioner, “Embodiments 4 and 6 contain PP as a solvent component, ADN and DENE as *dinitrile* compounds, and 1,3,6-hexanetricarbonitrile (HTCN)—a *trinitrile*—as the formula I compound,” and in both Embodiments, “ethylene carbonate, propylene carbonate, diethyl carbonate, fluorobenzene, ethyl propionate, and [PP] are mixed at a *mass* ratio of EC:PC:DEC:FB:EP:PP = 25:10:30:5:10:20.” *Id.* at 15 (citing Ex. 1006 ¶¶ 37, 44) (alteration in original).

Petitioner argues that a POSITA would have understood “then, lithium hexafluorophosphate of a concentration of 1.0 mol/L is slowly added to the mixed solution” to mean “adding (solid) LiPF₆ to the specified EC:PC:DEC:FB:EP:PP solvent mixture to reach a concentration of 1.0 mol/L LiPF₆.” Pet. 16 n.3 (citing testimony of its expert, Dr. Lucht, at Ex.1003 ¶ 69). Petitioner acknowledges that LiPF₆ is commercially available premixed in different solvents to different concentrations. *Id.* Petitioner argues, however, that Zeng already discloses a solvent mixture for its electrolytes and, “[i]n such cases, it is standard practice to mix LiPF₆ in the specified solvent mixture to a target concentration (usually around 1 mol/L)—not add LiPF₆, premixed in a second solvent mixture, to that solvent mixture. *Id.* (citing Ex. 1003 ¶ 69; Ex. 1023 ¶¶ 237, 245, 255; Ex. 1024 ¶ 48; Ex. 1025 ¶ 90). According to Petitioner, “[b]eyond rendering the ultimate concentration of LiPF₆ and amounts of the solvent components uncertain, this would disrupt the carefully-crafted solvent and additive weight percentages central to Zeng’s invention.” *Id.*

Petitioner contends that Embodiment 4 includes 4 wt% FEC, 2 wt% ADN, 0.5 wt% DENE, 0.2 wt% vinylene carbonate (VC), and 4.0 wt% of 1,3-propane sultone added to Zeng's base electrolyte on the basis of the total weight of the electrolyte solution, and 1% trinitrile 1,3,6-hexanetricarbonitrile (HTCN, T₄) as the Formula I nitrile; and Embodiment 6 is identical to Embodiment 4 except that VC in Embodiment 4 is swapped for 0.5 wt% ethylene sulfete (DTD) in Embodiment 6, which also has slightly less PS at 3.5 wt%. Pet. 16–17.

Petitioner provides the following illustrations for the compositions of Embodiments 4 and 6:



Pet. 17–18. Petitioner’s illustration above lists each ingredient and its weight percentage separately for the solvent and additives in Zeng’s Embodiments 4 and 6. Pet. 23–24 (citing Ex. 1003 ¶ 84). Petitioner calculates ADN and DENE (dinitriles) in Embodiments 4 and 6 as having a combined weight percentage (the claimed X) of $2 \text{ wt}\% + 0.5 \text{ wt}\% = 2.5 \text{ wt}\%$ in the total electrolyte. *Id.* at 18. Petitioner calculates HTCN (a trinitrile) as having a weight percentage (the claimed Y) of $1 \text{ wt}\%$ in the total electrolyte. *Id.*

For PP (related to Z in the claims), Petitioner contends that Embodiments 4 and 6 had $20 \text{ wt}\%$ PP *before* adding LiPF_6 and the remaining additives to the solvent mixture, and if LiPF_6 had zero weight, PP would have theoretical upper limit weight percentages in the total electrolytes of Embodiments 4 and 6 as follows:

$$\text{Embodiment 4: } 88.3\% \times (20 / (25 + 10 + 30 + 5 + 10 + 20)) = 17.66 \text{ wt}\%$$

$$\text{Embodiment 6: } 88.5\% \times (20 / (25 + 10 + 30 + 5 + 10 + 20)) = 17.70 \text{ wt}\%$$

Pet. 18–19. Petitioner argues that, assuming LiPF_6 has a non-zero weight, and Zeng teaches it was mixed in the base solvent to a concentration of 1.0 mol/L before mixing the remaining additives, the weight percentages Z of PP in the total electrolyte solutions are $Z < 17.66 \text{ wt}\%$ in Embodiment 4 and $Z < 17.70 \text{ wt}\%$ in Embodiment 6. *Id.* at 19. Because LiPF_6 has a non-zero weight, this pushes the weight percentages Z of PP in the total electrolyte solutions to $Z < 17.66$ in Embodiment 4 and $Z < 17.70$ in Embodiment 6, according to Petitioner. *Id.* at 19.

Petitioner argues that the ultimate weight percentage of PP in the total electrolyte would also be well above $5 \text{ wt}\%$ because that $5 \text{ wt}\%$ would require LiPF_6 to comprise over $60 \text{ wt}\%$ of the total electrolyte, corresponding to 4.0 mol/L solution of LiPF_6 , which is “much greater than

the typical 1.0 mol/L taught by Zeng, and atypical for lithium-ion batteries.” Pet. 19 (citing Ex. 1003 ¶ 77).

Petitioner contends that “[e]ach Embodiment in Zeng is a self-contained working example providing a complete list of compounds, amounts, and electrolyte preparation instructions.” Pet. 20. According to Petitioner, a POSITA would have been motivated to implement Zeng’s Embodiments 4 and 6 with a reasonable expectation of success because they significantly outperformed Comparative Examples on capacity retention after 500 cycles. *Id.* (citing Ex. 1006 ¶¶ 45–47). Embodiment 6 had the best capacity retention other than Embodiments 2 and 5. *Id.*

Petitioner also contends that it would have been obvious to try Zeng Embodiments 4 and 6. Pet. 20. Petitioner asserts that there was a market need for high-energy lithium-ion batteries driven by consumer demand that Zeng addressed with “a well-rounded ‘electrolyte solution that can remain homogeneous and stable over a wide temperature range . . . to ensure that a lithium-ion battery has good high-voltage cycle performance and can perform at high and low temperatures.’” *Id.* at 21. Petitioner argues that Zeng disclosed only a finite number of identified, predictable solutions—the nine Embodiments—and a POSITA would have a reasonable expectation of success in pursuing those options, given the Embodiments had better performance than the Comparative Examples. *Id.* at 21–22.

a. Claim 1

Addressing claim 1 specifically, Petitioner argues that Zeng satisfies elements [1.pre], [1.1], [1.5], and [1.6] for reasons discussed, *supra*.

Regarding element [1.2], “wherein, about $2.2 \text{ wt}\% \leq (X+Y) \leq$ about 8 wt%, about $0.1 \leq (X/Y) \leq$ about 2.3,” Petitioner argues that *X* and *Y* have the following values in Zeng’s total electrolyte:

Embodiment	<i>X</i>	<i>Y</i>	<i>X+Y</i>	<i>X/U</i>
4	2.5 wt%	1 wt%	3.5 wt%	2.5
6	2.5 wt%	1 wt%	3.5 wt%	2.5

Pet. 23. Thus, according to Petitioner, in both Embodiments, *X+Y* satisfies the claimed range, and *X/Y* equals 2.5, “which is ‘*about 2.3*’ as claimed.” *Id.* Petitioner points out that the ’910 patent states that “about” covers “minor variations” including “less than or equal to $\pm 10\%$ of the stated value,” or $(2.5-2.3)/2.3=8.7\%$ of 2.3. *Id.* (citing Ex. 1001, 4:12–31).

Regarding element [1.3], “wherein $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$ or $30 \text{ wt}\% \leq Z \leq 50 \text{ wt}\%$,” Petitioner argues that *Z* is less than 17.66 wt% in Embodiment 4 and 17.70 wt% in Embodiment 6. Pet. 24 (*see* § III.D.2., *supra*).

Regarding element [1.4], Petitioner argues the *Y* and *Z* and *Y/Z* have the following values:

Embodiment	<i>Y</i>	<i>Z</i>	<i>Y/Z</i>
4	1 wt%	<17.66 wt%	>0.057
6	1 wt%	<17.70 wt%	>0.056

Pet. 25. Therefore, *Y/Z* overlaps the claimed range of “about $0.02 \leq Y/Z \leq$ about 0.3.” *Id.*

Regarding element [1.7], herein the electrolyte further comprises a compound having a sulfur-oxygen double bond,” Petitioner argues that Embodiments 4 and 6 comprise 1,3-propane sultone (PS), which satisfies the claim. Pet. 27.

b. Dependent Claims 2–6

Claim 2 depends from claim 1 and further recites “wherein $0.1 \leq a$ weight percentage of the adiponitrile \div a weight percentage of the trinitrile compound ≤ 2.3 ” based on the total weight of the electrolyte. Ex. 1001, 34:38–47. Petitioner argues that, for reasons discussed regarding X/Y , 2.5 is “close enough” to 2.3 that a POSITA would have expected the electrolyte to have the same properties. Pet. 27.

Claim 3 depends from claim 1 and further recites “wherein the compound having a sulfur-oxygen double bond comprises 1,3-propanesultone, . . . and the weight percentage . . . is not less than 0.1 wt% and not greater than 3 wt%.” Ex. 1001, 34:47–51. Petitioner argues that the values of PS in Embodiments 4 and 6 (3.5 and 4) are “close enough” for a POSITA to expect them to have the same properties. Pet. 27–28.

Claim 4 depends from claim 1 and further recites “wherein $0.1 \leq X/Y \leq 2.0$.” Ex. 1001, 34:52–53. Petitioner argues that Zeng Embodiments 4 and 6 disclose this limitation. Pet. 28.

Claim 5 depends from claim 1 and further recites “where $0.025 \leq Y/Z \leq 0.3$.” Ex. 1001, 34:54–55. Petitioner argues that Embodiments 4 and 6 disclose $Y/Z > 0.057$ and > 0.056 , satisfying the claim limitation. Pet. 29.

Claim 6 depends from claim 1 and further recites “wherein X is 0.01–10 wt%, Y is 0.01–10 wt%.” Ex. 1001, 34:56–57. Petitioner argues that Zeng’s Embodiments 4 and 6 teach $X = 2.5$ wt% and $Y = 1$ wt%, meeting claim 6. Pet. 29.

c. Claims 12 and 16–26

Petitioner argues that these claims are substantively identical to or similar to claims 1–6 except for reciting an electrochemical device having electrodes. Pet. 29. Petitioner contends that Zeng Embodiments 4 and 6 electrolytes were used in a lithium-ions secondary battery, which is an electrochemical device that comprises electrodes. *Id.* at 30. Petitioner refers to its discussion regarding claims 1–6 for obviousness of these claims. *Id.* at 29–30.

3. *Patent Owner's Position*

Patent Owner argues that Zeng fails to disclose at least the following claim limitations:

wherein, based on a total weight of the electrolyte, a weight percentage of the dinitrile compound is X , a weight percentage of the trinitrile compound is Y . . . ; wherein, about $2.2 \text{ wt}\% \leq (X+Y) \leq \text{about } 8 \text{ wt}\%$, about $0.1 \leq (X/Y) \leq \text{about } 2.3$ (claim elements [1.2] and [12.2]);

a weight percentage of the propyl propionate is Z ; wherein . . . $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$ or $30 \text{ wt}\% \leq Z \leq 50 \text{ wt}\%$ (claim elements [1.3], [12.3], and [20.3]);

about $0.02 \leq (Y/Z) \leq \text{about } 0.3$ (claim elements [1.4], [12.4], and [20.4]).

Prelim. Resp. 7; *see also* Pet., Claims App.

First, Patent Owner argues that Petitioner fails to show that a POSITA would have selected or implemented Zeng's Embodiments 4 or 6 because various components and component amounts of Zeng's embodiments are ambiguous due to at least the addition of an unknown amount of lithium salt solution. Prelim. Resp. 8. Patent Owner argues that Zeng is silent on why Embodiments 4 and 6 would have provided any benefit that would distinguish them from the remaining potential embodiments. *Id.* Patent

Owner points out that Zeng Embodiments 2 and 5—containing no trinitrile compound—had better retention capacity than Embodiment 6 promoted by Petitioner. *Id.* (citing Ex. 1006 ¶¶ 45–46). Patent Owner also points out that Embodiment 8, with no trinitrile compound, had a better capacity retention rate than Embodiment 4 promoted by Petitioner. *Id.* at 9. According to Patent Owner, a POSITA would have interpreted the data in Zeng to teach that addition of a trinitrile compound negatively impacts the capacity retention rate, thus teaches away from trinitrile’s inclusion in Zeng’s electrolyte solution. *Id.* (citing Ex. 1006 ¶¶ 39–42, 45–46).

Petitioner also fails to show that Zeng’s Embodiments 4 and 6 would have been obvious to try, according to Patent Owner. Prelim. Resp. 9. Patent Owner contends that a POSITA would have recognized a large number of potential solutions to the problem of the ’910 patent, each of which requires extensive tradeoffs and careful balance of competing effects in the electrolyte solution. *Id.* at 9–10 (citing Ex. 2015 ¶¶ 76–78). Patent Owner argues that Petitioner fails to account for the thousands of embodiments would fit within the ranges described in Zeng. *Id.* at 10. Patent Owner contends that Petitioner does not establish a reasonable expectation of success of implementing Embodiments 4 and 6 due to Zeng’s teaching of a comparatively negative impact of the trinitrile compound on capacity retention rates, in addition to Zeng’s ambiguous instructions. *Id.* (citing Ex. 2015 ¶¶ 68–73, 79–81).

a. Claims 1, 12, and 20

Patent Owner argues that Petitioner fails to show that Zeng renders obvious the claimed *Z* and *Y/Z* ranges of claims 1, 12, and 20. Prelim. Resp. 10.

Patent Owner argues that Zeng does not disclose the weight percentage of PP (Z) used in its electrolyte solutions based on a total weight of the electrolyte or the claimed ratio of the weight percentages of trinitrile to PP (Y/Z). Prelim. Resp. 10–11. Zeng provides a relative mass ratio of each solvent or “electrolyte solvent partial component content” in a base solvent mixture, but then adds other additives and a lithium salt solution thereto. *Id.* at 11. Patent Owner contends that Zeng provides insufficient information from which a POSITA could determine the weight percentage of PP or the ratio of trinitrile to PP in each of Embodiments 4 and 6. *Id.* Patent Owner points out

Zeng discloses three different concentration units for its various components that are based on three different measurements—*total mass of the organic solvents*, *total weight of the electrolyte solution*, and *total volume of the lithium salt solution*—without actually providing those measurements, which would be necessary for a POSITA to even consider, let alone attempt to calculate, a theoretical weight percentage of the PP component based on the total weight of the electrolyte solution, and in turn, a ratio of trinitrile to PP.

Id. According to Patent Owner, Petitioner relies solely on Dr. Lucht’s unsupported and incorrect assumptions to calculate a theoretical upper limit weight percentage of PP, and a Y/Z ratio based on his estimated Z value, in each of Embodiments 4 and 6. *Id.*

Patent Owner contends that Petitioner errs in assuming that Zeng’s lithium salt (LiPF₆) is added in a solid form, and this error permeates each of Dr. Lucht’s calculations. Prelim. Resp. 12. All of Zeng’s Embodiments rely on Embodiment 1, which includes “then, lithium hexafluorophosphate of a concentration of 1.0 mol/L is slowly added to the mixed solution.” Ex. 1006 ¶ 37. Patent Owner argues that a POSITA would understand that LiPF₆ is

expressly added in the form of a salt solution of an unstated amount, making it impossible to calculate the weight percentage of PP based on a total weight of the electrolyte solution. Prelim. Resp. 12 (citing Ex. 2015 ¶ 95; Ex. 1023 ¶¶ 237, 245, 255; Ex. 1024 ¶ 48; Ex. 1025 ¶¶ 90, 100; Ex. 2022).

Patent Owner argues that Zeng states “Table 1 lists the electrolyte partial component content,” thus Zeng necessarily considers the presence of other electrolyte solution components in its embodiments, such as the unknown solvent components of the 1.0 mol/L LiPF₆ solution. Prelim. Resp. 14. Patent Owner contends that Petitioner’s expert, Dr. Lucht, bases his theoretical upper limit weight percentage of PP in Embodiments 4 and 6 on unsupported assumptions. *Id.* at 14–15.

According to Patent Owner:

Zeng discloses the addition of a lithium salt in *solution* form to the base solvent mixture in each embodiment, without the need for an explicit reference to the solvents of the solution, such that the weight percentage of PP and the ratio of trinitrile compound to PP in the final electrolyte solutions cannot be determined due to at least the unknown solvent components in the lithium salt solution and the unknown amount of lithium salt solution added. [Ex. 2015] ¶ 101. These unknowns render Dr. Lucht’s estimates of the alleged weight percentages of PP of <17.66 wt% and <17.70 wt% and the alleged Y/Z values of >0.057 and >0.056 in Embodiments 4 and 6 incorrect. *Id.* ¶¶ 102-103.

Prelim. Resp. 15–16. Patent Owner argues that “[t]here is simply not enough information in Zeng to reliably perform the calculations needed to reach the conclusions in the Petition.” *Id.* at 16.

Patent Owner next argues that the ’910 patent establishes that the claimed Y/Z range is critical to providing the advantages of the patent, and is not disclosed in Zeng. Prelim. Resp. 16. Patent Owner contends that, even

considering Dr. Lucht's assumptions, at best Zeng discloses electrolyte solutions with trinitrile and PP concentration ranges that are broader than the claimed ranges of Y/Z values in claims 1, 12, and 20. *Id.* Patent Owner asserts that PP is not required in Zeng's electrolyte solution, such that Z may be zero, resulting in a value of X/Z of 0, which is broader than the claimed range. *Id.* at 17 (citing Ex. 1006 ¶ 15).

Patent Owner contends that Zeng does not consider the presence of a trinitrile compound to be necessary, such that the amount of trinitrile in an electrolyte solution of Zeng may also be zero, thus Y/Z may be zero, making the range broader than that claimed. Prelim. Resp. 17 (citing Ex. 1006 ¶¶ 17–19, 45–46).

Patent Owner argues that the claimed specific weight percentage ratio ranges “were *unexpectedly* found to provide a firm, protective SEI film on the surface of the cathode that was not easily decomposed, and which could provide performance improvements by allowing a battery to operate at a high potential of 4.45V and effectively reduce DC internal resistance of the battery.” Prelim. Resp. 18 (citing Ex. 2015 ¶ 108; Ex. 1001, 1:56–61; 29:26–29). According to Patent Owner, Zeng does not disclose such criticality of the claimed Y/Z value ranges or associated advantages, but, rather, teaches away from addition of a trinitrile, making the claimed Y/Z range nonobvious in view of Zeng. *Id.*

Patent Owner asserts that Petitioner failed to provide a claim construction position on “about 2.3” in the context of X/Y , thus Petitioner's statement that 2.5 is “close enough” to the claimed range is misguided and insufficiently tied to competent evidence to render obvious the claimed X/Y ratio range of at least claims 1 and 12. Prelim. Resp. 19–20. Patent Owner

argues that Petitioner presents no evidence that a POSITA would expect an X/Y ratio of 2.5 to have the same properties as the claimed value.

b. Claims 2–6, 16–19, and 21–26

Patent Owner contends that claims 2–6, 16–19, and 21–26 are not unpatentable for the reasons discussed, *supra*.

c. Challenge to Claims 20–26 Forfeited

Patent Owner argues that Petitioner forfeited any challenge of claims 20–26 due to the absence of claim 20 in the summary table of Petitioner’s evidence purporting to explain where in the Petition Zeng discloses the limitations of claims 12 and 16–26. Prelim. Resp. 20. Patent Owner states that the electrolyte in claim 20 further comprises 1,3-propanesultone and fluoroethylene carbonate at specified weight percentages. *Id.* at 21. According to Patent Owner, both Petitioner and Dr. Lucht failed to provide evidence or argument that the required “fluoroethylene carbonate” is met in any of the Grounds, thus Petitioner forfeits any challenge of claim 20 and its dependent claims 21–26. *Id.*

4. *Analysis*

We first address whether Zeng teaches adding LiPF_6 as a solid to achieve a 1.0 mol/L concentration in the electrolyte solution (Petitioner’s argument), or the reference teaches adding a solution of LiPF_6 to achieve a concentration of 1.0 mol/L in the resulting electrolyte-solution-plus- LiPF_6 -solution (Patent Owner’s argument).

Petitioner’s expert, Dr. Lucht, testifies

[A] POSITA would understand [Zeng’s disclosure of “then, lithium hexafluorophosphate of a concentration of 1.0 mol/L is slowly added to the mixed solution”] to mean adding (solid) LiPF_6 to the specified EC:PC:DEC:FB:EP:PP solvent

mixture to reach a concentration of 1.0 mol/L. While LiPF₆ is commercially available premixed in different solvents to different concentrations, Zeng already discloses an EC:PC:DEC:FB:EP:PP solvent mixture for its electrolytes. In such cases, it is standard practice to mix LiPF₆ in the specified solvent mixture to a target concentration—usually around 1 mol/L—not add LiPF₆, premixed in some second solvent mixture, to the first solvent mixture. . . . Aside from rendering the ultimate concentration of LiPF₆ uncertain, adding some premixed solution of LiPF₆ would disrupt the carefully-crafted solvent and additive weight percentages central to Zeng’s invention.

Ex. 1003 ¶ 69 n.4.

In contrast, Patent Owner’s expert, Dr. Wheeler, testifies that Dr. Lucht’s testimony on the same language “relies on an unfounded and tenuous interpretation of the disclosure of Zeng that is diametrically opposed to the very wording and teaching of the document.” Ex. 2015 ¶ 91.

Dr. Wheeler emphasizes that Zeng reads “*then, lithium hexafluorophosphate of a concentration of 1.0 mol/L is slowly added to the mixed solution.*” *Id.* Dr. Wheeler testifies

It is immediately apparent from the text of Paragraph [0037] that the inventors of Zeng make a clear distinction as to how certain components are to be added to the electrolyte composition. For example, with respect to the additive components, Zeng explicitly states that their addition is “on the basis of the total weight of the electrolyte solution.” Ex. 1006 ¶ [0037]. And with respect to lithium hexafluorophosphate (LiPF₆), Zeng explicitly states that its addition is *at a certain concentration*, such that the POSITA would understand that the lithium hexafluorophosphate salt of Zeng is necessarily added in the form of a solution. That is, the terms “of a concentration” and “mol/L”, which are indisputably present in the Zeng specification, necessarily imply the existence of a solution with respect to the lithium hexafluorophosphate salt. Specifically,

Zeng recites that LiPF₆ “*of a concentration of 1.0 mol/L* is slowly added to the mixed solution.” *Id.* (emphasis added).

Id. ¶ 92 (underlining added, italics and bolding in original).

At this stage in the proceeding, we do not find that Zeng’s disclosure leads to the assertedly straightforward interpretation proffered by Patent Owner and Dr. Wheeler. To the extent Patent Owner raises a potential issue of fact, the issue is better addressed at trial.

Dr. Wheeler’s conclusion requires a POSITA to interpret Zeng as failing to provide (1) any information as to an undisclosed solvent in which solid LiPF₆ is to be dissolved to a concentration of 1.0 M LiPF₆ before that unspecified combination is added to the electrolyte solvent, or (2) any information as to how much of such LiPF₆ in solution with the undisclosed solvent is added to what amount of the electrolyte solvent. For instance, a 1.0 M solution of LiPF₆ in an undisclosed solvent (“the LiPF₆ solution”) would require 1.0 moles of LiPF₆ in 1.0 liters of the undisclosed solvent. Adding 1.0 liter of the LiPF₆ solution (1.0 M LiPF₆ dissolved in the undisclosed solvent) to 1.0 liter of the electrolyte solvent would result in a composition vastly different from that created by adding 1.0 liter of 1.0 M LiPF₆ solution to 99.0 liters of electrolyte solvent. In the first case, the combination would have 1.0 mole LiPF₆ in 2.0 liters total of solute, resulting in an electrolyte solution with a LiPF₆ concentration of 0.5 mol/L. In the second case, the combination would have 1.0 mole LiPF₆ in 100.0 liters total of solute, resulting in an electrolyte solution with a LiPF₆ concentration of 0.01 mol/L. These results would be the same even if the solvent used for diluting the LiPF₆ solid was identical to the starting electrolyte solution.

Dr. Wheeler’s testimony that “the applicant and inventors of Zeng knew what language to use to indicate to a POSITA that lithium salt is

added, in solid form, to a solvent mixture to obtain a target concentration of the salt in the solvent mixture, but chose not to” is unavailing at this stage of the proceeding. *See* Ex. 2015 ¶ 96 (citing Ex. 2022 as evidence of the intentions of the same applicant (Dongguan City Kaixin Battery Materials Co., Ltd.) and two of the same inventors (YANG Yongjun and WAN Huaping) as in Zeng).

Exhibit 2022, a 2014 Chinese patent application is titled, “A Non-Aqueous Electrolyte, Its Preparation Method, and a High-Voltage Lithium-Ion Battery.” Ex. 2022, codes (22), (71), (72), (54). Exhibit 2022 discloses as Embodiment 1:

A non-aqueous electrolyte for high-voltage lithium-ion batteries, primarily comprising organic solvents, conductive lithium salts, and additives, where the organic solvent is composed of cyclic carbonate solvents (ethylene carbonate EC), aromatic hydrocarbon solvents (fluorobenzene FB), and linear carbonate solvents (ethyl methyl carbonate EMC) in a ratio of EC:EMC:FB = 3:6:1. The conductive lithium salt LiPF₆ has a concentration of 1.0 mol/L in the organic solvent, and the commonly used additives include 1.0wt.% vinylene carbonate and 1.0wt.% propane sultone. The additive is dipyridyl disulfide used at a concentration of 0.5wt.%.

Id. ¶ 30. The electrolyte solvent in the Embodiment comprises ethylene carbonate (EC), ethyl methyl carbonate (EMC), and fluorobenzene (FB). *Id.* Other solvent components include propylene carbonate (PC) and fluoroethylene carbonate (FEC). *Id.* ¶ 14. Comparative Example 1 of Exhibit 2022 discloses

[T]he electrolyte for lithium-ion batteries mainly contains the following ingredients: organic solvents and aromatic hydrocarbon solvents (ethylene carbonate EC, ethyl methyl carbonate EMC, and fluorobenzene FB in a *weight ratio* of

EC:EMC:FB = 3:6:1), with the conductive lithium salt LiPF₆ having a concentration of 1.0 mol/L in the organic solvent.

Id. ¶¶ 56–57 (emphasis added). Exhibit 2022 describes mixing the organic solvents in the required proportions, using molecular sieves and other compounds to remove impurities and moisture, dissolving the conductive lithium salt (which may be LiPF₆) in the organic solvents such that the concentration of the lithium salt in the organic solvent is between 0.8 and 1.5 mol/L. *Id.* ¶¶ 13, 16, 31–33. Exhibit 2022 discloses additives selected from vinylene carbonate (VC), ethylene vinyl carbonate, fluorinated ethylene carbonate (FEC), propane sultone (PS), adiponitrile (ADN), and succinonitrile (SN), and that these commonly used additives constitute 0.1–5.0% of the total mass of the electrolyte. *Id.* ¶ 17.

Overall, Exhibit 2022 discloses an electrolyte solvent very similar to that of Zeng, both references disclosing electrolyte solvents comprising EC, PC, FB, and FEC. *Compare* Ex. 1006 ¶¶ 11–18, *with* Ex. 2022 ¶¶ 14, 30. Both references disclose LiPF₆ as a lithium salt that can be used in the electrolyte solution. *Compare* Ex. 1006 ¶ 37, *with* Ex. 2022 ¶ 16. Both references disclose vinylene carbonate (VC), ethylene vinyl carbonate, propane sultone (PS), adiponitrile (ADN), and succinonitrile (SN) as potential commonly additives. *Compare* Ex. 1006 ¶¶ 37, 45–47, *with* Ex. 2022 ¶ 17.

Exhibit 2022 does not appear to support Dr. Wheeler’s interpretation of Zeng.

Dr. Lucht’s interpretation, on the other hand, leads to information that a POSITA could have employed with confidence to produce Zeng’s disclosed Embodiments. Given the well-known molecular weight of LiPF₆ in g/mole, a POSITA would have taken any chosen volume of the electrolyte

solvent and added sufficient grams of solid LiPF_6 to produce a resulting electrolyte solution that had a LiPF_6 concentration of 1.0 mol/L. This conclusion is not “diametrically opposed to the very wording and teaching” of Zeng. *See* Ex. 2015 ¶ 91. The wording of Zeng—translated from the original Chinese version—could be clearer. However, a POSITA in possession of Zeng could more readily understand that LiPF_6 “of a concentration of 1.0 mol/L is slowly added to the mixed solution” means that a measured weight of solid LiPF_6 is added to a specified volume of the identified electrolyte solute to create an electrolyte solution that has a resulting concentration of 1.0 M LiPF_6 dissolved in it.

The expert testimony raises an issue that is better addressed at trial. Based on this preliminary record, we are unconvinced that Zeng’s “various components and component amounts of the embodiments are ambiguous,” as Patent Owner asserts. *See* Prelim. Resp. 8; *see also id.* at 11 (criticizing Zeng for failing to provide the total amount of LiPF_6 salt solution that is added as a solution to the electrolyte solvent), 14 (“There is no language or other exposition in Zeng indicating an intended final concentration of LiPF_6 in the electrolyte mixture.”), 14 n.3 (“Because Zeng teaches using a premixed salt solution, Petitioner cannot determine the ultimate concentration of LiPF_6 and the claimed amounts of the solvent components, the Zeng-based grounds fail.’), 16 (“There is simply not enough information in Zeng to reliably perform the calculations needed to reach the conclusions in the Petition.”).

We turn to the parties’ arguments relating to Embodiments 4 and 6 of Zeng.

Petitioner contends that Embodiments 4 and 6, both containing the trinitrile 1,3,6-hexanetricarbonitrile (HTCN) disclose electrolyte solutions that render most of the claims of the '910 patent obvious. Pet. 15–30.

Dr. Lucht provides testimony explaining his calculations that purportedly demonstrate that Embodiments 4 and 6 satisfy the claimed mathematical relationships of, Y , and Z . Ex. 1003 ¶¶ 66–113. Dr. Lucht's calculations are premised on the solvent components in the Embodiments being mixed at a reported mass ratio and solid LiPF_6 then being added to the electrolyte solvent. *See id.* ¶ 69.

Petitioner argues that a POSITA would have been motivated to implement Zeng Embodiments 4 and 6 because these batteries significantly outperformed the Comparative Examples on capacity retention rate, and Embodiment 6 outperformed all but two of the nine tested Embodiments. Pet. 20; *see* Ex. 1006 ¶¶ 45–47.

Patent Owner argues that Zeng's Embodiments 2 and 5 contained no trinitrile, yet had better capacity retention than Embodiment 6, and Embodiment 8 with no trinitrile had a better capacity retention rate than Embodiment 4. Prelim. Resp. 8–9. Therefore, according to Patent Owner, Zeng shows that trinitrile has a comparatively negative impact on capacity retention rates, and teaches away from selecting Embodiments 4 and 6, instead encouraging a POSITA to eliminate trinitrile from the electrolyte solution. *Id.* at 9. Patent Owner argues that “Zeng is silent regarding why the two selected embodiments provide any benefits that would distinguish them from the remaining potential embodiments and there is no unambiguous data in Zeng that would encourage a POSITA to choose any particular embodiment over another.” *Id.* at 8.

Patent Owner’s arguments are unavailing on the preliminary record.

Whether Zeng discloses ranges of components that could possibly cover thousands of embodiments (*see* Prelim. Resp. 8) is of no consequence here, as Petitioner is not relying on broadly taught ranges, but rather on specific identified compositions, Embodiments 4 and 6 (*see* Pet. 14–19). And, as discussed above, Zeng’s data is not ambiguous. Zeng reports nine Embodiments that appear to be acceptable and six Comparative Examples that appear not to meet the desired capacity retention rate. Ex.1006 ¶¶ 45–47. Zeng need not explicitly articulate or express why its teachings are beneficial so long as its teachings are beneficial and a POSITA would recognize that their application was beneficial. *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380–81 (Fed. Cir. 2023) (“There is a motivation to combine when a known technique ‘has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way,’ using the ‘prior art elements according to their established functions.’” (first quoting *KSR*, 550 U.S. at 417; and then quoting *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 799–800 (Fed. Cir. 2021))). In addition, Petitioner need not select the best option, but rather only a suitable option from which Zeng does not teach away. *Par Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1197–98 (Fed. Cir. 2014) (“Our precedent, however, does not require that the motivation be the *best* option, only that it be a *suitable* option from which the prior art did not teach away.”). Our reviewing court has “explained that just because better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.” *In re Mouttet*, 686 F.3d

1322, 1334 (Fed. Cir. 2012) (citing *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994)).

To the extent that Zeng discloses some Embodiments without trinitrile having higher capacity retention rates than Embodiments comprising trinitrile, it is insufficient to conclude that Zeng “criticize[s], discredit[s], or otherwise discourage[s] investigation into” use of a trinitrile in the electrolyte solution, and cannot be found to teach away from its use. *Meiresonne v. Google, Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017) (“A reference that ‘merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into’ the claimed invention does not teach away.” (quoting *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013))). “We will not read into a reference a teaching away from a process where no such language exists.” *Dystar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1364 (Fed. Cir. 2006).

Petitioner argues that it would have been obvious to try Zeng’s Embodiments 4 and 6; Patent Owner disputes this. Pet. 20; Prelim. Resp. 9. Noting that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton,” the Supreme Court has held

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103.

KSR, 550 U.S. at 421.

Petitioner argues that it would have been obvious to try Zeng Embodiments 4 and 6, as Zeng recognized market need for high-energy density lithium-ion batteries driven by consumer terminals demanding ever-higher energy density from batteries. Pet. 21 (citing Ex. 1006 ¶ 3). Petitioner contends that FEC had been added to conventional lithium-ion batteries to improve stability of the positive electrode, but it also tended to decompose at high temperatures. *Id.* Organic nitriles were then added to stabilize the electrode, but they have poor solubility in electrolyte solutions that limits cycling and low-temperature performance. *Id.* (citing Ex. 1006 ¶ 6). According to Petitioner, “Zeng thus sought a well-rounded ‘electrolyte solution that can remain homogeneous and stable over a wide temperature range . . . to ensure that a lithium-ion battery has good high-voltage cycle performance and can perform at high and low temperatures.’” *Id.* (citing Ex. 1006 ¶ 8). Petitioner contends that Zeng discloses a finite number (nine) of identified, predictable solutions, and presented a reasonable expectation of success because Zeng Embodiments had better performance than the Comparative Examples. *Id.* at 21–22 (citing Ex. 1006 ¶¶ 36–53, 82).

Patent Owner contends that Zeng does not articulate the problem or the solution of the '910 patent. Prelim. Resp. 9. Zeng identifies a problem and goes on to provide a solution. Patent Owner does not explain why Zeng must identify the *same* problem and solution as the '910 patent does. To render an invention obvious, the prior art does not have to address the same problem addressed by a patent applicant. *KSR*, 550 U.S. at 420; *see also Cross Med. Prods., Inc. v. Medtronic Sofamor Danek, Inc.*, 424 F.3d 1293, 1323 (Fed. Cir. 2005) (“One of ordinary skill in the art need not see the

identical problem addressed in a prior art reference to be motivated to apply its teachings.”).

We have already addressed Patent Owner’s arguments that Zeng demonstrates reason to avoid adding a trinitrile compound and contains ambiguous instructions. *See* Prelim. Resp. 10.

We next address Dr. Lucht’s calculations, provided in § III.D.2, *supra*.

Patent Owner’s arguments that Petitioner fails to show that Zeng renders the claimed *Z* and *Y/Z* ranges obvious are based almost entirely on the premise that Zeng discloses adding a 1.0 M solution of LiPF₆ in some unknown solvent to the electrolyte solvent. *See* Prelim. Resp. 10–16. Having determined that there is sufficient support at this stage of the proceeding for Petitioner’s position that Zeng discloses adding solid LiPF₆ to the identified electrolyte solvent, we do not further address those arguments.

Patent Owner argues that Zeng’s Table 1 lists “‘the electrolyte *partial* component content’ such that Zeng necessarily considers the presence of other electrolyte solution components in its embodiments.” Prelim. Resp. 14. However, we find nothing in Zeng to suggest the electrolyte solution contains any additional, unnamed components. *See generally* Ex. 1006. This argument is unavailing.

Patent Owner argues that propyl propionate is not required to be in Zeng’s electrolyte solution based on Zeng’s disclosure that “10% ≤ ethyl propionate (EP) + propyl propionate (PP) ≤ 50%,” and thus could be 0%

PP.⁸ Prelim. Resp. 15 (citing Ex. 1006 ¶ 15). We agree with Petitioner at this stage of the proceeding that Zeng discloses the range of EP + PP stated, and Petitioner relies on specific Embodiments 4 and 6, which each have 20 mass percent of PP. *See* Ex. 1006 ¶ 46. Thus, this argument is unavailing as well.

According to Patent Owner, the '910 patent establishes criticality of the claimed Y/Z range, and criticizes Petitioner for failing to address that the “*specific weight percentage ratio ranges*, including Y/Z values [in the claimed ranges] were *unexpectedly* found to provide a firm, protective SEI film on the surface of the cathode that was not easily decomposed.” Prelim. Resp. 16–18 (citing Ex. 2015 ¶ 108; Ex. 1001, 1:56–61, 29:26–29). The '910 patent states “[t]he present inventors unexpectedly found that by using a mixture of a dinitrile compound, a trinitrile compound and propyl propionate, a firm protective film which is not easily decomposed on the surface of the cathode at a high potential can be formed.” Ex. 1001, 1:56–61. The '910 patent does not state that the specific weight percentage ratio ranges unexpectedly were found to provide the benefits. *See generally id.*

Dr. Lucht testifies that Zeng’s Embodiments 4 and 6 show X/Y (weight percentage of dinitrile (X) divided by weight percentage of trinitrile (Y)) equals 2.5, which is “about 2.3” as claimed. Ex. 1003 ¶¶ 88–90. The '910 patent defines “about,” stating “when used in connection with a value, the term may refer to a range of variation less than or equal to $\pm 10\%$.”

⁸ Dr. Wheeler testifies that if PP is zero, then Y/Z is equal to 0. Ex. 2015 ¶¶ 106–107. Mathematically, it is not. Any number divided by zero is undefined.

Ex. 1001, 4:11–19. Thus $2.3\% \pm 0.23\% = 2.53\%$ based on this definition, which means 2.5% meets the claim limitation.

Patent Owner argues that claims 2–6, 16–19, and 21–26 are not unpatentable for the same reasons discussed with respect to claims 1, 12, and 20. Prelim. Resp. 20.

In challenging claims 12 and 16–26, Petitioner relies on a summary table of evidence that identifies which sections of the Petition address which limitations of claims 12, 16–19, and 21–26. Pet. 19–20. The summary table does not include any mention of claim 20. *See id.* Claim 1 recites, inter alia, “wherein the electrolyte further comprises a compound having a sulfur-oxygen double bond.” Ex. 1001, 34:37–38. Claim 3 depends from claim 1 and requires that “the compound having a sulfur-oxygen double bond comprises 1,3-propanesultone, based on the total weight of the electrolyte, a weight percentage of the 1,3-propanesultone is not less than 0.1 wt %, and not greater than 3 wt %.” *Id.* at 34:48–52. Claim 20 differs from claim 1 in that it recites “wherein the electrolyte further comprises 1,3-propanesultone and fluoroethylene carbonate; wherein, based on the total weight of the electrolyte, a weight percentage of the 1,3-propanesultone is not less than 0.1 wt%, and not greater than 3 wt%.” *Id.* at 37:3–7. Claim 20 is the only claim that requires fluoroethylene carbonate. *See id.* at claims.

Patent Owner argues that, because the summary table of evidence contains no mention of claim 20, Petitioner forfeits any challenge of claim 20 and its dependent claims over Zeng. Prelim. Resp. 20–21. Patent Owner’s argument is persuasive on this point on this preliminary record as Petitioner has not sufficiently shown that Zeng teaches or suggests an electrolyte comprising fluoroethylene carbonate.

Other than the arguments discussed above, Patent Owner does not separately address Petitioner's contentions regarding claims 1–6, 12, and 16–19. Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to at least claims 1–6, 12, and 16–19.

E. Ground 2A: Alleged Obviousness of Claims 13 and 14 over Zeng and Sunose

Claim 13 depends from claim 12; claim 14 depends from claim 13.

Claim 13 reads as follows:

13. The electrochemical device according to claim 12, wherein the electrode comprises a cathode, the cathode comprises a current collector, a single-sided coating and a double-sided coating;

a first part of the current collector is provided with the single-sided coating and a second part of the current collector is provided with the double-sided coating;

an electrode compaction density of the single-sided coating is D_1 , and, an electrode compaction density of the double-sided coating is D_2 , wherein, about $0.8 \leq D_1/D_2 \leq 1.2$; and,

$$3.5 \text{ g/cm}^3 \leq D_2 \leq 4.3 \text{ g/cm}^3.$$

Ex. 1001, 35:64–36:9.

Claim 14 reads as follows:

14. The electrochemical device according to claim 13, wherein,

both the single-sided coating and the double-sided coating are present on the same electrode; or,

only a single-sided coating or a double-sided coating present on the same electrode.

Ex. 1001, 36:10–15.

Petitioner argues that Zeng does not disclose all elements of claims 13 and 14, but Sunose discloses a lithium-ion battery with a cathode having the single- and double-sided coatings of claims 13 and 14. Pet. 31.

1. Overview of Sunose (Ex. 1010)

Sunose (Japanese Unexamined Patent Application Publication JP 2009-252349 A), titled “Electrode Plate for Non-aqueous Electrolyte Secondary Battery and Method for Manufacturing Such,” was published on Oct. 29, 2009. Ex. 1010, code (11), (54), (43). Sunose discloses a positive electrode (cathode) with a single-sided coating on a first part of the current collector and a double-sided coating on a second part of the current collector. *Id.* ¶¶ 7, 11. Sunose’s positive electrode is produced by

applying a positive electrode coating to a positive electrode current collector made of a strip of aluminum foil using a coating device, drying, and then forming a positive electrode active material layer on a single side of the positive electrode current collector. A positive electrode coating is similarly applied to a predetermined portion on the opposite side of the positive electrode current collector, creating a positive electrode on which a portion where the positive electrode active material is present on both sides of the current collector, a portion where the positive electrode active material is present only on a single side of the current collector, and a portion where the positive electrode active material is not present on either side of the current collector on only the current collector. *Id.*

Id. ¶ 24.

Sunose discloses Embodiments in which the density of the positive electrode active material layer portion on the single-sided coated portion may be 5.7 g/cc, 5.0 g/cc, 4.4 g/cc, or 4.0 g/cc while the density on the double-sided portion is 4.0 g/cc. Ex. 1010 ¶¶ 31–34. Sunose discloses Comparative Examples in which the density on the single-sided coated

portion is 2.0 g/cc, 6.5 g/cc, or 8.0 g/cc while the density on the double-sided portion is 4.0 g/cc. *Id.* ¶¶ 35–37.

2. *Petitioner's Position*

Petitioner argues that Zeng discloses testing of lithium-ion batteries (electrochemical devices) with the electrolytes taught in the reference. Pet. 31 (citing Ex. 1010 ¶¶ 36–53). Petitioner argues that Sunose discloses a positive electrode with a single-sided coating on one part and a double-sided coating on a second part. *Id.* at 31–32; *see also, e.g.*, Ex. 1010, Fig. 2. Petitioner contends that Sunose's Examples 2–4 teach that the double-sided coating has a compaction density, D2, of 4.0, and the single-sided coating has compaction densities, D1, of 4.0, 4.4, or 4.0. Pet. 33. Petitioner argues that Sunose's positive electrode satisfies the requirements of the cathode of claim 13. Petitioner also argues that Sunose teaches both the single-sided coating and the double-sided coating are present on the same electrode, satisfying claim 14's requirements. *Id.* at 37.

According to Petitioner, Zeng and Sunose would have motivated a POSITA to use Sunose's electrode assembly configuration in Zeng Embodiment 4 and 6 batteries. Pet. 35 (citing Ex. 1003 ¶ 125). Petitioner argues that Zeng focuses on electrolyte compositions and omits configuration details for the electrode assembly, thus a POSITA reading Zeng would have looked to references like Sunose for electrode assembly implementation details. *Id.* (citing Ex. 1003 ¶ 126).

Petitioner argues that Sunose's electrode configuration, “wherein the positive electrode plate and negative electrode plate are wound with a separator interposed therebetween,” serves “to maximize the electrode area” in two ways: (1) the spiral design permits more electrode surface area within

a given space, increasing capacity; and (2) rolling the electrode assembly exposes surfaces of the innermost and outermost ends of the rolled current collector, “increas[ing] the effective electrode area, thereby improving battery performance.” Pet. 35 (citing Ex. 1010 ¶¶ 4–5; Ex. 1003 ¶ 127).

Petitioner contends that industry pressure to increase battery capacity and performance would have motivated a POSITA to use Sunose’s rolled design to increase electrode surface area for a given form factor. Pet. 35–36 (citing Ex. 1003 ¶ 127). Moreover, Petitioner’s expert, Dr. Lucht, testifies that “the desire to reduce electrode breakage and [improve electrode] adhesion would have enticed a POSITA to use Sunose’s electrode configuration in Zeng.” Ex. 1003 ¶ 128. According to Petitioner, Sunose explains that one rolling setting might provide the right compaction density and adhesion for the single-sided portion, but that same setting excessively loads the thicker double-sided portion, weakening the electrode and increasing crack rate and breakage. Pet. 36 (citing Ex. 1010 ¶¶ 10, 12).

Sunose discloses the packing ratios N/M^9 between the single-sided M and double-sided N portions to fall between 0.7 and 1.0, so that the one-sided portion 1 is thicker than the double-sided portion 2. Pet. 36; *see also* Ex. 1010 ¶ 41. Petitioner argues that the rolling process applies uniform pressure across both portions of the electrode to improve overall adhesion while avoiding breakage. Pet. 36 (citing Ex. 1010 ¶ 42; Ex. 1003 ¶ 128).

Petitioner contends:

A POSITA would have had a reasonable expectation of success using Sunose’s rolled electrode configuration in Zeng’s example batteries. EX1003 ¶ 129 Zeng does not disclose any

⁹ Petitioner erroneously describes the ratio as M/N , instead of N/M . *See* Pet. 36; Ex. 1010 ¶¶ 14, 41.

physical specifications or restrictions for its high-voltage (4.4V) lithium-ion batteries, broadly intended for “the digital, energy storage, power, and military aerospace fields.” EX1006 ¶ [0002]; *see also id.* ¶ [0035]. Sunose generally intends its rolled electrode configuration for “consumer electronic devices,” so the POSITA would have reasonably expected Sunose’s electrode configuration to work in Zeng’s batteries. EX1010 ¶ [0002]; EX1003 ¶ 129.

Pet. 36–37.

3. Patent Owner’s Position

Patent Owner contends that the deficiencies of Zeng discussed in response to Ground 1A apply equally to Grounds 1A–1C. Prelim. Resp. 43.

4. Analysis

On the record at this stage of the proceeding, having found no fault with and sufficient support of Petitioner’s position on Zeng’s disclosure, and having no comment from Patent Owner to counter Petitioner’s argument regarding Sunose and the combination of Zeng with Sunose, we find that Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to claims 13 and 14.

F. Ground 3A: Alleged Obviousness of Claim 15 over Zeng, Sunose, and Su

Claim 15 depends from claim 13 and reads as follows:

15. The electrochemical device according to claim 13, wherein the electrode comprises an anode,

the anode comprises a current collector, a single-sided coating and a double-sided coating;

a first part of the current collector is provided with the single-sided coating and a second part of the current collector is provided with the double-sided coating;

an electrode compaction density of the single-sided coating is D1, and, an electrode compaction density of the double-sided coating is D2, wherein, about $0.8 \leq D1/D2 \leq$ about 1.2; and,

$$1.2 \text{ g/cm}^3 \leq D2 \leq 1.8 \text{ g/cm}^3.$$

Ex. 1001, 36:16–28.

1. Overview of Su (Ex. 1012)

Su (Chinese Patent Application Publication No. CN 108023117 A), titled “High-energy-density Lithium-ion Battery and Preparation Method Thereof,” published May 11, 2018. Ex. 1012, codes (10), (54), (43). Su provides a high-energy-density lithium-ion battery, wherein a negative electrode plate on the outermost layer of a cell of the lithium-ion battery is a negative electrode plate provided with a negative electrode slurry on a single side, with the side without slurry facing outwards. *Id.* ¶ 8.

Su discloses applying a negative electrode slurry on both sides of a negative electrode current collector and drying and compacting to form a double-sided negative electrode plate. Ex. 1012 ¶ 10. Su also discloses applying a negative electrode slurry on one side of a negative electrode current collector and drying and compacting to form a single-sided negative electrode plate. *Id.* ¶ 11. Su discloses cutting a double-sided positive electrode plate, a double-sided negative electrode plate, and a single-sided negative electrode plate into required sizes and assembling them into a cell, wherein the single-sided electrode plate is on the outermost layer with the side without slurry facing outwards. *Id.* ¶ 56. Su discloses examples in which the single-sided and double-sided negative electrode plate both have a compaction density of either 1.8 g/cm^3 or 1.5 g/cm^3 . *Id.* ¶¶ 59–63.

2. *Petitioner's Position*

Petitioner argues that Su discloses coating negative electrode slurry on both sides of a negative electrode collector, then drying and compacting to form a double-sided negative electrode plate, and the negative electrode slurry on one side of the negative electrode current collector, and then drying and compacting to form a single-sided negative electrode plate. Pet. 38–39 (citing Ex. 1012 ¶¶ 10–11). Petitioner contends that Su discloses a double-sided coating where “a second part of the current collector is provided with the double-sided coating,” as well as a single-sided coating where “a first part of the current collector is provided with the single-sided coating.” *Id.* (citing Ex. 1003 ¶¶ 136–137). Petitioner contends that Su’s Examples 2 and 3 disclose compaction density for single- and double-sided coatings of the negative electrode that have a D1/D2 ratio of 1.0. *Id.* at 39 (citing Ex. 1012 ¶¶ 59–64).

According to Petitioner, a POSITA would have found it obvious, with a reasonable expectation of success, to implement Su’s Examples 2 and 3 for the negative electrode (anode) of Zeng/Sunose to increase energy density. Pet. 39–40. Petitioner argues that Sunose describes a rolled electrode configuration and focuses primarily on the positive electrode (cathode), but leaves out details on implementing the anode. *Id.* at 40. Thus, Petitioner argues, a POSITA would have “look[ed] to Su—also describing a rolled electrode configuration—for anode implementation details, including appropriate compaction densities for the single- and double-sided coating portions of the current collector.” *Id.*

Petitioner argues that a POSITA considering Zeng and Sunose would have been concerned with increasing energy density, and “Su designed its

electrode configuration—including the anode—to improve energy density, and all Su’s Example batteries had strong performance in capacity and energy density over more than 2000 cycles.” Pet. 40 (citing Ex. 1006 ¶ 3; Ex. 1010 ¶ 2; Ex. 1012 ¶¶ 41, 58, 61, 64, 67, 70, 73, 76).

In addition, a POSITA would have found it obvious to try Su’s Examples 2 and 3 anode configurations in Zeng/Sunose, according to Petitioner. Pet. 41 (citing Ex. 1003 ¶¶ 142–145). Petitioner contends that all three references recognized a market need for high energy density lithium batteries. *Id.* Petitioner argues that Su’s disclosure of only seven Example batteries and one comparative Example battery indicates that there was a finite number of identified, predictable solutions, making it obvious for a POSITA to try all Examples. *Id.* (citing Ex. 1012 ¶¶ 50–84). Petitioner asserts that a POSITA would have had a reasonable expectation of success because Sunose and Su both describe wound/rolled electrode configurations and have current collectors with single- and double-coated portions. *Id.* at 42. Petitioner contends that Sunose describes a cathode configuration in detail, and it has a similar single-sided and double-sided configuration to that described by Su. *Id.* In addition, Su’s Example batteries were successfully tested over more than 2000 cycles, with good results in capacity and energy density, according to Petitioner. *Id.*

3. Patent Owner’s Position

Patent Owner contends that the deficiencies of Zeng discussed in response to Ground 1A apply equally to Grounds 1A–1C. Prelim. Resp. 43.

4. Analysis

On the record at this stage of the proceeding, having found no fault with Petitioner’s position on Zeng’s disclosure and having no comment from

Patent Owner to counter Petitioner's argument regarding Sunose or Su or their combination with Zeng, we find that Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to claim 15.

G. Grounds 1B, 2B, 3B: Alleged Obviousness over Zeng and Matsuoka (Claims 1–6, 12, and 16–26, Ground 1B); Zeng, Matsuoka, and Sunose (Claims 13 and 14, Ground 2B); Zeng, Matsuoka, Sunose, and Su (Claim 15, Ground 3B)

Petitioner contends that, to the extent Patent Owner argues that Zeng is ambiguous regarding adding LiPF_6 , making the weight proportion of the solvent components uncertain, Matsuoka cures any defect. Pet. 42–43.

1. Overview of Matsuoka

Matsuoka (US Patent Application Publication No. 2013/0224535 A1), titled “Non-aqueous Electrolyte Solution and Non-aqueous Secondary Battery,” was published Aug. 29, 2013. Ex. 1007, codes (10), (54), (43). Matsuoka describes a non-aqueous electrolyte solution that includes the nitrile additive acetonitrile and a lithium salt, as well as a non-nitrile additive to improve the durability of the SEI layer formed on the electrode surface. *Id.*, code (57), ¶¶ 56–57.

Matsuoka explains that compounds having LUMO (Lowest Unoccupied Molecular Orbital) and HOMO (Highest Occupied Molecular Orbital) energy levels falling in preferred ranges make suitable non-nitrile additives. Ex. 1007 ¶¶ 15, 36, 39. An ideal LUMO level improves reducibility of the non-nitrile additive, helping form the SEI film on the negative electrode while “provid[ing] good effects on . . . a positive electrode and a separator” and suppressing “an increase in internal resistance caused by repeating charge-discharge cycles[.]” *Id.* ¶ 36. An ideal HOMO

level distributes the protective effects of the SEI layer to at least the positive electrode. *Id.* .

2. *Petitioner's Position*

Matsuoka lists non-nitrile additives with LUMO and HOMO levels appropriate for use in its electrolytes. Pet. 44 (citing Ex. 1007 ¶¶ 36, 38–40). According to Petitioner, Matsuoka discloses PP isomers as suitable additives with LUMO and HOMO energies falling in or near the most-preferred ranges. *Id.* (citing Ex. 1007 ¶¶ 38, 40). The preferred amount of non-nitrile additive is 0.1 to 30 wt%, and the more preferred amount is 0.1 to 10 wt%. *Id.* (citing Ex. 1007 ¶ 41). Petitioner argues that Matsuoka's preferred range overlaps the upper and lower portions of the claimed *Z* range, and Matsuoka's more preferred range overlaps the lower portion of the claimed *Z* range. *Id.* at 44–45. Petitioner contends that Matsuoka thus discloses elements [1.4]/[12.4]/[20.4].¹⁰ *Id.* at 44–45.

Petitioner argues that a POSITA would have been motivated, with a reasonable expectation of success, to incorporate Matsuoka's preferred non-nitrile weight percentages as the weight percentage of the PP (*Z*) in Zeng's Examples 4 and 6. Pet. 45. Petitioner contends that Zeng uses “[f]luoroethylene carbonate (FEC), which has good film-forming properties

¹⁰ Petitioner's reference to elements [1.4]/[12.4]/[20.4] appears to be in error, as elements [1.4] and [12.4] recite “about $0.02 \leq (Y/Z) \leq$ about 0.3,” and element [20.4] recites “about $0.01 \leq (Y/Z) \leq$ about 0.3.” Petitioner's subsequent statements regarding incorporating Matsuoka's preferred non-nitrile weight percentage of PP into Zeng's Examples 4 and 6 suggest that Petitioner meant to refer to elements [1.3]/[12.3]/[20.3]: “a weight percentage of the propyl propionate is *Z*; wherein . . . $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$ or $30 \text{ wt}\% \leq Z \leq 50 \text{ wt}\%$.”

and resistance to oxidation” and “ensures good high-voltage cycling performance of the battery without seriously affecting the high-temperature performance of the battery” (Ex. 1006 ¶ 28), and Matsuoka uses its non-nitrile additive such as PP to form a stable protective film on the negative electrode, suppressing side reactions that generate gas and rise in internal resistance that can damage the battery and/or hurt cycling performance (Ex. 1007 ¶¶ 11, 22, 36, 42, 57, 104). Pet. 45–46. Consequently, Petitioner argues, a POSITA would have considered Matsuoka in the proposed combinations. *Id.* at 46.

According to Petitioner,

Any hypothetical uncertainty in Zeng’s preparation instructions would have prompted the POSITA to consider Matsuoka for implementation details regarding appropriate amounts of PP to include in Zeng’s electrolytes. The POSITA would have noted Matsuoka’s “off-the-shelf” preferred weight proportion ranges for the non-nitrile additive, such as PP, to use as for the weight percentage Z of PP in Zeng Embodiments 4 and 6.

Pet. 46. Petitioner argues that Matsuoka teaches increasing the amount of the non-nitrile additive improves electrolyte stability at the cost of low-temperature performance, and vice versa. *Id.* Per Petitioner, by using the non-nitrile additive in Matsuoka’s preferred weight proportion ranges, “all of the cycling performance of the electrolyte solution, high-rate performance under a low temperature environment, and other battery characteristics can be further improved.” *Id.* “Apart from implementation details, the desire for balanced performance would have motivated the POSITA to use Matsuoka’s preferred weight proportion ranges as the amount of PP in Zeng’s Example 4 and 6 electrolytes.” *Id.*

Petitioner contends that a POSITA would have had a reasonable expectation of success in using Matsuoka's preferred non-nitrile weight proportions for PP in Zeng's electrolytes, citing to the overlap in composition of Zeng's electrolytes and those of Matsuoka, which both also include the same carbonate-based solvents (EC, PC), ester compound (EP), LiPF_6 as the lithium salt, and VC as an additive. Pet. 47. Petitioner also argues that Zeng and Matsuoka both use electrolyte components to improve the SEI film. *Id.*

Petitioner argues that the combination of Zeng and Matsuoka teaches or suggests the claimed Y/Z ranges, e.g., in claim 1, "a weight percentage of the propyl propionate is Z ; wherein . . . $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$ or $30 \text{ wt}\% \leq Z \leq 50 \text{ wt}\%$." Pet. 48 (citing Ex. 1003 ¶ 159); *see also* Ex. 1001, 34:21–27. According to Petitioner, using Matsuoka's more preferred upper limit for PP in Examples 4 and 6 of Zeng results in $Y/Z=1/10=0.1 \text{ wt}\%$, falling in the claimed range 0.02 to 0.3 (elements [1.5], [12.5]) and 0.025 to 0.33 (elements [5.1] and [20.5]). Pet. 48 (citing Ex. 1003 ¶ 160). Matsuoka's preferred upper limit 30 wt% results in $Y/Z=1/30=0.033 \text{ wt}\%$, also within the claimed range. *Id.*

As an alternative reason for a motivation to combine, Petitioner indicates that Matsuoka highlights PP's ability to prevent a rise in internal resistance, which the '910 patent suggests needs improvement. Pet. 48–49 (citing Ex. 1003 ¶ 161). Petitioner contends that a POSITA seeking to enhance Zeng's Embodiments 4 and 6 would recognize from Matsuoka that PP effectively suppresses rise in internal resistance and adjust the PP content, "experimenting within Matsuoka's preferred ranges of 0.1–10 wt%

and 0.1–30 wt% to identify an optimum PP proportion for suppressing rise in internal resistance.” *Id.* at 49.

3. Patent Owner’s Position

Patent Owner argues that there is no motivation to modify Zeng’s electrolyte system with Matsuoka. Prelim. Resp. 22. According to Patent Owner, “Zeng already provides the POSITA with the necessary amount of PP to include in a relative mass ratio of the base solvent mixture. Ex. 2015 ¶¶ 126-128.” *Id.* at 22–23.

Petitioner fails to show that a POSITA would have selected PP from Matsuoka’s numerous non-nitrile additives, according to Patent Owner. Prelim. Resp. 23. Patent Owner notes that Matsuoka lists PP isomers (*n*-propyl propionate and isopropyl propionate) in two lists of more than 75 other potential “non-nitrile additive” components. *Id.* at 23–24 (citing Ex. 1007 ¶¶ 38, 40). Patent Owner contends that nearly all of the additives in the LUMO list fall within the most-preferred LUMO ranges and a majority of the additives in the HOMO list fall in or near the most-preferred HOMO ranges. *Id.* at 24. Patent Owner argues that neither PP isomer is given special significance in Matsuoka or is tested for actual functionality, pointing out that Table 2 lists 20 additives used in the Examples and Comparative Examples of Matsuoka but PP compound is not included. *Id.*; Ex. 1007 ¶ 108, Table 2.

Patent Owner criticizes Dr. Lucht for assuming that a POSITA would single out PP and apply Matsuoka’s preferred non-nitrile additive ranges in the proposed combination of Matsuoka with Zeng. Prelim. Resp. 24–25. According to Patent Owner, numerous other components of Zeng’s electrolyte would also be considered “non-nitrile additive” components as

disclosed in Matsuoka. *Id.* at 25 (citing Ex. 2015 ¶ 133). Patent Owner argues

Matsuoka teaches that such preferred non-nitrile additive ranges would apply to the *aggregate* of all non-nitrile components, not just a single non-nitrile additive. *Id.*; Ex. 1007 ¶ [0035] (“by a combined use of two or more ingredients . . . preferably contains two or more of the non-nitrile additives.”) ¶ [0038] (“used singly or in combination of two or more”)[.] Significantly, in addition to the PP isomers, Matsuoka identifies many other example non-nitrile additive compounds that overlap with the components of Zeng’s Embodiments 4 and 6. Ex. 2015 ¶ 133; Ex. 1007 ¶¶ [0038], [0040].

Id. Matsuoka’s non-nitrile additive ranges would necessarily apply to the *aggregate* of such overlapping components in Zeng’s Embodiments 4 and 6, not just PP, per Patent Owner. *Id.* Patent Owner concludes that Petitioner necessarily fails to show that Matsuoka renders obvious the claimed *Y/Z* ranges. *Id.* at 26.

According to Patent Owner, Zeng’s implementation details are sufficient for the purposes of Zeng by providing the necessary amount of PP to include in a relative mass ratio of the base solvent mixture. Prelim. Resp. 26 (citing Ex. 2015 ¶¶ 126–128). Thus, Patent Owner argues, there is no motivation to combine Matsuoka with Zeng. *Id.*

Patent Owner contends that “the electrolyte solutions of Zeng and Matsuoka are so fundamentally different that the POSITA would not be motivated to combine or have a reasonable expectation of success in combining Matsuoka with Zeng.” Prelim. Resp. 26–27 (citing Ex. 2015 ¶¶ 136, 138). Patent Owner argues that “Matsuoka identifies at least PP, ethyl propionate (EP), and monofluorobenzene (FB) as ‘*non-nitrile additives*,’ however, Zeng considers and accounts for at least PP, EP, and FB

as *solvent* components in the initial solvent mass ratio, *not as additives.*” *Id.* at 27 (emphasis added) (citing Ex. 1007 ¶¶ 38, 40; Ex. 1006 ¶ 37).

A POSITA would not identify the teachings of Matsuoka as applicable to Zeng and would have no reason to expect that the applicability of amounts or ranges of Matsuoka’s *additive* components to the same components found in Zeng’s solution as *solvent* components (especially in view of Zeng’s solvents being in a defined solvent mass ratio) would have predictable results given the inherent unpredictability of the interactions of these components. Ex. 2015 ¶ 137.

Id. In addition, according to Patent Owner, Matsuoka considers acetonitrile (a mononitrile) to be an essential, preferably main or only component in addition to the lithium salt. *Id.* (citing Ex. 1007 ¶¶ 43, 109, and Tables 3–5). Patent Owner points out that Zeng’s Embodiments 4 and 6 do not include any mononitriles as a solvent or an additive, and only adiponitrile (a dinitrile), 1,2-bis(2-hexanetricarbonitrile (a trinitrile) as minor additives. *Id.* at 27–28 (citing Ex. 1006 ¶¶ 45–49). None of Matsuoka’s examples include a trinitrile as an additive, which Patent Owner argues supports the position that a POSITA would consider the electrolyte systems of Zeng and Matsuoka to be fundamentally different. *Id.* at 28. Patent Owner contends that a POSITA would not have any indication that the preferred non-nitrile additive range described in Matsuoka as advantageous for an acetonitrile solvent-based electrolyte would have any positive effect on other electrolyte solutions which do not contain acetonitrile as a solvent component, such as Zeng. *Id.* (citing Ex. 2015 ¶ 139; Ex. 1007 ¶ 41).

Patent Owner argues that Matsuoka teaches away from Zeng’s mixed solvent electrolyte systems due to Matsuoka showing lower discharge capacity at low temperatures for mixed solvents. Prelim. Resp. 28 (citing Ex. 7, Table 3, Table 9; Ex. 2015 ¶¶ 140–144). Matsuoka also teaches away

from Zeng's use of the single inorganic lithium salt, LiPF_6 , according to Patent Owner. *Id.* at 29. In addition to acetonitrile, Matsuoka requires "an organic lithium salt, wherein an anion of the organic lithium salt has a LUMO . . . energy in the range of -2.00 to 4.35 eV, and a HOMO . . . energy in the range of -5.35 to -2.90 eV." Ex. 1007 ¶ 14. Zeng's LiPF_6 is an inorganic lithium salt having a LUMO of 4.05 eV and a HOMO of -5.39 eV. *Id.* ¶ 29, Table 1. Patent Owner argues that LiPF_6 , which is used by itself in Zeng, does not meet the organic lithium salt requirements or the HOMO requirements of Matsuoka's required organic lithium salt. Prelim. Resp. 29 (citing Ex. 1007 ¶ 30).

Patent Owner contends that claims 2–6, 16–19, and 21–26 are not unpatentable over Zeng and Matsuoka for at least the reasons discussed, *supra*. Prelim. Resp. 30.

Patent Owner argues that Petitioner forfeited any challenge of claims 20–26 due to the absence of claim 20 in the summary table of Petitioner's evidence purporting to explain where in the Petition Zeng discloses the limitations of claims 12 and 16–26. Prelim. Resp. 30.

4. Analysis

In our analysis of unpatentability over Zeng alone, we determined that Petitioner has shown there is a reasonable likelihood that it would prevail in showing unpatentability of claims 1–6, 12, and 16–19.

However, Ground 1B addresses Patent Owner's assertion that "Zeng provides insufficient information from which a POSITA could determine such weight percentage of PP based on a total weight of the electrolyte or the ratio of trinitrile to PP in each of [Zeng's] Embodiments 4 and 6." Prelim. Resp. 11. Therefore, we discuss Matsuoka here.

Petitioner relies on Matsuoka's direct disclosure of an appropriate weight percentage Z of PP, rather than determining it from Zeng. Pet. 43. Dr. Lucht testifies that Matsuoka lists n-propyl propionate and isopropyl propionate as suitable non-nitrile additives with LUMO and HOMO energies falling in or near Matsuoka's most-preferred ranges. Ex. 1003 ¶ 150 (citing Ex. 1007 ¶¶ 38, 40). Dr. Lucht testifies that Matsuoka teaches the preferred amount of non-nitrile additive is 0.1 to 30 wt%, and the most preferred amount is 0.1 to 10 wt%, such that Matsuoka's preferred range overlaps both the upper and lower portions of the claimed Z range, and Matsuoka's more preferred range overlaps the lower portion of the claimed Z range. *Id.* ¶¶ 151–152 (citing Ex. 1007 ¶ 41). Dr. Lucht also testifies that the Zeng-Matsuoka combination teaches or suggests the claimed Y/Z range, using 10 wt% and 30 wt% from Matsuoka to calculate Y/Z at 0.1 and 0.033. *Id.* ¶¶ 159–160. Dr. Lucht testifies that any uncertainty in Zeng's instructions would have motivated to look to Matsuoka for implementation details regarding appropriate amounts of PP to include in Zeng's electrolytes. *Id.* ¶ 156. In addition, "Matsuoka uses its non-nitrile additive such as PP to form a stable protective film on the negative electrode, suppressing side reactions that generate gas and rise in internal resistance that can damage the battery and/or hurt cycling performance." *Id.* ¶ 155.

A POSITA, seeking enhancements based on Zeng, would recognize from Matsuoka that PP effectively suppresses rise in internal resistance, testifies Dr. Lucht. Ex. 1003 ¶ 161. A POSITA would therefore be able to adjust the PP content in Zeng's Embodiments 4 and 6, experimenting within Matsuoka's preferred ranges of 0.1–10 wt% and 0.1–30 wt% to identify an optimum PP proportion for suppressing rise in internal resistance. *Id.*

Dr. Wheeler testifies that “the disclosure of Zeng does not provide sufficient detail that would allow the POSITA to determine that Zeng discloses the claimed weight percentages of propyl propionate (*Z*) or the claimed mixing ratio of trinitrile to propyl propionate (*Y/Z*) of independent claims 1, 12, or 20. Ex. 2015 ¶ 127. Patent Owner argues that “Zeng already provides the POSITA with the necessary amount of PP to include in a relative mass ratio of the base solvent mixture.” Prelim. Resp. 22; *see also id.* at 26. These two statements do not seem entirely consistent.

Patent Owner argues that Matsuoka lists two PP isomers in two lists of 75+ other potential “non-nitrile additive” components, gives PP no special significance, and fails to use PP in Examples or Comparative Examples. Prelim. Resp. 23. According to Patent Owner, “Matsuoka teaches that such preferred non-nitrile additive ranges would apply to the *aggregate* of all non-nitrile components, not just a single non-nitrile additive.” *Id.* at 25 (citing Ex. 1007 ¶ 35). Dr. Wheeler testifies that “Matsuoka identifies multiple components that overlap with Zeng’s Embodiments 4 and 6 as example non-nitrile additive compounds” and in his opinion “such non-nitrile additive ranges would apply to the sum of all overlapping components in Zeng’s Embodiments 4 and 6.” Ex. 2015 ¶ 133. “As such, there would be numerous variables for the POSITA to adjust such that there would be no “direct disclosure of an appropriate weight percentage *Z* of PP.” *Id.*

Matsuoka states “[f]rom the viewpoint of the durability of SEI, the non-aqueous electrolyte solution of the present embodiment *preferably* contains two or more of the non-nitrile additives,” but also “[t]hese [non-nitrile additive] compounds are *used singly* or in combination of two or more.” Ex. 1007 ¶¶ 35, 38 (emphasis added). We note that over half of the

electrolyte solutions (d) in Matsuoka had a single additive. *See id.* ¶ 109 (Tables 3 and 4).

Patent Owner appears to be taking the position that Matsuoka's teaching of using a single non-nitrile compound is to be ignored in favor of the teaching that the electrolyte solution "preferably contains two or more non-nitrile additives," and then concluding that any of the 75+ compounds listed by Matsuoka that are also in Zeng's Embodiments 4 and 6 must necessarily be counted as part of the non-nitrile additive that is "preferably 0.1 to 30 mass %" in Matsuoka. Thus, according to Patent Owner and Dr. Wheeler, a POSITA with Zeng in hand who considered Matsuoka would understand Matsuoka as teaching use of the combination of PP, EC, PC, and EP (and possibly VC) in an amount of 0.1 to 30 wt%.

For purposes of § 103, a reference is prior art for all that it discloses. *Symbol Techs., Inc. v. Opticon, Inc.*, 935 F.2d 1569, 1578 (Fed. Cir. 1991). Matsuoka's disclosures that propyl propionate qualifies as a non-nitrile additive that meets its requirements and that non-nitrile additives may be used singly are not to be ignored.

In addition, "[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference." *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). "It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *In re Mouttet*, 686 F.3d at 1332. We are not aware of precedential case law requiring that Zeng and Matsuoka have electrolyte solutions comprising several of the same components to require that Matsuoka's disclosure of propyl propionate be restricted by the components also in

Zeng. Patent Owner is welcome to further explain the position in future briefing.

Patent Owner contends a POSITA would have had no motivation to combine Matsuoka with Zeng. Prelim. Resp. 26. Patent Owner argues that “Zeng’s implementation details are sufficient for the purpose of Zeng—Zeng already provides the POSITA with the necessary amount of PP in include in a relative mass ratio of the base solvent mixture.” *Id.* As note, *supra*, this position is in some tension with Dr. Wheeler’s testimony that “the disclosure of Zeng does not provide sufficient detail that would allow the POSITA to determine that Zeng discloses the claimed weight percentages of propyl propionate (Z). *See* Ex. 2015 ¶ 127.

Patent Owner contends that Zeng and Matsuoka are so fundamentally different that a POSITA would not be motivated to combine or have a reasonable expectation of success in combining the references. Prelim. Resp. 26. Dr. Wheeler testifies that Matsuoka identifies at least propyl propionate (PP), ethyl propionate (EP), and monofluorobenzene (FB) as non-nitrile additives (Ex. 1007 ¶¶ 38, 40), but Zeng identifies the same compounds as solvent components in the initial solvent mass ratio, not as additives. Ex. 2015 ¶ 137. The significance of identifying the same components with different names is not clear, especially when considering that solvent, lithium salt, and additives are all added together in both references for use as electrolyte solutions.

Dr. Wheeler also testifies that Matsuoka teaches using acetonitrile, a mononitrile, as an essential or even only solvent. Ex. 2015 ¶ 138 (citing Ex. 1007 ¶¶ 43, 109). Zeng is said to have no mononitriles, and dinitriles and trinitriles as minor additives. *Id.* (citing Ex. 1006 ¶¶ 45–49). Dr. Wheeler

acknowledges that Matsuoka discloses examples that include a dinitrile as an additive. *Id.* According to Dr. Wheeler’s testimony, because Zeng’s Embodiments 4 and 6 do not contain acetonitrile, a POSITA would not consider Matsuoka as a reference, as the electrolyte systems of the two references are fundamentally different. *Id.* ¶ 139. Dr. Wheeler testifies that a POSITA would not have had a reasonable expectation of success in applying Matsuoka because the reference teaches away from the mixed solvent systems of Zeng. *Id.* ¶ 140. This is because, according to Dr. Wheeler, Matsuoka’s single solvent acetonitrile electrolyte systems outperformed such mixed solvent electrolyte systems in low-temperature discharge capacity measurements. *Id.* ¶¶ 142–144.

Table 9 of Matsuoka is reproduced below.

TABLE 9

	Elec- trolyte		Battery evaluation	Discharge capacity [mAh]		
	solution	Battery		-30° C.	-20° C.	25° C.
Example 21	S3	SL1	2-1	5.37	7.36	8.40
Example 22	S18	SL1	2-1	4.73	7.21	8.42
Example 23	S19	SL1	2-1	3.61	6.73	8.50
Example 24	S20	SL1	2-1	2.80	6.45	8.31
Comparative Example 8	S21	SL1	2-1	1.32	6.33	8.50
Example 25	S3	SC1	2-2	2.11	2.34	3.20
Comparative Example 9	S22	SC1	2-2	1.53	2.08	3.13

Table 9 shows in columns the electrolyte solution, battery type, battery evaluation, and discharge capacity [mAh] at -30 °C, -20 °C, and -25 °C for Examples 21–25 and Comparative Examples 8 and 9. Ex. 1007 ¶ 177.

The solvents in Examples 21, 22, and 25 are acetonitrile. Ex. 1007 ¶¶ 109, 177. The solvents in Example 24 and Comparative Examples 8 and 9 are mixed without acetonitrile; the solvent in Example 23 is acetonitrile plus other solvents. *Id.* The data shown supports Dr. Wheeler’s testimony that the acetonitrile-only solvents have better *low temperature* performance than the mixed solvents. The same cannot be said of a comparison of performance at 25 °C, however, where the mixed solvent demonstrate better performance. Zeng is drawn to wide-temperature-range homogeneous non-aqueous electrolyte solution, not low-temperature non-aqueous electrolyte solutions. Ex. 1006 ¶ 1. Zeng discusses problems in electrolyte solutions at both high temperatures and low temperatures. *See id.* ¶¶ 5–7, 8 (“[I]t is indeed necessary to provide an electrolyte solution that can remain homogeneous and stable over a wide temperature range in order to ensure that a lithium-ion battery has good high-voltage cycle performance and can perform at high and low temperatures.”). Therefore, Matsuoka does not “criticize, discredit, or otherwise discourage” investigation into use of mixed solvents.

Dr. Wheeler points out that Matsuoka requires an organic lithium salt with specified LUMO and HOMO energy ranges. Ex. 2015 ¶ 145. Matsuoka provides one comparison of an organic lithium ion in acetonitrile to LiPF₆ in acetonitrile, and discloses that the acetonitrile/LiPF₆ electrolyte solution had much lower discharge capacity. This minimal data is insufficient to discredit, or otherwise discourage use of LiPF₆ for use in mixed solvents for electrolyte solutions.

Regarding Ground 2B, Patent Owner relies on arguments made disputing Zeng alone or in combination with Matsuoka. Prelim. Resp. 43. Petitioner incorporates its arguments regarding 1A and 1B. Pet. 43. Patent

Owner argues that Petitioner forfeits any challenge to claims 20–26 because Petitioner’s summary table incorporated by reference fails to address claim 20. We note that neither Ground 1A nor Ground 1B in the Petition directly address claim 20 or the fluoroethylene carbonate recited in claim 20, but not elsewhere.

On this preliminary record, Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to at least claims 1–6, 12, and 16–19.

H. Grounds 1C, 2C, 3C: Alleged Obviousness over Zeng, Matsuoka, and Kim (Claims 1–6, 12, and 16–26, Ground 1C); Zeng and Kim, with or without Matsuoka (Claims 13 and 14, Ground 2C); Zeng, Kim, Sunose, and Su, without or without Matsuoka (Claim 15, Ground 3C)

Petitioner’s Grounds 1C, 2C, and 3C address the claim limitations directed to the ratio of the weight percentage of trinitrile (Y) to the weight percentage of PP (Z), i.e., Y/Z .¹¹ Pet. 49. Petitioner argues that Zeng discloses an electrolyte with Y and Z falling within and overlapping the claimed ranges and relationships for Y and Z . *Id.* Petitioner contends that “[s]imply calling out the quotient Y/Z cannot patentably distinguish the challenged claims from prior art disclosing or rendering obvious Y and Z values that mathematically meet it.” *Id.* (citing Ex. 1003 ¶ 164). Petitioner identifies Zeng Embodiments 4 and 6 as disclosing dinitrile-based

¹¹ Independent claims 1 and 12 recite “about $0.02 \leq (Y/Z) \leq$ about 0.3,” independent claim 20 recites “about $0.012 \leq (Y/Z) \leq$ about 0.3,” and dependent claims 5 and 26 recite ““about $0.025 \leq (Y/Z) \leq$ about 0.3.” Ex. 1001, 34:29, 34:54–55, 35:54, 36:62, 37:26–27.

fluoroalkyl group. *Id.* at Abst. Formula 1 includes three or more nitrile (CN) groups and may be asymmetric. *Id.* ¶ 55. The C₃ to C₅ alkyl propionate may include propyl propionate, and may be included in an amount of about 10 volume % to about 80 volume % based on the total amount of the organic solvent. *Id.* ¶¶ 13–14. The lithium salt may include LiPF₆, which may be in a concentration of about 0.1 M to about 2.0 M. *Id.* ¶¶ 22–23.

2. *Petitioner's Position*

Petitioner argues “Kim experimented with electrolytes including a dinitrile, trinitrile, and PP, noting: “after storage at 60°C for four weeks, and after 250 cycles, batteries using electrolytes that have both a trinitrile and PP exhibited improved capacity retention over batteries using electrolytes that lack at least one of these two components.” Pet. 51 (citing Ex. 1008, Tables 2–4).

According to Petitioner, Kim’s Examples show enhanced performance of electrolytes that incorporate a trinitrile and PP compared to those lacking one or both. Pet. 51. Only Examples 1 and 2 contain both a HTCN (trinitrile) and PP, Comparative Examples 1–6 lacking trinitrile HTCN, PP, or both. *Id.* at 51 (citing Ex. 1008 ¶ 91). Petitioner contends this draws attention to electrolytes containing both a trinitrile and PP in different relative amounts, and the Y/Z element of the ’910 patent claims. *Id.* at 52 (citing Ex. 1003 ¶ 170). Petitioner argues that the dinitrile and trinitrile contents are identical in Examples 1 and 2, but the PP weight percentage increases from 40% in Example 1 to 60% in Example 2. *Id.* at 53 (citing Ex. 1008 ¶ 90, Table 1). Petitioner contends that Kim shows that adjusting PP while maintaining trinitrile content in Examples 1 and 2 significantly impacts battery performance, causing a POSITA to recognize that fine-tuning trinitrile to PP

weight percentage ratios (Y/Z) optimizes battery performance. *Id.* (citing Ex. 1008 ¶¶ 92–103 and Ex. 1003 ¶ 173).

Petitioner argues that both Kim and the '910 patent highlight adjusting Y/Z to improve electrolyte performance. Pet. 53 (citing Ex. 1003 ¶ 174). According to Petitioner, the difference between the general teachings of the '910 patent and Kim lies in their focus on the effect of PP: “the '910 patent explicitly states that adding PP to dinitrile and trinitrile helps suppress DC internal resistance,” while “Kim generally shows that the combination of PP with dinitrile and trinitrile improves cycling performance but does not specifically address the suppression of DC internal resistance.” *Id.* at 55 (citing Ex. 1008 ¶¶ 90–104 and Ex. 1003 ¶¶ 176–177). Petitioner asserts that testing DC internal resistance was a routine procedure for evaluating electrolyte performance, and, since Kim already teaches that adding PP to electrolytes containing dinitrile and trinitrile improves battery performance, it would have been routine to evaluate performance of Kim’s electrolytes based on internal resistance. *Id.* (citing Ex. 1003 ¶ 176).

Petitioner argues that Kim “would have further motivated a POSITA to consider and adjust the ratio of trinitrile to PP in Zeng’s electrolytes and/or incorporate Matsuoka’s disclosed preferred non-nitrile additive weight percentage ranges in Zeng.” Pet. 55 (citing Ex. 1003 ¶ 177).

3. Patent Owner’s Position

Patent Owner argues that Petitioner purports to cure, with Kim, the deficiencies in Zeng, or Zeng and Matsuoka, in disclosing the claimed ratio of the weight percentage of trinitrile (Y) to the weight percentage of PP (Z), i.e., Y/Z . Prelim. Resp. 30. According to Patent Owner, a POSITA would have interpreted Zeng as teaching that the addition of a trinitrile compound

negatively impacts the capacity retention rate, such that he or she would not turn to any trinitrile teachings of Kim. *Id.* at 31. Patent Owner contends that “no teaching in Zeng would instigate, prompt, or otherwise ‘motivate[] [a POSITA] adjusting relative amounts of these two components (i.e., Y/Z) to improve performance,’ because the comparative capacity retention rate data of Zeng’s Embodiments teaches otherwise.” *Id.* (quoting Pet. 50-51) (citing Ex. 2015 ¶ 69).

Patent Owner contends that Petitioner never makes a motivation to combine argument for Ground 1C, and never evaluates a POSITA’s reasonable expectation of success—thus failing to make out a *prima facie* case of obviousness to combine Kim with the other references, which is fatal to grounds relying on Kim. Prelim. Resp. 32 (citing Pet. 49–55). “Even setting aside this fatal deficiency,” Patent Owner argues that “Kim is replete with internally contradicting data and woefully inadequate experimental procedure details from which a POSITA could not draw any conclusions.” *Id.*

Patent Owner challenges Petitioner’s position that “Examples 1 and 2 of Kim ‘underscore enhanced performance of electrolytes that incorporate a trinitrile and PP against those lacking one or both,’ by ‘outperform[ing] Comparative Examples 1-6 (lacking trinitrile or PP) in resisting increase in battery thickness and capacity retention.” Prelim. Resp. 32–33 (citing Pet. 51–52). Patent Owner specifically criticizes Petitioner’s analysis of Kim’s Examples 1 and 2, and reliance on Kim’s four evaluation methods that purportedly “would lead a POSITA to ‘recognize that fine-tuning trinitrile (Y)/PP (Z) ratio optimizes battery performance.’” *Id.* at 33.

According to Patent Owner, Kim's experimental procedures are not articulated in any meaningful way that allows evaluation or reproduction. Prelim. Resp. 33. Patent Owner contends that Kim fails to provide the meanings of "recovery capacity" and "thickness variation," as well as how those values are calculated from, or related to, underlying capacity and thickness measurements. *Id.* (citing Ex. 2015 ¶ 153). As a first issue, Patent Owner argues that Kim does not specify how its "capacity" values are measured, when many different tests can be used to measure capacity and cycling. *Id.* at 34 (citing Ex. 2015 ¶¶ 153–155). Kim does not specify how or where its "thickness" values are measured, or how multiple values are treated, whether the thickness is measured under a particular stack pressure, among other conceivable interpretations of "thickness." *Id.*

Patent Owner next asserts that Kim's undiscussed data shows that its capacity results are highly dependent on cell format, e.g., prismatic cells in comparison to pouch cells. Prelim. Resp. 34 (citing Ex. 2015 ¶¶ 156–157; Ex. 1008, Tables 2 and 3). "No description is given as to how the respective prismatic and pouch cells are manufactured or are otherwise distinct from each other, nor are there teachings as to how they should be comparatively evaluated." *Id.* According to Patent Owner, a POSITA would infer that there is a comparatively wide band of statistical uncertainty in the measurements made for each example in the two cell formats, making comparisons unreliable. *Id.* at 35 (citing Ex. 2015 ¶¶ 156–157).

Patent Owner contends that Kim's disclosure with respect to linear sweep voltammetry contradicts itself, as Kim states that the thermal aging measurements on pouch cells were made after being "allowed to stand at 60°C. for **3 weeks**," but Table 3 indicates the same measurements were made

after being “allowed to stand at 60°C. for **4 weeks**.” Prelim. Resp. 35 (citing Ex. 1008 ¶¶ 99–100 and Table 3). Patent Owner also argues that Figure 2 of Kim provides “linear sweep voltammetry” data fails to show that Examples 1 and 2 are more electrochemically stable electrolytes than Comparative Examples 1 to 6 at all electrode potentials tested, and more realistic potentials, i.e. around 4.4V, are not tested. *Id.* at 35–36 (citing Ex. 1008, Fig. 2; Ex. 2015 ¶ 159).

Patent Owner argues that Kim lacks key information for assessing the performance of Kim’s batteries shown in Figure 7, such as the voltage up to which the battery is charged or discharged and at what rate the cycling is performed. Prelim. Resp. 36. According to Patent Owner, Kim’s summary of cycle life in Table 4 is inconsistent with the data presented in Figure 7, “leading [a POSITA] away from relying on Kim at all.” *Id.*

Patent Owner contends that Kim shows significant discrepancies between the data reported in Table 4 and Figure 7 regarding capacity retention values of Comparative Examples, although the results should be identical. Prelim. Resp. 37 (citing Ex. 2015 ¶¶ 161–162; Ex. 1008, Table 4, FIG. 7). According to Patent Owner, the notable unexplained discrepancies between Figure 7 and Table 4’s capacity retention values for the same Comparative Examples would deter a POSITA from relying on or applying Kim. *Id.* (citing Ex. 2015 ¶ 162).

The multiple “evaluation methods” of Kim relied on by Petitioner are not clear or reproducible and are therefore not usable by a POSITA according to Patent Owner. Prelim. Resp. 38 (citing Pet. 53; Ex. 2015 ¶¶ 152–155).

Patent Owner further argues that Examples 1 and 2 of Kim do not motivate a POSITA to adjust the relative amounts of PP and a trinitrile as Petitioner claims. Prelim. Resp. 38 (citing Ex. 2015 ¶ 163). Even if a POSITA had confidence in Kim's data, he or she would note that Example 1 is superior to Example 2 in Kim's data, and therefore would consider Example 1's composition as superior to Example 2's composition. *Id.* Such conclusion would require substitution of a portion of the PP and PC solvent fractions used in Example 2, with a substantial EP solvent fraction used in Example 1, thus teaching away from using an even higher fraction of PP than is used in Example 1. *Id.* at 39. Patent Owner asserts that this "would draw the POSITA's attention, if any, to the ratio of PP to EP (rather than PP to HTCN as asserted by Petitioner)." *Id.*

According to Patent Owner, nothing in Kim indicates a preference for, much less mandates, the presence of PP and other alkyl propionates, such as variations of butyl (C₄) or pentyl (C₅) propionate. Prelim. Resp. 39 (citing Ex. 1008 ¶¶ 13–14 ("C3 to C5 alkyl propionate")). Patent Owner argues that "Kim provides no direct comparison between different C3-C5-alkyl propionates that would motivate selection of PP over another C3-C5-alkyl propionate discussed in Kim, and Petitioner provides no motivation to make such a selection." *Id.* at 39–40 (citing Ex. 2015 ¶ 164).

Patent Owner further argues that Kim fails to provide a POSITA with any guidance with respect to a weight percentages ratio of a trinitrile compound to PP based on a total weight of the electrolyte, i.e. Y/Z. Prelim. Resp. 40 (citing Ex. 2015 ¶ 165). Kim discloses solvents in volume percentages, based on the total amount of the organic solvent, which Patent Owner argues means that Kim does not disclose the claimed weight

percentage of PP “based on a total weight of the electrolyte.” *Id.* (citing Ex. 1008 ¶ 13, Table 1). According to Patent Owner, Kim fails to provide a POSITA with any guidance as to a ratio based on weight percentages of components, let alone weight percentages of the components based on a total weight of the electrolyte. *Id.* Thus, Patent Owner argues, a POSITA would not be motivated to turn to Kim from Zeng at least because Zeng’s solvents are set forth in a relative mass ratio and Kim only discloses its solvents in volume percentages. *Id.* at 40–41.

Patent Owner asserts

[T]here is little variation and no experimentation in Kim to suggest to a POSITA that there should be a preferred or critical range of values for the combination of dinitrile (*X*) and trinitrile (*Y*) compounds, providing no motivation to modify Kim or Zeng to arrive at the claimed values or ranges.

Prelim. Resp. 41.

Concluding, Patent Owner argues that Petitioner does not provide sufficient motivation to combine Kim with Zeng or Zeng and Matsuoka. Prelim. Resp. 42. Patent Owner notes that Kim does not contain any teaching to prevent increases in the internal DC resistance of a battery, which is a main objective of the ’910 patent. *Id.* at 41. Kim discloses four evaluation approaches, none of which evaluate DC internal resistance. *Id.* According to Patent Owner, Kim does not contain any teachings to improve electrode plate wettability and interfacial compatibility, which are main objectives of Zeng. *Id.* at 42 (citing Ex. 1006, Abst.; Ex. 2015 ¶ 170). Kim’s purpose is to increase the thermal stability of a battery through the use of “an electrolyte additive including greater than or equal to about three nitrile groups,” with the optional addition of an additive, which is intended to

suppress the generation of gas in the electrodes during storage at high temperatures. *Id.* (citing Ex. 1008 ¶¶ 55–56, 64).

Patent Owner contends that claims 2–6, 16–19, and 21–26 are not unpatentable for the reasons discussed with respect to claims 1, 12, and 20. Prelim. Resp. 43.

Patent Owner argues that Petitioner did not present any argument that element [20.7] is met in Ground 1C, therefore Petitioner forfeited any challenge of claims 20–26. Prelim. Resp. 43.

4. *Analysis*

On the preliminary record before us, we find that Petitioner’s position is sufficiently supported by the evidence.

Contrary to Patent Owner’s arguments, Petitioner identifies motivations to combine Kim with Zeng and Matsuoka to adjust the relative amounts of trinitrile and PP. *See* Pet. 50, 55. And Petitioner explains how Kim’s disclosure of using PP along with a dinitrile and a trinitrile in both Examples was more successful than the Comparative Examples, none of which employed all three components. *See id.* at 51; Ex. 1008 ¶ 90.

To the extent that Patent Owner calls into question Kim’s methods of testing, “in considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.” *In re Preda*, 401 F.2d 825, 826 (CCPA 1968). Rejecting a blinkered focus on individual documents, the Supreme Court in *KSR* required an analysis that reads the prior art in context, taking account of “demands known to the design community,” “the background knowledge possessed by a person having ordinary skill in the art,” and “the inferences

and creative steps that a person of ordinary skill in the art would employ.” *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (citing *KSR*, 550 U.S. at 418). “This ‘expansive and flexible approach,’ . . . , is consistent with our own pre-*KSR* decisions acknowledging that the inquiry ‘not only permits, but *requires*, consideration of common knowledge and common sense.’” *Id.* (citing *DyStar Textilfarben*, 464 F.3d at 1367).

On this preliminary record, Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to at least claims 1–6, 12, and 16–19.

I. Ground 4A: Alleged Obviousness of Claims 1–6, 12, and 16–26 over Zhou

1. Overview of Zhou (Ex. 1014)

Zhou (Chinese Patent Publication CN 105552439 A), titled “Fast charging lithium-ion battery electrolyte,” was published on May 4, 2016. Ex. 1014, code (54), (10), (43). According to Zhou, during the fast charging process, lithium-ions quickly escape from the positive electrode into the electrolyte, then pass through the diaphragm and enter the negative electrode for lithium insertion. *Id.* ¶ 3. The rapid migration of a large number of lithium-ions requires the electrolyte to have higher kinetic properties and smaller mass transfer resistance during the mass transfer process, thus the electrolyte needs better wettability, lower viscosity, and lower lithium-ion transmission resistance. *Id.*

Low-boiling-point organic solvents commonly used in the prior art had lower viscosity and could provide a more suitable channel for lithium-ion transmission, but caused challenges with the high temperature performance of the battery. Ex. 1014 ¶ 4. Poor compatibility of carboxylic

acid ester organic solvents with the negative electrode graphite of the battery caused the battery cycle performance to deteriorate. *Id.*

Zhou seeks to address these deficiencies in providing a fast charging lithium-ion battery electrolyte composed of a solvent that preferably accounts for 70%–88% of the total mass of the lithium-ion battery electrolyte, a lithium salt (preferably accounting for 8%–20% of the total mass of the lithium-ion battery electrolyte), and an additive, wherein the non-aqueous organic solvent includes a mixture of two or more of a low-boiling-point linear carbonate (preferably dimethyl carbonate or ethyl methylcarbonate) and a linear carboxylic acid ester, fluorobenzene and hydrofluoroether. Ex. 1014 ¶¶ 8–11, 18. The additive preferably accounts for 0.1% to 20% of the total mass of the lithium-ions battery electrolyte, includes a first additive for negative electrode film formation, a second additive for improving battery cycle performance, and a third additive (preferably a nitrile compound which may be HTCN, and accounts for 0.5–5% of the total mass of the lithium-ion battery electrolyte) for improving battery high temperature performance. *Id.* ¶¶ 13–17.

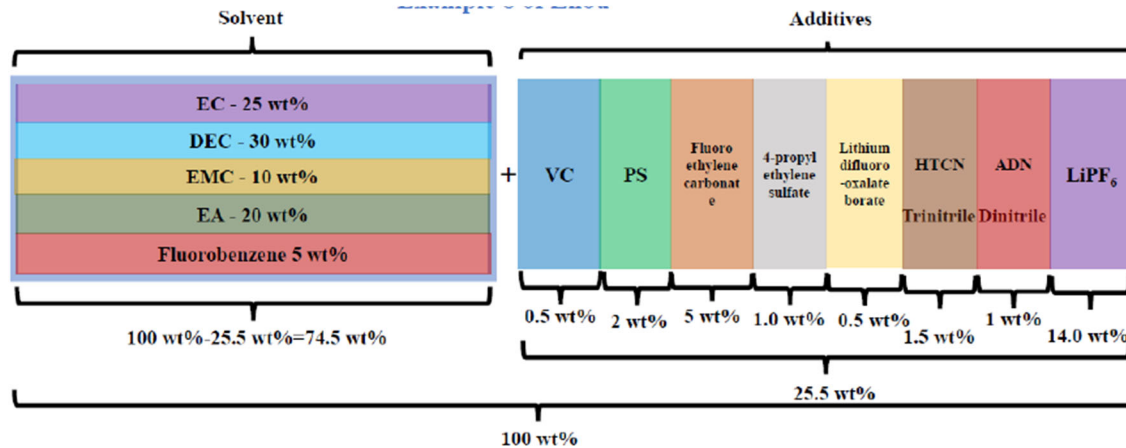
2. *Petitioner's Position*

Petitioner relies on Zhou Example 8 as disclosing an adiponitrile-based (ADN, *dinitrile*) electrolyte containing HTCN (*trinitrile*) and the linear carboxylic acid ester ethyl acetate (EA). Pet. 55–56. Petitioner acknowledges that Example 8 lacks PP, but argues that Zhou lists only eight alternative suitable linear carboxylic acid esters, two of which are EA and PP, and replacement of EA with PP in Example 8 would have been obvious. *Id.* at 56. Petitioner contends that Example 8 has 16.56 wt% EA, so

substituting EA with PP results in PP falling within the claimed Z range of 5–20 wt% of the total electrolyte. *Id.*; *see also* Ex. 1014 ¶ 11.

According to Petitioner, “Zhou prefers dinitriles and trinitriles as additives, as they ‘improve the high temperature performance of the battery,’ and particularly prefers HTCN because it is ‘[an] efficient high temperature additive’ having ‘better compatibility with the negative electrode and . . . protect[ing] the positive electrode.” Pet. 57 (citing Ex. 1014 ¶ 59) (alterations in original). Petitioner states that Zhou “identifies a few suitable linear carboxylic acid esters: ‘[PP], ethyl propionate, propyl acetate, butyl propionate, [EA], isopropyl propionate, ethyl butyrate, and methyl acetate.’” *Id.* (citing Ex. 1014 ¶ 11).

Petitioner provides the overall composition of Zhou Example 8 in an illustration:



Pet. 58 (citing Ex. 1003 ¶¶ 183–184). Petitioner’s illustration above lists each ingredient and its weight percentage separately for Example 8’s solvent and additives. Pet. 63 (citing Ex. 1014 ¶ 47; Ex. 1003 ¶¶ 204–184).

According to Petitioner, Zhou specifies the weight percentage of additives based on “the total mass of the lithium-ion battery electrolyte.” *Id.* at 62 (quoting Ex. 1014 ¶¶ 9, 13–16, 18; Ex. 1003 ¶ 202).

Petitioner contends that the weight percentage of ADN (dinitrile) in the total electrolyte is 1 wt% (the claimed *X*) in Example 8. Pet. 58. Petitioner contends that HTCEN (trinitrile) has a weight ratio of 1.5 wt% (the claimed *Y*).¹² *Id.* Example 8¹³ is asserted to have a weight ratio for EA (denoted as *Z'* and claimed to be interchangeable with PP) in the total electrolyte after mixing the additives with the lithium salt and solvent, of $(1-25.5\%) \times (20\% / (25\% + 30\% + 10\% + 20\% + 5\%)) = 16.56\%$.¹⁴ *Id.* at 58–59. Petitioner reports the following values for *X*, *Y*, and *Z'*: *X* = 1 wt%, *Y* = 1.5 wt%, *Z'* = 16.56 wt%. *Id.* at 59.

Petitioner contends that “[e]ach Example electrolyte in Zhou is a self-contained working example providing a complete list of compounds, amounts, and preparation instructions.” Pet. 59. According to Petitioner, a POSITA would have been motivated to implement Zhou’s Example 8 with a reasonable expectation of success, as the battery of Example 8 significantly outperformed the Comparative Example batteries on low impedance. *Id.* (citing Ex. 1014 ¶¶ 57, 61), Figs. 1, 4.

Petitioner also contends that it would have been obvious to try Zhou Example 8. Pet. 60. Petitioner asserts that there was a market need for fast-charging technology driven by popularization of smart digital products and

¹² Petitioner identifies this HTCEN weight ratio with Example 4, but this appears to be a typographical error, as Petitioner’s discussion relates to Example 8, and Example 8 also has an HTCEN weight ratio of 1.5 wt%.

¹³ This again appears to refer to Example 8, not Example 4, based on the number provided.

¹⁴ Because the solvent components add up to 90 wt%, rather than 100 wt%, Petitioner’s calculation is incorrect, but it appears that *Z'* would be < 20 wt% taking the error into account.

electrical vehicles that Zhou addressed with “a combination of solvent and additives that matches the fast charging electrolytes” and “[i]mprov[es] battery kinetics, high temperature performance, and cycle performance[.]” *Id.* (citing Ex. 1014 ¶ 5). Petitioner argues that Zhou discloses only eight electrolyte solutions (Examples 1–8), all of which had better performance than the Comparative Examples. *Id.* Petitioner contends that Example 8 outperformed Examples 3–6 in discharge capacity and outperformed Examples 1, 2, 4, and 6 in internal impedance, making Example 8 a priority to try. *Id.* According to Petitioner, all of Zhou’s Examples were successfully tested in batteries and outperformed the Comparative Examples. *Id.* at 61 (citing Ex. 1014 ¶¶ 57–63).

a. Claim 1

Addressing claim 1 specifically, Petitioner argues that Zhou Example 8 teaches [1.pre] an electrolyte, comprising [1.1] a dinitrile (ADN) and a trinitrile (HTCN). Pet. 61. Petitioner acknowledges that Zhou Example 8 discloses EA rather than PP for element [1.1], but argues that Zhou lists EA and PP as two of only eight alternative suitable linear carboxylic acid esters, and replacement of EA with PP in Example 8 would have been obvious with a reasonable expectation of success. *Id.* at 61–62. Petitioner also argues that a POSITA would have found it obvious to substitute PP for EA, citing a recognized need, finite number of identified, predictable solutions, and reasonable expectation of success discussed, *supra*. Petitioner contends that the substitution was a simple one, replacing one carboxylic acid ester for another having similar properties, and would yield predictable results. *Id.* at 64.

Regarding element [1.2], “wherein, about $2.2 \text{ wt}\% \leq (X+Y) \leq$ about 8 wt%, about $0.1 \leq (X/Y) \leq$ about 2.3,” Petitioner argues that X and Y have the following values in Zhou’s Example 8:

X	Y	$X+Y$	X/Y
1 wt%	1.5 wt%	2.5 wt%	0.67

and both $X+Y$ and X/Y satisfy the claimed ranges. Pet. 65.

Regarding element [1.3], “wherein $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$ or $30 \text{ wt}\% \leq Z \leq 50 \text{ wt}\%$,” Petitioner argues the amount of EA in Example 8 is 16.56 wt% (Z'), and the proposed substitution of PP for EA would mean 16.56 wt% of PP, satisfying $5 \text{ wt}\% \leq Z \leq 20 \text{ wt}\%$. Pet. 65.

Regarding element [1.4], Petitioner argues that $Y=1.5 \text{ wt}\%$ and $Z'=16.56 \text{ wt}\%$, thus $Y/Z'=0.091$, and Y/Z would also equal 0.091, satisfying the element. Pet. 66.

Petitioner contends that Zhou discloses ADN as a dinitrile compound (element [1.5]), HTCN as a trinitrile compound (element [1.6]), and 1,3-propane sultone (PS) as a compound having a sulfur-oxygen double bond (element [1.7]). Pet. 66.

b. Dependent Claims 2–6

Claim 2 depends from claim 1 and further recites “wherein $0.1 \leq$ a weight percentage of the adiponitrile \div a weight percentage of the trinitrile compound ≤ 2.3 ” based on the total weight of the electrolyte. Ex. 1001, 34:38–47. Petitioner argues that Zhou’s Example 8 teaches $X/Y=0.67$, falling within the claimed range. Pet. 67.

Claim 3 depends from claim 1 and further recites “wherein the compound having a sulfur-oxygen double bond comprises 1,3-propanesultone, . . . and the weight percentage . . . is not less than 0.1 wt%

and not greater than 3 wt%. Ex. 1001, 34:47–51. Petitioner argues that the values of PS in Zhou Example 8 (2 wt%) falls within the claimed range. Pet. 67.

Claim 4 depends from claim 1 and further recites “wherein $0.1 \leq X/Y \leq 2.0$. Ex. 1001, 34:52–53. Petitioner argues that Zhou Example 8 discloses $X/Y=0.67$, falling within the claimed range. Pet. 67.

Claim 5 depends from claim 1 and further recites “where $0.025 \leq Y/Z \leq 0.3$. Ex. 1001, 34:54–55. Petitioner argues that Example 8 as modified renders this claim obvious. Pet. 67.

Claim 6 depends from claim 1 and further recites “wherein X is 0.01–10 wt%, Y is 0.01–10 wt%.” Ex. 1001, 34:56–57. Petitioner argues that Zhou Example 8 discloses $X=1$ wt% and $Y=1.5$ wt%, meeting claim 6. Pet. 68.

c. Claims 12 and 16–26

As with Zeng (*see* § III.D.2.c), Petitioner argues that these claims are substantively identical to or similar to claims 1–6 except for reciting an electrochemical device having electrodes. Pet. 68–69.

3. *Patent Owner’s Position*

Patent Owner alleges that Zhou fails to teach, suggest, disclose, or otherwise render obvious at least the PP weight percentages of elements [1.3], [12.3], and [20.3] or the trinitrile to PP ratios of [1.4], [12.4], and [20.4]. Prelim. Resp. 43–44.

Patent Owner argues that Petitioner fails to show that a POSITA would have selected or implemented Zhou. Prelim. Resp. 44. Patent Owner asserts that an objective task of the ’910 patent was to provide electrolyte compositions which prevent premature degradation of the electrolyte and thus deterioration of the battery material with reduced battery capacity,

especially for electrochemical devices working at voltages above 4.4V, such as 4.45V. *Id.* (citing Ex. 2015 ¶ 193). According to Patent Owner, however, Zhou is silent with respect to cathode SEI film formation or high-voltage operation as its objective is a fast-charging electrolyte, which emphasizes better wettability, lower viscosity, and lower lithium-ion transmission resistance. *Id.* (citing Ex. 2015 ¶ 194; Ex. 1014 ¶ 3). Patent Owner argues that Zhou is directed to batteries with a lower charging voltage of only 4.35V, which a POSITA would know is substantially different from and much lower than the high working voltages (e.g. 4.45V) of the '910 patent. *Id.* at 44–45 (citing Ex. 2015 ¶ 195 (explaining that a POSITA would know that small voltage differences can lead to substantial (e.g., exponential) differences in rates of reaction)). Patent Owner also argues that a POSITA would have found Zhou's AC impedance testing/focus to be insufficient when faced with the decomposition and premature degradation problem of the '910 patent because the DC internal resistance of the '910 patent is different from the AC impedance studied in Zhou. *Id.* at 45 (citing Ex. 2015 ¶¶ 196–197). Patent Owner alleges that Zhou has “multiple erroneous references to different or non-existent comparative examples in nearly every Example and Comparative Example,” causing a POSITA not to select or implement the reference. *Id.* at 46 (citing Ex. 2015 ¶ 198).

Patent Owner challenges Petitioner's and Dr. Lucht's position that Zhou Example 8 outperforms all other example batteries depicted in Zhou Figure 4. Prelim. Resp. 46 (citing Ex. 2015 ¶¶ 199–203; Ex. 1003 ¶ 191). Patent Owner details why it believes Dr. Lucht's interpretations of Figure 4 are wrong. *Id.* at 46–48 (citing Ex. 2015 ¶¶ 201–203).

Patent Owner notes that Figure 3 of Zhou is the only figure that purports to depict battery cycle performance at high temperatures (45 °C), and Zhou indicates that HTCEN is particularly preferred to improve the high temperature performance of the battery. Prelim. Resp. 49. Patent Owner questions Petitioner's failure to address the fact that the electrolyte solutions of Examples 4 and 8 of Zhou are the only examples that include a trinitrile (HTCN), yet neither Example 4 nor Example 8 is depicted in Figure 3. *Id.* Patent Owner concludes that a POSITA would not be able to draw any conclusions from Zhou regarding the effect of a trinitrile on high temperature performance, and would not have selected or implemented Example 8 over any other Examples. *Id.* (citing Ex. 2015 ¶ 207). Patent Owner thus asserts that a POSITA would not have a reasonable expectation of success in implementing Example 8. *Id.*

Zhou teaches away from the combination of a dinitrile compound and a trinitrile compound in its electrolyte solutions, according to Patent Owner. Prelim. Resp. 49. Zhou discloses that among the nitrile compounds containing two or three nitrile functional groups, HTCEN is particularly preferred, and the high temperature improvement effect of other dinitrile compounds or mononitrile compounds is relatively poor. Ex. 1014 ¶ 59. Patent Owner contends that a POSITA would not have selected or implemented Example 8, having both a dinitrile and a trinitrile to avoid the negative effect on cycle performance in fast charging of excessive addition of nitrile. Prelim. Resp. 50.

Patent Owner argues that there is no unambiguous data that would indicate to or encourage a POSITA to choose any particular embodiment of

Zhou over another. Prelim. Resp. 50 (citing Ex. 2015 ¶ 209). Patent Owner identifies the following in support of this argument:

Ex. 1014, FIGS. 1 (Examples 1 and 2 are absent), 2 (Examples 3 and 6–8 are absent), 3 (Examples 3, 4, 7, and 8 are absent and Comparative Example 1 is depicted as having two distinct curves), and 4 (Examples 3, 5, and 7 are absent) ¶¶ [0060]–[0063].

Prelim. Resp. 50.

Further questioning Petitioner’s use of Zhou Example 8, Patent Owner notes that the sum of the mass ratio of the solvent components in Example 8 only adds up to 90, while the mass ratios of all other Examples and Comparative Examples add up to 100. Prelim. Resp. 50–51 (citing Ex. 2015 ¶ 210). Patent Owner criticizes Petitioner’s failure to address the discrepancy. *Id.* at 51. Patent Owner further criticizes Dr. Lucht’s assumption that mass ratio directly corresponds to weight percentages of the identified solvent components. *Id.* Patent Owner suggests that “[i]t is unknown if there is an additional, different solvent component present at 10 wt% or if there is an additional 10 wt% of one or more of the identified solvent components,” concluding that a POSITA would have disregarded Example 8. *Id.*

a. Claims 1, 12, and 20

Because Zhou does not teach or suggest the ratio of the content of the trinitrile compound to the content of PP, argues Patent Owner, Petitioner relies on what is characterized as Dr. Lucht’s erroneous interpretations of Example 8. Prelim. Resp. 51. Patent Owner contends that Dr. Lucht assumes that the mass percentages for various additives (including ADN and HTC�) and for lithium salt are all based on the total mass of the final electrolyte

solution, and uses this assumption in his calculations. *Id.* at 51–52 (citing Pet. 57; Ex. 1003 ¶¶ 183–189). However, Patent Owner urges, Example 8 is silent as to what the identified mass percentages are relative to and is subject to at least two other interpretations detailed by Patent Owner. *Id.* at 52. Patent Owner argues that “Dr. Lucht’s flawed assumptions otherwise permeate his calculations of the alleged weight percentages of dinitrile, trinitrile, and PP, as well as the corresponding claimed weight percentage sums and ratios such that they should be disregarded.” *Id.* at 53 (citing Ex. 2015 ¶ 215).

Patent Owner challenges Petitioner’s assertion that a POSITA would have substituted PP for ethyl acetate (EA) in Zhou’s Example 8. Prelim. Resp. 53. Patent Owner argues that Zhou reports “no preference, special significance, or even the slightest indication to select PP” as the linear carboxylic acid ester for the electrolyte solution “as PP is not used in any of the Comparative Examples or Examples or otherwise tested for its actual functionality.” Prelim. Resp. 54 (citing Ex. 1014 ¶¶ 26–48, 52–55). According to Patent Owner, the chemical interactions and effects of complex combinations of various compounds in electrolyte solutions are extremely complex and unpredictable, not yielding predictable results from substituting PP for EA. *Id.* (citing Ex. 2015 ¶ 217).

In addition, Patent Owner contends that a POSITA would not expect PP to have a low melting point and provide a good channel for ion conductivity because PP is a larger molecule and substitution of it for EA would increase both the melting point and the boiling point relative to the smaller EA molecule, defeating Zhou’s identified purpose of providing a more suitable channel for lithium-ion transmission and reducing the

impedance of the battery system. Prelim. Resp. (citing Ex. 2015 ¶¶ 218, 222). Dr. Wheeler testifies that having both a low melting point and a low boiling point correlates to lower viscosity. Ex. 2015 ¶ 220. Dr. Wheeler testifies that PP's boiling point is considerably higher than other solvents used in Examples 1–8, its melting point is also nearly 10 °C higher than that of EA, and its viscosity is 53% higher than that of EA. *Id.* ¶¶ 219–220. Without accounting for such varying parameters, Petitioner's assumption that the PP would be substituted at a 1:1 weight percentage ratio "severely further undercuts the reliability of Dr. Lucht's opinions." Prelim. Resp. 55 (citing Ex. 2015 ¶ 224).

b. Claims 2–6, 16–19, and 21–26

Patent Owner contends that claims 2–6, 16–19, and 21–26 are not unpatentable over Zhou for the same reasons as discussed in relations to claims 1, 12, and 20, *supra*. Prelim. Resp. 56.

c. Challenge to Claims 20–26 Forfeited

Patent Owner argues that, similar to Ground 1A, Petitioner chose to provide a summary table with respect to any application of Zhou to Claim 20 in Ground 4A. Prelim. Resp. 56 (citing Pet. 68–69). The argument and evidence cited in the summary table for element [20.7] as alleged "reasoning" fails to address the requirement of "fluoroethylene carbonate" in element [20.7], according to Patent Owner. *Id.* (citing Ex. 2015 ¶ 230). Nor does Dr. Lucht present any argument that element [20.7] is met. *Id.* (citing Ex. 2015 ¶¶ 226, 229; Ex. 1003, p. 98 (summary table)). Patent Owner argues that Petitioner thus forfeits any challenge of claim 20 and claims 21–26 which depend therefrom. *Id.*

4. Analysis

Patent Owner contends that Zhou is fundamentally different from the claims of the '910 patent, and “[a] POSITA would not have selected or implemented Zhou because the electrolyte formulation purposes in Zhou are not aligned with the objective task underlying the '910 Patent.” Prelim. Resp. 44. However, our reviewing court holds “[o]ne of ordinary skill in the art need not see the identical problem addressed in a prior art reference to be motivated to apply its teachings.” *Cross Med.*, 424 F.3d at 1323; *see also In re Oetiker*, 977 F.2d 1443, 1448 (Fed. Cir. 1992) (Nies, C.J., concurring). “In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. What matters is the objective reach of the claim.” *KSR*, 550 U.S. at 419.

Thus, we do not find that a POSITA would be dissuaded from considering Zhou for all that it discloses. *Symbol Techs., Inc. v. Opticon, Inc.*, 935 F.2d 1569, 1578 (Fed. Cir. 1991) (a reference is prior art for all that it teaches).

As to the issues of multiple alleged errors in Zhou and by Dr. Lucht, these are better addressed through the discovery process in which experts for both sides can state and defend their positions.

Patent Owner contends that Zhou teaches away from a combination of a dinitrile and a trinitrile because dinitrile contains less nitrile groups for the same volume. Prelim. Resp. 49. Patent Owner argues that Zhou teaches a POSITA to explicitly avoid implementing Example 8 due to its combination of a dinitrile and a trinitrile. *Id.* at 49–50.

Zhou states:

For the improvement of high temperature performance under high voltage of the fast charging system, *among the nitrile compounds containing 2 or 3 nitrile functional groups in the third additive used in the present invention to improve the high temperature performance of the battery, 1,3,6-hexane trinitrile is particularly preferred.* This is related to the poor compatibility of nitrile compounds with the negative electrode. The high temperature performance is often challenged when using the solvent system of the present invention. An efficient high temperature additive is the best choice. Nitrile compounds containing 2 or 3 nitrile functional groups, such as 1,3,6-hexane trinitrile, contain three nitrile groups, and the density of nitrile groups per unit volume is higher. It has better compatibility with the negative electrode and is easier to protect the positive electrode. The high temperature improvement effect of other dinitrile compounds or mononitrile compounds is relatively poor. This requires more nitrile to compensate. However, *excessive addition of nitrile has a negative effect on the cycle performance,* especially in the case of fast charging, this phenomenon is more obvious, and the cycle performance will drop rapidly.

Ex. 1014 ¶ 59 (emphasis added). We do not read Zhou as explicitly teaching away from implementing Example 8. Rather, Zhou seems to encourage use of HTCN, the trinitrile used in Example 8. Zhou teaches “*excessive addition of nitrile*” has a negative effect, but does not “criticize, discredit, or otherwise discourage investigation into” any of the electrolyte solutions of the Examples. *See Meiresonne*, 849 F.3d at 1382.

Dr. Wheeler criticizes Dr. Lucht’s calculations for mistakenly assuming that the mass ratios of the solvent components in Example 8 add up to 100, when in fact, they add up only to 90. *See Ex. 2015 ¶¶ 185–189, 210.* Dr. Wheeler also criticizes Dr. Lucht for assuming that mass ratios directly correspond to weight percentages of the identified solvent components. *Id.* ¶ 210. According to Dr. Wheeler, “[i]t is unknown if there

is an additional, different solvent component present at 10 wt% or if there is an additional 10 wt% of one or more of the identified solvent components.”

Id. This is another issue that is best investigated through the discovery process.

The final issue with Zhou is whether a POSITA would have substituted PP for ethyl acetate in Zhou Example 8.

Petitioner argues that Zhou discloses PP and EA as two of eight suitable, alternative linear carboxylic acid esters to be used in the solvent. Pet. 62 (citing Ex. 1014 ¶¶ 8, 11; Ex. 1003 ¶ 197). Petitioner contends that a POSITA would have found it obvious to try the substitution because Zhou acknowledged a recognized demand for fast charging lithium ion batteries which require the electrolyte to have higher kinetic properties and smaller mass transfer resistance, and explained that “low-boiling-point organic solvents are commonly used to improve the kinetic properties of the electrolyte.” *Id.* (citing Ex. 1014 ¶¶ 3–4); *see also* Ex. 1014 ¶ 55 (“[T]he melting and boiling points of the linear carbonate and carboxylate solvents . . . are both low, providing a more suitable channel for lithium-ion transmission and reducing the impedance of the battery system.”). Zhou discloses that fast-charging batteries need organic solvents that improve kinetic properties of electrolytes, according to Dr. Lucht. Ex. 1003 ¶ 199. Dr. Lucht testifies that Zhou proposes a handful of solutions to increase kinetic performance, and PP is one of them. *Id.* ¶ 200. And a POSITA would have had a reasonable expectation of success in replacing one linear carboxyl acid ester (EA) with another (PP) listed alongside as a suitable linear carboxylic acid ester, per Dr. Lucht. *Id.* ¶ 201. Dr. Lucht testifies that Zhou teaches that large quantities, and different types, of carboxylic acid

esters in electrolyte solutions “is more conducive to the fast charging of the system under high voltage and high compaction conditions.” *Id.* ¶ 202. Thus, a POSITA would not expect replacing EA with PP in Example 8 to render the electrolyte inoperable or hurt performance, but rather that the resulting electrolyte would provide a good ion channel for fast charging. *Id.*

Patent Owner points out that none of the Examples in Zhou include PP. Prelim. Resp. 53. Patent Owner contends that it would not have been obvious to try the substitution of PP for EA in Zhou Example 8. *Id.* Zhou discloses no preference or special significance for selecting PP, accord to Patent Owner. *Id.* at 54. Patent Owner asserts that the chemical interactions and effects of complex combinations of various compounds in electrolyte solutions are extremely complex and unpredictable, and a POSITA would not expect predictable results from adding PP in the place of EA. *Id.* (citing Ex. 2015 ¶ 217).

Dr. Wheeler testifies that, even though Zhou lists PP alongside EA in a list of eight linear carboxylic acid esters, a POSITA would not expect PP to have a low melting point and provide a good channel for ion conductivity. Ex. 2015 ¶ 218. According to Dr. Wheeler, PP is a larger molecule and such substitution would increase both the melting point and the boiling point relative to the smaller EA molecule, which defeats Zhou’s identified purpose of using this solvent component. *Id.* ¶ 222. Dr. Wheeler criticizes Dr. Lucht’s assumption that that PP would be substituted at a 1:1 weight percentage ratio, without accounting for varying parameters (e.g., boiling point, viscosity, molecule size, molar mass, etc.). *Id.* ¶ 224.

Patent Owner argues that the chemical reactions in a battery are unpredictable, and a POSITA would understand that all of the components

of an electrolyte are important and interact in complex and unexpected ways and substituting one component for another, even if apparently chemically similar, can cause substantial changes to properties of interest. Prelim. Resp. 55 (citing Ex. 2015 ¶ 223).

Petitioner provides a chart to show where, in earlier parts of the Petition, each element of claims 12 and 16–26 may be found. Pet. 68–69. Unlike in the Zeng-based Grounds, for the Zhou-based Grounds Petitioner directs us to its briefing related to each of claim elements [20.pre] through [20.7]. *See id.* at 69. Patent Owner contends that none of the cited evidence is sufficient to teach fluoroethylene carbonate, as recited in claim 20, therefore Petitioner forfeits any challenge to claims 20–26. Prelim. Resp. 56.

Considering the preliminary record and, in particular, Zhou’s identification of PP as a linear carboxylic acid ester for use in Zhou’s electrolyte, Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to at least claims 1–6, 12, and 16–19.

J. Ground 5A: Alleged Obviousness of Claims 13 and 14 over Zhou and Sunose

1. Petitioner’s Position

Petitioner contends that Zhou and Sunose render claims 13 and 14 obvious. Pet. 69.

a. Claim 13

Petitioner argues that Zhou discloses electrolytes that meet the requirements of element [13.1]. Pet. 70 (citing Ex. 1014 ¶¶ 6, 57, 61; Ex.1003 ¶ 230).

Petitioner contends that Sunose discloses element [13.2]. Pet. 70 (citing Ex. 1003 ¶ 231).

For elements [13.3] and [13.4], Petitioner relies on Sunose. Pet. 70 (citing Ex. 1003 ¶¶ 232–234). According to Petitioner, for the reasons discussed in Ground 2A, a POSITA would have found it obvious to configure Zhou’s cathode according to Sunose’s Examples. *Id.* (citing Ex. 1003 ¶ 233). Petitioner argues that, because Zhou focuses on electrolytes and omits description of the physical configuration of the battery, a POSITA would have looked to Sunose for implementation details for its improved electrode and would have had a reasonable expectation of success. *Id.* at 70–71 (citing Ex. 1003 ¶ 233).

b. Claim 14

Petitioner argues that the Zhou-Sunose combination includes this element. Pet. 71 (citing Ex. 1003 ¶ 235).

2. *Patent Owner’s Position*

Patent Owner argues that the deficiencies discussed with respect to Ground 4A applies equally here. Prelim. Resp. 59.

3. *Analysis*

On the record at this stage of the proceeding, having found sufficient support to meet Petitioner’s burden in relation to Zhou’s disclosure and having no comment from Patent Owner to counter Petitioner’s argument regarding Sunose or its combination with Zhou, we find that Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to claims 13 and 14.

K. Ground 6A: Alleged Obviousness of Claim 15 over Zhou, Sunose, and Su

1. Petitioner's Position

Petitioner argues that Zhou discloses or suggests element [15.1]. Pet. 71. Petitioner argues the Su discloses elements [15.2]–[15.4], relying on the discussion of these references in relation to Ground 3A. *Id.* at 71–72 (citing Ex. 1003 ¶¶ 238–239).

2. Patent Owner's Position

Patent Owner argues that the deficiencies discussed with respect to Ground 4A regarding Zhou applies equally here. Prelim. Resp. 59.

3. Analysis

On the record at this stage of the proceeding, having found no fault with Petitioner's position on Zhou's disclosure and having no comment from Patent Owner to counter Petitioner's argument regarding Sunose or Su, or their combination with Zhou, we find that Petitioner meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to claim 15.

L. Grounds 4C, 5C, 6C: Alleged Obviousness over Zhou and Kim (Claims 1–6, 12, 16–26, Ground 4C); Zhou/Kim and Sunose (Claims 13 and 14, Ground 5C); Zhou/Kim/Sunose and Su (Ground 6C)

1. Petitioner's Position

Petitioner argues that Kim motivates considering the ratio of trinitrile to PP in Zhou and substituting EA for PP in Zhou Example 8 for the reasons discussed in relation to Grounds 1C–3C. Pet. 72. Petitioner contends that “Zhou draws further attention to the advantage of the trinitrile HTC� by explaining that it has ‘[a high] density of nitrile groups per unit volume’ and

‘better compatibility with the negative electrode and is easier to protect the positive electrode.’” *Id.* at 72–73 (citing Ex. 1014 ¶ 59) (alteration in original). Petitioner argues that Zhou also discloses that EA can be substituted for PP, drawing attention to PP. *Id.* (citing Ex. 1014 ¶ 11). Petitioner notes that Zhou cautions a POSITA against using an “excessive” amount of PP because it “has a negative effect on the cycle performance,” focusing attention on *Y/Z*. *Id.* at 73 (citing Ex. 1014 ¶ 59); Ex. 1003 ¶¶ 240–242).

2. Patent Owner’s Position

Patent Owner argues that Petitioner merely incorporates other sections of the Petition having to do with the Zeng/Kim combinations, but “nowhere sets forth or otherwise incorporates its analysis of Zhou with respect to the individual elements that rely solely on Zhou (Grounds 4A, 5A, or 6A).” Prelim. Resp. 57 (citing Pet. 72). Patent Owner asserts that Petitioner’s failure to adequately incorporate the relevant portions of its Petition dooms Grounds 4C, 5C, and 6C. *Id.* at 57–59.

3. Analysis

On the preliminary record, we agree with Patent Owner that Petitioner fails to demonstrate that it meets the threshold showing under 35 U.S.C. § 314(a) for institution of trial with respect to Grounds 4C, 5C, and 6C.

IV. CONCLUSION

For the foregoing reasons, we determine that Petitioner has demonstrated a reasonable likelihood that it would prevail with respect to at least one of the claims challenged in the Petition. Accordingly, we institute an *inter partes* review of the ’910 patent.

This determination is, however, based on a preliminary record and is not final on any issues of patentability. We will make a final determination on the patentability of the challenged claims, as necessary and applying the preponderance of the evidence standard, based on a fully developed record through trial.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–6 and 12–26 of U.S. Patent No. 11,769,910 B2 is hereby *instituted* with respect to all grounds set forth in the Petition, commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; and

FURTHER ORDERED that the trial will be conducted in accordance with a separately issued Scheduling Order.

IPR2025-00405
Patent 11,769,910 B2

FOR PETITIONER:

Jason Eisenberg
Jason Fitzsimmons
Kristina Kelly
STERNE, KESSLER, GOLDSTEIN & FOX PLLC
jasone-ptab@sternekessler.com
jfitzsimmons-ptab@sternekessler.com
kckelly-ptab@sternekessler.com

James Stein
LEE & HAYES, P.C.
james.stein@leehayes.com

PATENT OWNER:

Christopher Douglas
Madeline Byrd
Miranda Sooter
Casey Hickey
ALSTON & BIRD LLP
christopher.douglas@alston.com
maddy.byrd@alston.com
miranda.sooter@alston.com
casey.hickey@alston.com