

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
APPLE INC.,¹
Petitioners

v.

RJ TECHNOLOGY LLC,
Patent Owner.

Case IPR2023-01183

Patent No. 7,749,641 B2

PATENT OWNER'S SUR-REPLY

¹ Apple Inc. was joined as a petitioner in this proceeding based on a petition and motion for joinder filed in IPR2024-00597, which was granted.

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EXHIBIT LIST

Exhibit No.	Description
2001	C. Love, et al., <i>Impedance Diagnostic for Overcharged Lithium-Ion Batteries</i> , Electrical and Solid-State Letters 15, pp. A53-A56 (2012)
2002	Declaration of George Stamatopoulos
2003	Declaration of Daniel Zaheer
2004	Declaration of Robert Zhou
2005	Declaration of Michael Ng
2006	Declaration of Dr. Yan Yao
2007	CV of Dr. Yan Yao
2008	Deposition Transcript of Marc Juzkow, dated May 3, 2024
2009	A. Robert Armstrong & Peter Bruce, <i>Synthesis of layered LiMnO₂ as an electrode for rechargeable lithium batteries</i> , 381 NATURE 499 (June 6, 1996) (“Armstrong 1996”)
2010	Order Regarding Claim Construction, <i>RJ Technology LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 82 (August 2, 2023) (“Apple Claim Construction Order”).
2011	Plaintiff RJ Technology LLC’s and Defendants Samsung Electronics Co., Ltd.’s and Samsung Electronic America, Inc.’s P.R. 4-5(d) Joint Claim Construction Chart, <i>RJ Technology LLC v. Samsung Electronics Co. Ltd.</i> , No. 2:22-v-00401-JRG-RSP, Dkt. 105 (January 25, 2024).
2012	Plaintiff RJ Technology LLC’s Responsive Claim Construction Brief, <i>RJ Technology LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 74 (July 14, 2023)
2013	SAFT, <i>Charging your lithium-ion batteries: 5 expert tips for a longer lifespan</i> (https://www.saft.com/energizing-iot/charging-your-lithium-ion-batteries-5-expert-tips-longer-lifespan#:~:text=When%20the%20battery%20provides%20current,This%20restores%20the%20battery's%20capacity) (last accessed May 7, 2024).

2014	Kazunori Ozawa, <i>Lithium-ion rechargeable batteries with LiCoO₂ and carbon electrodes: the LiCoO₂/C system</i> , 69 Solid State Ionics 212 (1994) (“Ozawa 1994”).
2015	B. Pattipati et al., <i>Open circuit voltage characterization of lithium-ion batteries</i> , 269 J. Power Sources 317 (2014) (“Pattipati 2014”)
2016	Takeshi Uyama et al., <i>Synthesis of Rhombohedral LiCo_{0.64}Mn_{0.36}O₂ using a high-pressure method</i> , 58 Inorg. Chem. 6684 (2019) (“Uyama 2019”)
2017	Akihisa Kajiyama et al., <i>Synthesis and electrochemical properties of Li_xCo_{0.5}Mn_{0.5}O₂</i> , Solid State Ionics 149 (2002) 39-45 (“Kajiyama”)
2018	Jaephil Cho et al., <i>Electrochemical properties and thermal stability of Li_aNi_{1-x}Co_xO₂ cathode materials</i> , 147 Journal of the Electrochemical Society (1) 15-20 (2000) (“Cho 2000”)
2019	Declaration of Thomas F. Fuller, Ph.D. in Support of Samsung’s Proposed Claim Construction, <i>RJ Technology LLC v. Samsung Electronics Co. Ltd.</i> , No. 2:22-v-00401-JRG-RSP, Dkt. 100-8 (November 16, 2023).
2020	Ramadass Premanand et al., <i>Studies on Capacity Fade of Spinel-Based Li-Ion Batteries</i> , J. Electrochem. Soc 149 A54 (2002)
2021	C. Julien et al., <i>Combustion synthesis and characterization of substituted lithium cobalt oxides in lithium batteries</i> , 135 Solid State Ionics 241
2022	Declaration of Dr. Yan Yao in Support of Plaintiff RJ Technology LLC’s Opening Claim Construction Brief, <i>RJ Technology LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 70-1 (June 23, 2023)
2023	Pankaj Arora et al., <i>Capacity fade mechanisms and side reactions in lithium-ion batteries</i> , 145 J. Electrochemical Soc. (10) 3647-3667 (“Arora 1998”)
2024	Bradely Johnson & Ralph White, <i>Characterization of commercially available lithium-ion batteries</i> , Journal of Power Sources 70 (1998) 48-54 (“Johnson 1998”)
2025	S. Ohta et al., <i>Electrochemical performance of an all-solid-state lithium ion battery with garnet-type oxide electrolyte</i> , Journal of Power Sources 202 (2012) 332-335
2026	Eiji Hosono et al., <i>Synthesis of single crystalline electro-conductive Na_{0.44}MnO₂ nanowires with high aspect ratio for the fast charge-discharge Li ion battery</i> , Journal of Power Sources 182 (2008) 349-352

2027	Kaoru Dokko et al., <i>Solvate Ionic Liquid Electrolyte for Li-S Batteries</i> , Journal of the Electrochemical Society, 160 (8) A1304-A1310 (2013)
2028	Kai Chen et al., <i>High capacity and cyclic performance in a three-dimensional composite electrode filled with inorganic solid electrolyte</i> , Journal of Power Sources 249 (2014) 306-310
2029	Zhanpeng Huang et al., High-capacity and stable sodium-sulfur battery enabled by confined electrocatalytic polysulfides full conversion, Adv. Funct. Mater. 2021, 31, 2100666
2030	Declaration of Mr. Louis Hruska, <i>Apple Inc. v. RJ Technology LLC</i> , IPR2023-01350, Ex1003.
2031	Declaration of Dr. Yanliang Liang
2032	CV of Dr. Yanliang Liang
2033	Spreadsheet by Mr. Marc Juzkow
2034	W.D. Johnston et al., <i>The preparation, crystallography, and magnetic properties of the $\text{Li}_x\text{Co}_{(1-x)}\text{O}$ system</i> , J. Phys. Chem. Solids. Pergamon Press 1958, Vol. 7, 1-13
2035	K. Banov et al., <i>High voltage cathode materials based on lithium cobaltate with nickel and manganese doping</i> , Bulgarian Chemical Communications, Volume 50, Special Issue A, 171 (2018)
2036	M.M. Thackeray et al., <i>Lithium insertion into Co_3O_4: a preliminary investigation</i> , 17 Solid State Ionics 175 (1985)
2037	T.D. Tran et al., <i>Rate effect on lithium-ion graphite electrode performance</i> , J. Applied Electrochem. 26 (1996) 1161-67 (“Tran 1996”)
2038	R. Prasad et al., <i>Dopant-induced stabilization of rhombohedral LiMnO_2 against Jahn-Teller distortion</i> , 71 Physical Review B 134111 (2005) (“Prasad 2005”)
2039	Z.P. Guo et al., <i>Structure and electrochemical characteristics of $\text{LiMn}_{0.7}\text{M}_{0.3}\text{O}_2$ ($\text{M}=\text{Ti}, \text{V}, \text{Zn}, \text{Mo}, \text{Co}, \text{Mg}, \text{Cr}$)</i> , 348 J. Alloys and Compounds 231 (2003) (“Guo 2003”)

Petitioner misrepresents the Apple litigation record and baselessly accuses PO's experts in an attempt to distract from the merits of this proceeding. For the reasons set forth below, the Board should find the challenged claims patentable.

I. THE CHARGE CUTOFF VOLTAGE SHOULD NOT EXCEED 4.2V²

Contrary to Petitioner's assertions (Reply, 2), both experts testified that as of the priority date, charge cut-off voltages above 4.2V were not used, including because they were known to be dangerous and cause cathode dissolution in batteries with LiMn₂O₄ cathodes. Ex2006, ¶¶51-54, 206, 208-209; Ex2008, 76:8-15, 77:9-15, 100:14-20, 123:13-24, 124:21-25; POR, 8-9, 63-65. Petitioner's assertion is predicated solely upon examiner comments during prosecution of a child application that are not entitled to deference "in deciding the merits of an IPR." *TRUSTID, Inc. v. Next Caller, Inc.*, 2021 WL 4427918, at *8 (Fed. Cir. Sept. 27, 2021).

² Contrary to Petitioner's assertion, PO's references do not show the charge cutoff voltage could exceed 4.2V. Two references are not prior art. *See* Ex2017 (published in 2002); Ex2039 (published in 2003). Others disclose *electrolyte* stability at high voltages, not battery stability. *See* Ex2009, Ex2023. Arora charged the half-cell at 4.2V and Armstrong found that charging the half-cell at 4.3V led to significant capacity loss. Ex2006, ¶67.

II. PETITIONER'S CLAIM CONSTRUCTION ASSERTIONS ARE MERITLESS

A. The “charge cut-off voltage” is a battery property

Petitioner agrees the “charge cut-off voltage” is “the maximum voltage *to which* the battery *is configured to be charged*” (POR, 18) but incorrectly asserts that it is an applied voltage, not a battery property.

The “cut-off” is a voltage the battery is configured to reach (i.e., when charged to its full capacity); it thus refers to a battery property. Both experts testified that the battery’s voltage when fully charged (i.e., the “charge cut-off voltage”) is not necessarily equal to the maximum applied voltage. For example, the battery voltage is lower than the applied voltage in fast charging conditions. Ex2006, ¶¶89-90; Ex2008, 58:18-20; POR, 19-21. Thus, unlike the applied voltage, the charge cut-off voltage is indisputably a battery property. *Id.*; Ex1043, 77:12-16.

Claim 5 recites a “*secondary lithium-ion cell or battery [that] has a charge cut-off voltage,*” and other claims contain similar language from which a POSITA would understand that the charge cut-off voltage is a battery property. Ex1001, claims 1-3, 6-7. The specification also describes the charge cut-off voltage as a voltage “of” the battery or that the battery “has.” *See, e.g.*, Ex1001, 3:20-21, 3:26-29 (“the single secondary lithium-ion cell has a charge cut-off voltage”), 7:24-27.

Misinterpreting descriptions of an unclaimed embodiment (a “charging device ... with the proviso that said charging device controls the charge cut-off

voltage of the single lithium-ion cell within a range from 4.3V to 5.8V”) Petitioner incorrectly asserts that the charge cut-off voltage is an applied voltage. Reply, 4; Ex1001, 9:49-55. These descriptions—which cannot outweigh the claims in any event—merely require that this *unclaimed embodiment* must ensure that the battery is not overcharged to a voltage above its cut-off. For example, a charger could use constant current/constant voltage charging to ensure a battery’s voltage does not exceed its charge cut-off voltage. Ex2006, ¶91; POR, 30-31; Ex1043, 273:21-275:1, 276:8-277:3. Thus, the specification is consistent with the charge cutoff voltage being a battery property.

Petitioner also asserts that “examples 14 and 15 are identical batteries with different charge cut-off voltages.” Reply, 4. The assertion that the batteries are identical is baseless: the patent discloses that the invention “is advantageously carried out during the formation” period and “the cell reaches its optimal working state” after formation. Ex1001, 4:43-53; Ex1043, 107:16-108:12. A POSITA would thus understand that the example batteries—configured with different formation periods and tested at different voltages—have different charge cut-off voltages, even if they have identical pre-formation compositions. Ex1041, 7:12-16. But even if the batteries were identical, Petitioner’s assertion is inconsistent with the parties’ agreed-upon construction. Under that construction, identical batteries should be configured to identical charge cut-off voltages (since they are identical). Adopting

Petitioner’s construction (i.e., “charge cut-off voltage” is an applied voltage) would imply (improperly) that batteries with identical structures can be configured to different “charge cut-off voltages.” Petitioner’s position does not make sense.

Nor has PO shifted its position from the Apple litigation (Reply, 5-6), where the parties disputed whether the claims required a specific charging algorithm but agreed that the “charge cut-off voltage” is a battery property: Apple stated that claim 5 requires the battery to “have the physical property of a charge cut-off voltage” (*RJ Technology LLC v. Apple Inc.*, No. 8:22-cv-1874-JVS-JDE, Dkt. 73 (C.D. Cal. July 14, 2023), 6) (screenshot below); *see also* Ex1041, 9:23-10:16)³; and PO agreed that the claimed voltage is a “physical characteristic of the battery.” *See* Ex1041, 7:24-8:18 (“The physical characteristics of the battery are what counts here. There are physical properties of the battery that set the maximum to which [the battery] is charged”). Accordingly, the Board should reject Petitioner’s assertion.

7	Moreover, Plaintiff’s added limitation that the maximum voltage must be
8	“designed and manufactured” (Pl.’s Br. 9) improperly introduces a requirement as to
9	the <i>subjective intent</i> of a designer or manufacturer regarding the cut-off voltage. In
10	other words, Plaintiff’s proposed construction introduces the new requirement that a
11	battery be “ <i>configured</i> ” (“i.e., <i>designed and manufactured</i> ”) (<i>id.</i>) to be charged at a
12	charge cut-off voltage of 4.2 V, not just that it have the physical property of a charge
13	cut-off voltage set at 4.2 V, as claim 5 requires. <i>See</i> Horn Decl., ¶12. Plaintiff’s

³ Petitioner omits Apple’s position in the Reply. Reply, 5-6.

B. The charge cut-off voltage is a full-cell property

Petitioner improperly seeks to rewrite the claims so that the charge cut-off voltage is a half-cell rather than full-cell property. Reply, 6-7. Claim 5 expressly recites a “*secondary lithium-ion cell or battery has* a charge cutoff voltage greater than 4.2V” and thus unambiguously requires that the claimed voltage is a property of a *lithium-ion* battery (i.e., full-cell), not of a *lithium metal* battery (i.e., half-cell). *See also* Ex1001, claims 1-3, 6-7. Petitioner’s assertion that this phrase (“secondary lithium-ion cell or battery has”) would be superfluous unless the cut-off is also a half-cell property is illogical since this phrase limits the claimed cut-off to the full battery. In any event, Petitioner agreed that the term be construed as “the maximum voltage to which *the battery* [not half-cell] is configured to be charged” (Ex2011, 6) and should not be permitted to shift its position in Reply.

Further, the specification refutes Petitioner’s assertions by disclosing that half-cell voltages as high as 4.3V were known in the art; and 4.2V was a known battery voltage limit. *See* Ex1001, 1:64-2:14. Petitioner’s construction would render the specification self-anticipatory, which is disfavored. *Omega Eng’g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1329 n.6 (Fed. Cir. 2003) (“courts should attempt to construe claims to preserve their validity”).

In any event, regardless of whether the electrode capacity can be measured with a half-cell voltage (which is not required by the claims), the claims require that

the full-cell charge cut-off voltage be within the claimed range; thus, whether this term can be context-dependent does not affect the Board's analysis of the prior art in this IPR.

C. The “capacity ratio” uses theoretic capacities at 4.2V

Petitioner mischaracterizes the Apple litigation record to improperly assert that PO disclaimed the use of theoretic capacities measured at 4.2V. Reply, 7-9. There, PO argued (and the court agreed) that the claimed ratio is the ratio of the electrodes' theoretical capacities measured at 4.2V. Ex2010, 15; *see infra*. The court omitted the word “theoretic” from the construction to avoid jury confusion in light of the claims already specifying the use of “theoretic” capacities and Apple's references to “theoretic” as the maximum electrode capacity irrespective of voltage conditions (rather than measured at 4.2V). Ex1041, 17:24-25, 18:17-19:15, 20:5-24.

PO was clear to the district court that the claims require using theoretical capacities at 4.2V to arrive at the claimed ratio:

- “[a] POSITA would recognize that ... the cathode capacity variable ... must refer to *the theoretical capacity at that voltage.*”
- “[T]he claim clears . . . ambiguity by specifying that it is *the theoretical capacity at 4.2V.*”
- “For most cathode materials ... 4.2V points to an adjustment to something less than 100% of the maximum theoretical capacity.”

- The relevant capacity is not just any capacity but the one “determine[d] ... using a particular coefficient, a particular mathematical reference adjustment, to determine how much is pulled out at a particular voltage.”

Ex1032, 14-15; Ex2012, 12; Ex1041, 21:11-19. Thus, omitting “theoretic” from the construction did not broaden the claims, which recite the theoretical capacity at 4.2V. Ex1041, 20:8-9. Indeed, PO specifically noted that the ratio in claim 5 is *not* calculated with just any practically measured capacity. *Id.*, 21:11-19. Accordingly, the Board should reject Petitioner’s assertions about the Apple litigation record and its contention for judicial estoppel. *SanDisk Corp. v. Memorex Prod., Inc.*, 415 F.3d 1278, 1291 (Fed. Cir. 2005).

III. PETITIONER’S ASSERTIONS ABOUT PO’S EXPERTS LACK MERIT

Petitioner makes an assortment of baseless attacks against Dr. Yao and Dr. Liang. As discussed throughout, Dr. Yao’s claim construction opinions are consistent across the Apple litigation and these proceedings. Further, the Board should reject Petitioner’s assertion that Dr. Yao’s opinions lack support because Petitioner has failed to identify with any specificity the opinions it contends lack such support and why (Reply, 10); and in any event, Dr. Yao provided over 150 citations to his declaration. Also contrary to Petitioner’s assertions, Dr. Liang has extensive experience and numerous publications on synthesizing layered battery materials (Ex1042, 39:21-43:7); and Dr. Liang and Dr. Yao disclosed their

professional relationship in their CVs submitted in this proceeding (Ex1042, 37:16-38:2, 39:17-20), which identify Dr. Yao's consulting activities for LiBeyond (Ex2007, 6), that he was Dr. Liang's post-doctoral advisor (Ex2032, 1), and the articles and patents on which they are co-authors or co-inventors. Ex2032, 2-6; Ex2007, 7-14, 18-19. Further, as explained *infra*, Dr. Liang's testing methodology was appropriate.

IV. UEMURA DOES NOT RENDER OBVIOUS OR ANTICIPATE CLAIMS 1-8 (GROUNDS 1-2)

A. Uemura discloses an applied voltage, not a charge cutoff voltage

Petitioner incorrectly asserts (for the first time in the Reply, since the Petition did not raise this issue) that Uemura discloses a battery voltage of 4.3V. Reply, 11-12. The charge-cutoff voltage can equal the applied voltage in specific circumstances, but not with Uemura's charging conditions; and as explained in the POR, Uemura discloses an applied voltage and charging conditions from which a POSITA would understand that the battery voltage is below 4.2V. POR, 28-34.

Petitioner's expert testified that Uemura's disclosure that "[t]he charge-discharge was repeatedly performed at ... a voltage ranging from 4.3V to 2.0V" (Ex1009, ¶81) refers to an externally applied voltage:

Q. And according to Uemura's description, the charging would stop once the externally applied voltage would reach 4.3V. Correct?

A. The way it's written in paragraph 81, yes.

Q. Is there any other way to understand what's written in paragraph 81?

A. No.

Ex2008, 113:5-12.

The Reply misleadingly asserts that Uemura discloses charging a battery “*to*” 4.3V (when Uemura clearly states that charging is performed “*at*” 4.3V, thus disclosing an applied and not a battery voltage) (*compare* Ex1009, ¶81, *with* Reply, 11-12)); and Mr. Juzkow contradicts his deposition testimony that Uemura discloses an applied voltage and not a battery voltage. *Compare* Ex1044, ¶57, *with supra*. The Board should reject Petitioner's rewriting of Uemura and Mr. Juzkow's contradictory new opinion.

Moreover, contrary to Petitioner's misleading assertions (Reply, 12), PO has always argued that the charge cut-off voltage is a battery voltage that may be but is *not always* equal to the applied voltage. Dr. Yao explained that:

- “[o]nce the battery reaches a predetermined voltage (i.e., the charge cut-off voltage), the charging stops.”
- The battery can reach that predetermined voltage with constant current charging, but only if it is performed at a slow rate and *the applied current is low*.

Ex2022, 10; Ex2006, 56 n.64; Ex1043, 14:20-15:17, 24:16-21, 25:8-13, 31:6-8. Mr. Juzkow agrees: “when you charge and discharge a cell, if you charge it at a slow enough rate, you don’t need that constant voltage component[.]” Ex2008, 113:13-16. PO has consistently argued that the applied voltage is different from the charge cut-off voltage even though the two can be equal in limited circumstances not present in Uemura.

A POSITA would understand that Uemura does not disclose a battery charged to a voltage above 4.2V because it indisputably discloses an applied voltage and constant current charging at a medium level—not slow enough to charge the battery to its full capacity. POR, 29; *see also* Ex2008, 118:8-11, 117:16-20 (describing the charging rate used in Uemura as “in the middle”); Ex2006, 56 n.64. Uemura does not thus disclose or render obvious the claimed charge cut-off voltage.

B. Uemura does not disclose the claimed ratio limitations

Petitioner does not dispute that the electrode capacity ratios in Uemura’s batteries are not within the claimed ranges when calculated as required by the claims (*i.e.*, as the ratio of theoretic capacities at 4.2V). Petitioner’s contention that Uemura discloses the claimed ratio thus boils down to two incorrect assertions.

First, Petitioner incorrectly asserts that any capacity measured at 4.2V satisfies the claims. Reply, 13-14. A POSITA would understand that the “theoretic” capacity at 4.2V is the maximum capacity at that voltage, which can be approximated

through slow charging. Ex2006, ¶134 (“One common way of identifying the theoretical capacity of an electrode material is through slow charging,” citing references); Ex1043, 171:9-172:17 (Slow charging allows a POSITA to “get the practical capacity as close to the theoretic capacity.”); Ex2006, ¶134 (Dr. Yao uses the capacity measured at an extremely slow rate of $10\text{ }\mu\text{A}/\text{cm}^2$ to approximate the theoretical capacity of layered LiMnO_2 at 4.2V). The limitation “theoretic” thus requires slow charging conditions that ensure consistency in measuring the theoretic capacity at different voltage levels (e.g., 4.2V). In contrast, improperly broadening the claims to include non-theoretic capacities measured at 4.2V (as Petitioner proposes and Uemura discloses) allows for varying charging conditions that produce inconsistent measurements and would result in claim indefiniteness.

Second, Petitioner asserts that PO improperly excluded the capacity attributable to the non-carbon content of the anode because it was well-known that “inactive” material “doesn’t provide or affect capacity.” Reply, 14. However, it is precisely because inactive materials do not contribute to the usable capacity of the electrode that it was proper to discount those materials. Examples 2-4 of Uemura use anode material with high non-carbon content (Ex1009, ¶¶84-86) that does not participate in the reactions through which the battery stores and releases energy *repeatedly*. Ex2006, ¶140. A POSITA would understand that non-carbon content is not “active material,” as required by the construction of the capacity ratio. POR,

24. Yet, Petitioner incorrectly contends that the non-carbon content's *irreversible capacity* should be included in the anode capacity used to arrive at the capacity ratio as though it were "active" material. Reply, 14. Further, Mr. Juzkow's supplemental declaration contradicts his prior testimony that carbon is the active material that participates in the intercalation/*deintercalation* process. Ex2008, 20:14-19 ("Q. What is the active material? A. The active material would be carbon."), 20:20-23., 86:7-11 (Q. [W]hat's your understanding of active material? A. Active material is material that is involved in the intercalation and deintercalation of lithium-ions."). Because the non-carbon content only contributes to the irreversible capacity and is not involved in the *deintercalation* of lithium-ions, it is not active material. Ex2006, ¶140. Thus, PO properly excluded the irreversible capacity of that content from the anode capacity used in the ratio calculation.

Petitioner also incorrectly asserts that PO failed to address Uemura's disclosure of a "capacity balance" in Uemura (Ex1009, ¶33). Reply 14-15. As Dr. Yao explained, a POSITA would understand paragraph 33 to refer to the examples in Uemura's Fig. 3 (Ex2006, ¶127) and that the "capacity balance" was thus calculated identically to those, all of which have ratios outside the claimed range. *Id.* Petitioner's assertion is thus meritless. But if ¶33 were distinct from those examples, Uemura does not define "total capacity" and therefore renders the disclosure in ¶33 ambiguous such that a POSITA could not determine whether the

“total capacity” refers to the theoretical capacity at 4.2V, and if not, whether Uemura’s “capacity balance” falls within the claimed range when translated to the claimed ratio. Thus, ¶33 does not disclose the claimed ratio. *Wasica Fin. GmbH v. Continental Auto. Sys., Inc.*, 853 F.3d 1272, 1284 (Fed. Cir. 2017).

C. Uemura is not enabling

1. Uemura does not enable the subject matter of claims 1-8

Petitioner relies upon ¶81 of Uemura for the claimed charge cutoff voltage (Reply, 16), which is specifically directed to the batteries in Fig. 3 (*See* Ex1009, ¶81 (“A result thereof is shown in Table 1 [i.e., Fig. 3] together with other values”)), each of which is limited to a layered LiMnO₂ as the cathode and hard carbon as the anode. To anticipate or render obvious, Uemura must thus enable ¶81, *i.e.*, a POSITA following ¶81 should be able to produce a secondary lithium-ion battery configured to be charged to a maximum voltage within the claimed range, with cyclability as shown in Fig. 3. *Raytheon Techs. Corp. v. Gen. Elec. Co.*, 993 F.3d 1374, 1381 (Fed. Cir. 2021).

Uemura does not enable ¶81. First, a POSITA cannot produce the layered LiMnO₂ material supposedly used in Uemura following Uemura’s disclosure. POR, 43-45. Dr. Liang improved upon Uemura’s preparation procedure and reproduced

Uemura's battery;⁴ and the test battery (which was materially identical to Uemura's) substantially degraded and lost capacity when charged with an applied voltage of 4V. Ex2031, ¶¶45-46. Dr. Liang's testing (which Petitioner did not attempt to reproduce) thus demonstrates that Uemura's battery is not functional when charged as described in ¶81. Accordingly, Uemura cannot anticipate or render obvious the challenged claims.⁵ *Raytheon*, 993 F.3d at 1381.

2. Dr. Liang faithfully followed Uemura's experiments

Contrary to Petitioner's assertions (Reply 17-18), Dr. Liang's testing demonstrating Uemura is not enabled followed Uemura's disclosure.

First, Petitioner's assertion that Dr. Liang only tried to synthesize Uemura's cathode materials once (Reply, 6-7) fails. Examples 1-3 (i.e., those that Dr. Liang

⁴ Petitioner does not dispute that Dr. Liang successfully synthesized the purported cathode active material of Uemura's example 2 (layered $\text{Li}_{0.8}\text{Mn}_{0.5}\text{Co}_{0.5}\text{O}_2$) and used hard carbon that does not differ materially from Uemura's anode for his testing. Ex2031, ¶¶36-46; Ex2006, ¶¶153-154.

⁵ Contrary to Petitioner's assertion, Dr. Yao explains why the examples tested were representative: example 2 has all the features of Uemura's alleged invention and the best chance of enablement. Ex2006, ¶147. Because example 2 is not enabled, the other examples are not either. *Id.*; Ex1043, 246:16-247:13.

replicated) present only immaterial differences in lithium content, and Dr. Liang followed the same procedure for all three of those examples (Ex2031, ¶¶18-19). Thus, Dr. Liang repeated the same synthesis method disclosed in Uemura three times, all of which consistently yielded cathode materials that do not function in the manner reported in Uemura. *Id.*, ¶¶16-28. Critically, Petitioner does not challenge Dr. Liang's testing results or his interpretation of those results; and the consistency of those results demonstrates the reliability of his testing.

Second, contrary to Petitioner's assertions (Reply, 18; Ex1044, ¶¶21-24), Dr. Liang used robust controls consisting of two layers. The first layer of controls was that by employing the same experimental procedure to synthesize the three examples, each acted as a control against the others. The second layer of controls was Dr. Liang's comparison of the above three examples with his synthesized layered material. Using the same equipment he used for those three examples, Dr. Liang was able to reproduce the layered materials in Kajiyama, demonstrating that his equipment works. Ex2031, ¶¶36-44. The fact that those three examples differ significantly from the synthesized layered material demonstrates that following Uemura would not produce layered LiMnO_2 .

Mr. Juzkow incorrectly disputes that the synthesized layered material has the properties reported in Kajiyama. Ex1044, ¶23. Dr. Liang explains that the material has XRD patterns consistent with those reported in Kajiyama (Ex2031, ¶40); and the

cells have capacity data comparable to the data reported in Kajiyama. Ex2031, ¶¶44. Dr. Liang tested the synthesized example 2 cathode material in a full cell, using hard carbon as the anode, and the cell started to degrade before the applied voltage reached 4V. *Id.*, ¶¶45. Mr. Juzkow’s assertion that the data for the full-cell is different from the data in Kajiyama (Ex1044, ¶¶23) is misplaced since (1) Kajiyama only tested the cathode materials in lithium-metal half-cell, not in a full-cell, and (2) Dr. Liang’s half-cell data is consistent with Kajiyama’s half-cell data.

Third, Petitioner asserts that Dr. Liang deviated from Uemura in ways that might have impacted his results but fails to demonstrate that any such impact would have been material or why this would be the case (it would not). Reply, 18. As a threshold matter, Dr. Liang’s protocol followed Uemura, and any departures were appropriate in light of his experience and expertise as to how a POSITA would have understood Uemura’s disclosures. Ex1042, 109:12-110:20, 111:13-112:4. In any event, Dr. Liang explained that his protocol would not have materially affected his results compared to the different steps that Petitioner asserts (without basis) would have been appropriate:

Petitioner Assertions (Ex1044):	PO Responses:
Improperly added a pre-annealing step (¶¶29)	Dr. Liang explained that the step is “common in the synthesis of lithium-containing compounds where high-temperature annealing is involved” and “not an attempt to alter the reaction path of synthesis but to prevent uncontrolled

Petitioner Assertions (Ex1044):	PO Responses:
	lithium loss.” Ex1042, 102:10-103:3, 104:9-105:11.
Test sample was “deep gray powder” rather than the “brown” reported in Uemura (¶¶30-31)	Dr. Liang explained that both colors are deep and color perception “varies from person to person.” Ex1042, 131:9-132:2.
No citric acid or ammonium bicarbonate during the coprecipitation method (¶31)	The lithium hydroxide solution Dr. Liang used was the “most suitable method” described by Uemura. <i>See</i> Ex1009, ¶59; Ex2031, ¶18.
No measurement of particle size (¶32)	Dr. Liang explained that he did not measure particle size of the electrode material (Ex1044, ¶32) because it is not relevant as the intermediary was “finely ground.” Ex2031, ¶19.
Inadequate pressure (¶¶33-34)	Dr. Liang testified that the pestle-and-mortar method he employed would not impact the results. Ex1042, 139:5-16, 143:9-144:17. Mr. Juzkow does not contend otherwise and describes this method as “reliable.” Ex2008, 156:15-157:8.
No heating of the electrode (¶¶35-36)	Dr. Liang explained that he heated the electrode material to remove moisture. Ex1042, 114:6-115:18, 118:3-5.
Different current collector (¶¶37-38)	Dr. Liang explained that the molybdenum current collector he used does not impact testing results because it is inert to other battery materials and “can withstand the potential we apply to the electrodes.” Ex1042, 116:5-117:12. There is no evidence that the current collector oxidizes at the voltages

Petitioner Assertions (Ex1044):	PO Responses:
	applied to the test cells; and Dr. Liang's half-cell testing results for charging at 5V are consistent with Kajiyama, further demonstrating the collector's suitability. Ex2031, ¶44.
Different electrode dimensions (¶39)	Dr. Liang testified that this change would not impact his results, which Petitioner does not dispute. Ex1042, 24:3-12.
Different electrolyte (¶40)	Dr. Yao explained the electrolytes are similar; and Uemura does not describe the particular volume ratio of the solvent as a critical factor. Ex1043, 253:9-15; Ex1009, ¶65.
Different separator (¶41)	Dr. Yao testified that using a different separator does not affect the testing results. Ex1043, 253:16-254:2.
No oxygen pressure reduction (¶42)	Dr. Liang explained that he performed the baking in an argon atmosphere as prescribed by Uemura (Ex1042, 120:18-22; Ex1009, ¶71). Uemura also does not require a reduction of oxygen. <i>Id.</i>

In short, Dr. Liang followed Uemura's procedure with only non-material deviations that did not affect his results and were, in any event, designed conservatively (e.g.,

lowering the current disclosed in Uemura) to facilitate the assembly of a functional battery.⁶ See Ex1043, 254:3-18.

⁶ Mr. Juzkow makes other misplaced assertions. His assertion that Dr. Liang failed to record aspects of his testing is irrelevant because Dr. Liang, in fact, did perform those steps (e.g., increasing the baking temperature gradually and drying the samples before further testing), and those are routine procedures subject to his discretion. Ex1044, ¶¶25-26; Ex1042, 113:16-114:5, 114:16-115:18.

With respect to Dr. Liang's XRD data, Mr. Juzkow's assertion that Dr. Liang did not remember the names of the databases used to locate relevant XRD reference patterns (Ex1044, ¶26) fails because Dr. Liang identified the specific articles from which he obtained his XRD data (and the databases in question are publicly available in any event) (Ex2031, 8-14 nn.4-5, & 8; Ex1042, 73:5-18); his assertion that Dr. Liang fails to "use any 'standard' for layered material" (Ex1044, ¶26) fails because Dr. Liang relied upon data from Kajiyama and confirmed that his synthesized sample aligns with that data (Ex1042, 86:12-87:5); and, in any event, these assertions are utterly irrelevant because Mr. Juzkow does not dispute the accuracy of Dr. Liang's interpretation of XRD patterns.

3. Petitioner's articles about the state of the art of layered LiMnO₂ are irrelevant.

Petitioner's articles claiming that layered LiMnO₂ with doping element could be suitable cathode materials only report electrochemical data concerning test cells using lithium metal anode. *See* Ex1040, 1 (“a foil of lithium metal ... used as ... a counter electrode”); Ex1045, 2 (“[l]ithium ribbon ... was used as the negative electrode”); Ex1046, 1 (“[c]ells contained lithium metal as the anode”); Ex1047, 2 (Figure 3 identifying anode as Li). In contrast, the challenged claims are directed to *lithium-ion*—not *lithium metal*—batteries. Ex2008, 28:1-7. Lithium batteries are irrelevant to whether Uemura enables its pertinent disclosure, which concerns lithium-ion batteries with hard carbon anode. Tellingly, Petitioner does not cite any papers on battery systems similar to Uemura's with the cyclability reported in Uemura, and did not provide its own testing to demonstrate Uemura is enabled.

4. A POSITA would disregard Uemura's disclosures due to their obvious errors.

Petitioner concedes that there are errors in Uemura's Fig. 3 but asserts that they are immaterial or irrelevant because they do not infect the “text” of Uemura ¶¶33, 81, and 103 or the cyclability data reported in Uemura. Reply, 20-21. Not so.

First, Petitioner has not addressed Dr. Yao's opinions that the electrode capacity data disclosed in Uemura cannot be experimentally determined and are inaccurate. POR, 48-52; Ex2006, ¶¶162-179. Thus, to the extent that the Board

agrees with PO that Uemura purports to disclose experimentally determined capacity data, the Board should find that a POSITA would disregard the data in question as patently inaccurate.

Second, Petitioner's assertion that Uemura presents the data in question (i.e., all data other than the last column of Fig. 3) as calculated instead of being experimentally measured is untenable. Uemura discloses that the data was experimentally determined on its face. *See* Ex1009, ¶81 ("A result thereof is shown in Table 1 together with other values"); ¶102; POR, 48. Petitioner's expert testified that his "[c]onclusion was that the total capacity values that are shown in the table here are the values that were *measured experimentally*." Ex2008, 173:16-18. The last column of Uemura's Fig. 3 describes "the number of cycles taken to a point where the discharge capacity becomes less than 90% of the initial discharge capacity" (Ex1009, ¶81), thus confirming that the cycle life data is based on an experimentally determined "initial discharge capacity," which can only refer to the "total capacity" data reported in Fig. 3. It is apparent that Uemura reports its capacities as

experimentally determined, and there is *no* suggestion in Uemura that this data is calculated.⁷ *See* Ex1043, 223:8-224:4.

Third, the “capacity balance” data upon which Petitioner relies for the claimed capacity ratio ranges are drawn from Uemura Fig. 3 (Pet., 18-19; Reply, 13), which is the support for ¶¶33 and 81; thus, Petitioner’s assertion that errors in Fig. 3 do not plague other disclosures in Uemura is baseless. Further, as discussed *supra*, the erroneous capacity data of Fig. 3 was part and parcel with the cyclability testing reported in Fig. 3. Thus, to the extent that this data is wrong, it plagues—and renders ineffectual—the disclosures in ¶¶33, 81, 103, which cannot thus anticipate the relevant limitations to which Petitioner has mapped them.

Accordingly, the Board should find that a POSITA would disregard Uemura’s Fig. 3 capacity data and the other disclosures it plagues (¶¶33, 81, 103, and the

⁷ Both experts agree that Uemura’s data is too uniform to be experimentally measured. POR, 51-52. Dr. Yao analyzed further and concluded that Uemura’s data was wrong; Mr. Juzkow did not analyze the issue until the eve of his deposition and did not complete his analysis. *Id.*

cyclability data). *See LG Elecs. Inc. v. ImmerVision, Inc.*, 39 F.4th 1364, 1372 (Fed. Cir. 2022); *In re Yale*, 434 F.2d 666, 668-69 (C.C.P.A. 1970).⁸

V. CLAIMS 9-18 ARE NOT OBVIOUS (GROUNDS 3-4, 8-9)

Contrary to Petitioner’s assertion (Reply, 20 n.10), combining Uemura with Guyomard cannot disclose the cycling limitations in claims 11-18 if the Board agrees with PO that Uemura does not enable those limitations. Uemura expressly teaches away from Guyomard’s cathode material, and the two references are thus fundamentally incompatible. POR, 53. Accordingly, Guyomard cannot cure Uemura’s deficiencies.

VI. ABE DOES NOT ANTICIPATE OR RENDER OBVIOUS CLAIMS 1-8 (GROUNDS 5-6)

A. Abe does not disclose the claimed charge cut-off voltage.

Abe discloses a 4.2-4.3V *lithium metal* battery (or half-cell) voltage corresponding—at most—to a 4.2V *lithium-ion* battery (or full-cell) voltage. POR, 53-59. Petitioner does not dispute that a 4.3V half-cell voltage translates to a full-cell voltage under 4.2V but incorrectly asserts that Abe discloses a full-cell voltage,

⁸ Even if the Board finds Uemura’s capacity data reliable, Uemura still cannot invalidate the claims because the “capacity balance” figures—when calculated in accordance with the proper construction (i.e., using theoretical capacities at 4.2V)—fall outside the claimed ranges.

relying exclusively on unpersuasive attorney argument, “unsupported by expert testimony or other evidence.” *Ex Parte Brady P. Haislet & Bryan J. Hayward*, No. 2022-004096, 2023 WL 2425035, at *2 (P.T.A.B. Mar. 1, 2023); *Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (“Attorney argument is not evidence.”).

As Dr. Yao testified, Abe discloses measuring the “design capacity” of an electrode “in a predetermined charging voltage range” by using a “three-electrode cell in which both the counter and the reference pole are made of metal lithium” (Ex1005, ¶78; Ex2006, ¶96) and that the “predetermined voltage” for the anode is 0V and “4.2-4.3V” for the cathode (*id.*); and “0V” and “4.2-4.3V” refer to the half-cell voltage of the respective electrode relative to lithium metal, which is not a lithium-ion cell. *See* Ex1005, ¶78; Ex2006, ¶¶95, 188-192.⁹

⁹ Contrary to Petitioner’s accusations that PO “strategically” omitted ¶78, the omitted portion duplicates in substance the portion of that paragraph that Dr. Yao quoted, which also states that the predetermined voltage for the anode is 0V. *See* Ex2006, ¶188. Dr. Yao, citing various sources that are not rebutted by Petitioner, confirms that the full-cell voltage to which Abe’s half-cell voltage disclosure translates would be lower than 4.2V. *Id.*, ¶¶193-198; Ex1043, 259:12-262:21.

Moreover, Petitioner's assertion that Abe does not teach against raising the cutoff voltage above 4.2V (POR, 58-59; Ex2006, ¶¶207, 196-198) consists solely of attorney argument and is likewise unpersuasive. Petitioner acknowledges that *all* working examples in Abe have a full-cell voltage of at most 4.1V, including LiMn₂O₄ batteries. Reply, 24. That is consistent with Abe's general teaching that for its invention, "if the cut-off voltage at the time of charging is limited to 4.1V, a longer-lived non-aqueous electrolyte-based secondary battery can also be obtained." Ex1005, ¶80. PO's reading of paragraph 80 of Abe is supported by Dr. Yao's sworn testimony and is un rebutted by Mr. Juzkow, accordingly, should be adopted. Ex2006, ¶¶207, 196-198.

B. Abe does not disclose the claimed capacity ratio

Petitioner admits that Abe's "design capacity" ratio is determined using practical specific capacity. Reply, 26. Because the capacity ratio limitation requires using the theoretical capacity at 4.2V, Petitioner cannot meet its burden for anticipation or obviousness. Similarly, because Abe only discloses a half-cell voltage of "4.2-4.3V, preferably 4.2V," and the only working example of LiMn₂O₄ cell has a full-cell voltage of at most 4.1V, a POSITA would understand that Abe's "design capacity" ratio is determined at 4.1V. Ex2006, ¶¶201-202. Because Petitioner does not provide any evidence regarding whether the "design capacity"

ratio would fall within the claimed range if it were determined at 4.1V, Petitioner failed to meet its burden for this additional reason. *See* POR, 59-61.

VII. CLAIMS 2-4, 6-8, and 11-18 ARE NOT OBVIOUS (GROUND 7)

Petitioner's Reply with respect to Ground 7 relies exclusively on attorney argument and is, in any event, wrong. Reply, 26-28.

First, Abe teaches against raising the charge cutoff voltage and explains that irreversible structural cathode breakdown occurs at a **half-cell** voltage somewhere between 4.2-4.3V and that limiting the charge cut-off voltage of the half-cell to 4.2V is "preferable." Ex2006, ¶208; Ex1005, ¶78. Given that Abe's half-cell voltage translates to a full-cell charge cut-off voltage between 4.0-4.2V (POR, 57), and that Abe focuses on safety (i.e., against high voltages), Abe teaches against **full-cell** voltages above 4.2V. Ex2006, ¶¶207-209.

Second, Petitioner conflates electrolyte and cathode material stability by contending—with unsupported attorney argument—that Guyomard teaches that the LiMn_2O_4 cathode does not significantly degrade at higher voltages. Reply, 27-28. But Petitioner's own expert testified that Guyomard does **not** discuss LiMn_2O_4 dissolution (or, of course, whether it does or does not degrade at higher voltages):

Q. And Guyomard is not focused on the phenomenon that you spoke about earlier concerning the cathode poisoning the electrolyte with manganese. Correct?

A. He's not speaking about that, correct.

Ex2008, 134:2-6. Moreover, Guyomard does not address the fact that electrode decomposition generally occurs at 4.2V. *See supra* Section I.

Finally, because Guyomard does not disclose the capacity loss between the first and the fifth cycles, it does not disclose the capacity retention limitations in claims 11-18. POR, 16; Ex2006, ¶78; Ex1043, 107:3-108:12. Petitioner provides no rebuttal to PO's argument on this point.

VIII. CONCLUSION

For the reasons above, PO respectfully requests that the Board find the challenged claims patentable.

Date: September 9, 2024

Respectfully submitted,

/Minghui Yang/
Minghui Yang
Reg. No. 71,989
Counsel for Patent Owner
CARMICHAEL IP, PLLC
8607 Westwood Center Drive
Suite 270
Tysons, VA 22182
Email: mitch@carmichaelip.com
Telephone: (703) 646-9248

CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Patent Owner's Sur-Reply (the "Sur-Reply") consists of 5,588 words, excluding table of contents, table of authorities, certificate of service, this certificate, or table of exhibits. The Sur-Reply complies with the type-volume limitation of 5,600 words as mandated in 37 C.F.R. § 42.24. In preparing this certificate, counsel has relied on the word count of the word-processing system used to prepare the paper (Microsoft Word).

Respectfully submitted,

/ Minghui Yang /

Date: September 9, 2024

CERTIFICATE OF SERVICE

The undersigned hereby certifies that the following document was served by electronic service, by agreement between the parties, on the date below:

PATENT OWNER'S SUR-REPLY

The names and email addresses of the parties being served are as follows:

Samsung:

Andrew Sommer	SommerA@gtlaw.com
Stephen E. Pulley	Stephen.Pulley@gtlaw.com
Jeffrey Colin	Colinj@gtlaw.com
Trenton A. Ward	Trenton.Ward@gtlaw.com
Samsung-RJT-IPR@gtlaw.com	

Apple:

W. Karl Renner	axf-ptab@fr.com
Hyun Jin In	in@fr.com
Gretchen DeVries	devries@fr.com

Respectfully submitted,

/Minghui Yang/

Date: September 9, 2024