

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner

v.

RJ TECHNOLOGY LLC,
Patent Owner

Case: IPR2023-01350
U.S. Patent No. 7,749,641

PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE

TABLE OF CONTENTS

I.	PO’S CLAIM CONSTRUCTION POSITION IS INCONSISTENT AND UNSUPPORTED.....	1
II.	YAMAKI-SAKAMOTO RENDERS OBVIOUS CLAIMS 5-10.....	6
A.	PO’s attacks on the sufficiency of Yamaki’s disclosure are unwarranted and legally incorrect.....	7
B.	PO’s arguments that a POSITA would not have been motivated to combine Yamaki and Sakamoto are rooted in a mischaracterization of the combination	9
C.	PO fails to acknowledge Sakamoto’s capacity ratio disclosure and the motivations for implementing such a ratio.....	11
1.	PO ignores the Petition’s reliance on Sakamoto’s specific disclosure of a capacity ratio.....	11
2.	PO ignores the stated motivations for the combination.....	11
D.	PO’s argument that a POSITA would not have combined Yamaki’s and Sakamoto’s “fundamentally different” batteries is inaccurate and ignores relevant explanation in the Petition	13
III.	YASUNAMI-KOYAMA RENDERS OBVIOUS CLAIMS 5-10.....	14
A.	That Yasunami’s end-of-charge voltages render obvious the claimed CCV range withstands PO’s claim construction and criticality attacks	14
1.	PO’s assertions that Yasunami’s end-of-charge voltage is not a CCV are inconsistent with the record and with its own expert’s statements.....	15
2.	Yasunami satisfies the claimed CCV range even under PO’s proposed construction	15
3.	Yasunami’s 4.3V end-of-charge voltage falls within the claimed range under either construction.....	18

4.	PO fails to demonstrate criticality of the claimed CCV range sufficient to rebut obviousness in view of Yasunami’s overlapping range.....	18
B.	PO fails to establish that a POSITA would not have combined Yasunami and Koyama	20
1.	Yasunami does not teach away from the combination, which is motivated by unrebutted advantages.....	20
2.	The Petition disproves PO’s position that Yasunami indicates that capacity ratio was an “unimportant” design parameter	23
3.	PO’s failure to recognize similarities between Yasunami and Koyama undermines its argument that a POSITA would not have expected success.....	24
IV.	CLAIMS 11-14 ARE RENDERED OBVIOUS BY BOTH YAMAKI-SAKAMOTO AND YASUNAMI-KOYAMA.....	25
A.	A POSITA would have found obvious that the Yamaki-Sakamoto and Yasunami-Koyama batteries have the recited capacity retention capabilities.....	26
B.	A desire for good cycle life would have motivated a POSITA to do routine experimentation using well-established parameters that impact cycle life	28
V.	CONCLUSION.....	30

LIST OF EXHIBITS

APPLE-1001	U.S. Patent No. 7,749,641 (“the ’641 Patent”)
APPLE-1002	Excerpts from Prosecution History of the ’641 Patent (“the Prosecution History”)
APPLE-1003	Declaration of Mr. Louis Hruska
APPLE-1004	Japanese Patent Publication No. 2001-167763 (“Yamaki”) (with certified translation)
APPLE-1005	Japanese Patent Publication No. H09-293536 (“Sakamoto”) (with certified translation)
APPLE-1006	Japanese Patent Publication No. H07-122298 (“Yasunami”) (with certified translation)
APPLE-1007	Japanese Patent Publication No. JP2000260472A (“Koyama”) (with certified translation)
APPLE-1008	PCT Publication No. WO 01/29920 (“Richardson”)
APPLE-1009	U.S. Patent No. 5,858,573 (“Abraham”)
APPLE-1010	Reserved
APPLE-1011	Reserved
APPLE-1012	“High-voltage lithium cathode materials” Hiroo Kawai, Mikito Nagata, Hisashi Tukamoto, Anthony R. West. Journal of Power Sources 81-82 (1999) 67-72 (“Kawai”)
APPLE-1013	Reserved
APPLE-1014	“Effect of Li ₂ CO ₃ additive on gas generation in lithium-ion batteries.” Jee-Sun Shin, Chi-Hwan Han, Un-Ho Jung, Shung-Ik Lee, Hyeong-Jin Kim, Keon Kim. Journal of Power Sources 109 (2002) 47-52 (“Shin”)
APPLE-1015	David Linden. Handbook of Batteries, Second ed. McGraw-Hill, Inc., 1995 (excerpts). (“Handbook”)

APPLE-1016	U.S. Patent No. 5,192,629 (“Guyomard”)
APPLE-1017	U.S. Patent No. 6,280,881 (“Wendsjo”)
APPLE-1018	U.S. Patent Pub. No. 2002/0012830 (“Uemura”)
APPLE-1019	U.S. Patent No. 6,506,518 (“Kobayashi”)
APPLE-1020	“Mathematical Modeling of the Lithium Deposition Overcharge Reaction in Lithium-Ion Batteries Using Carbon-Based Negative Electrodes.” Pankaj Arora, Marc Doyle, Ralph E. White. <i>Journal of the Electrochemical Society</i> 146 (10) 3543-3553 (“Arora”)
APPLE-1021	Japanese Patent Publication No. JPH0562712 (“Satoshi”)
APPLE-1022	Japanese Patent Publication No. JPH10172608 (“Ijiri”)
APPLE-1023	U.S. Patent No. 5,487,960 (“Tanaka”)
APPLE-1024	U.S. Patent No. 6,372,387 (“Kawakami”)
APPLE-1025	U.S. Patent No. 5,587,133 (“Amatucci”)
APPLE-1026	U.S. Patent No. 5,278,000 (“Huang”)
APPLE-1027	European Patent Specification EP 0 746 050 B1 (“Shimizu”)
APPLE-1028	U.S. Patent No. 6,172,482 (“Eguchi”)
APPLE-1029	U.S. Patent No. 6,577,105 (“Iwaizono”)
APPLE-1030	U.S. Patent No. 5,763,119 (“Adachi”)
APPLE-1031	<i>RJ Technology, LLC v. Apple Inc.</i> , Order Regarding Claim Construction, 8:22-CV-01874-JVS (JDEx), Document 82, August 2, 2023
APPLE-1032	Order Regarding Motion to Stay, Case 8:22-cv-01874-JVS dated October 4, 2023
APPLE-1033	Patent Owner’s Sur-Reply (Paper 33) in IPR2023-01183
APPLE-1034	Transcript of Dr. Yan Yao, Ph.D., dated September 27, 2024

APPLE-1035	Second Declaration of Mr. Louis Hruska
APPLE-1036	Patent Owner's Response (Paper 17) in IPR2023-01183
APPLE-1037	Declaration of Dr. Yan Yao in IPR2023-01183
APPLE-1038	"Charging Algorithms of Lithium-Ion Batteries: an Overview." Weixiang Shen, Thanh Tu Vo, Ajay Kapoor. 2012 7 th IEEE Conference on Industrial Electronics and Applications (ICIEA), Singapore, 2012, pp. 1567-1572 ("Shen")
APPLE-1039	U.S. Patent No. 8,712,708 ("Halme")
APPLE-1040	Apple Inc.'s Responsive Claim Construction Brief in <i>RJ Technology, LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Document 73, July 14, 2023
APPLE-1041	Transcript of Dr. Yan Yao, Ph.D., dated August 8, 2024 (Ex. 1043 in IPR2023-01183)
APPLE-1042	RJ Technology LLC's Opening Claim Construction Brief in <i>RJ Technology, LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Document 70, June 23, 2023

The Patent Owner Response (“POR”) fails to rebut the Petition’s showing that claims 5-14 are unpatentable over both Yamaki-Sakamoto and Yasunami-Koyama. Patent Owner’s (“PO”) arguments are based on unjustified claim constructions, mischaracterizations of the references and combinations, and failures to rebut the Petition’s showing of motivations underpinning these combinations.

For these and the reasons explained further below, PO’s arguments are unavailing and the Challenged Claims should be found unpatentable.

I. PO’S CLAIM CONSTRUCTION POSITION IS INCONSISTENT AND UNSUPPORTED

PO’s proposed construction for “charge cut-off voltage” as “the maximum voltage to which the battery is configured to be charged” is consistent on its face with its construction in district court. APPLE-1031, 11. But PO’s arguments here—that “charge cut-off voltage” is “a battery property” rather than “the voltage applied to the battery during charging” (POR, 21-24)—improperly attempt to re-construe this term in a way contradicted by the ’641 Patent itself and PO’s own litigation positions, and should be rejected. Nevertheless, regardless of whether or not PO’s unjustified construction is adopted, the advanced grounds render obvious the Challenged Claims.

First, the '641 Patent contradicts PO's position that the charge cut-off voltage ("CCV") is "not the externally applied voltage at which a battery is charged." POR, 24. The '641 Patent describes that a "charging device ***controls the charge cut-off voltage***" of the cell.¹ APPLE-1001, 9:49-55; *see* 3:45-50, 4:26-37. PO's remarks responsive to a similar argument in the co-pending Samsung IPR (IPR2023-01183)—that a charger could "ensure a battery's voltage does not exceed" its intrinsic battery voltage (what PO equates to CCV)—are misleading. APPLE-1033, 3. A charging device cannot "control" (APPLE-1001, 9:52) a battery property, as PO contended there; it can only control applied voltage. And PO's attempt in the Samsung IPR to discount this relevant disclosure as merely an "unclaimed embodiment" (APPLE-1033, 2-3) runs directly counter to Federal Circuit precedent requiring consideration of the entire specification in construing claims. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005).

The '641 Patent also makes clear that CCV is something that is "used"—again, not some intrinsic property of the battery, as PO contends. APPLE-1001, 10:33-37 ("***using*** an [sic] charge cut-off voltage"), 10:45-49-11:3, 12:59-67,

¹ Emphasis added unless otherwise indicated.

Table 1 (showing batteries of the same composition, tested with different CCV).

Notably, in the Samsung IPR, PO provides no explanation for this inconsistency.

Second, PO's proposed construction here is inconsistent with its district court position, where it argued that intrinsic evidence confirms that the "maximum voltage to which the battery is configured to be charged"—*i.e.*, CCV—is a "charging voltage." *See* APPLE-1042, 12 (explaining that the specification "refers to the **charging voltage** maximum"), 13 (characterizing the prosecution history as showing that "the inventors distinguished a prior art reference by arguing that the reference 'shows that the cycle property of a cell drastically decreases when the **charging voltage increases beyond 4.2V**'"), 9 ("the patent explains that the charge cutoff voltage is a maximum voltage for use in normal operation," but can be "exceeded"). To the extent that PO attempts to argue, as it did in the Samsung IPR, that "the parties [in district court] ... agreed that the 'charge cut-off voltage' is a battery property" (APPLE-1033, 4), this would constitute is a mischaracterization based on an out-of-context misinterpretation of Apple's statement.² No such agreement was reached.

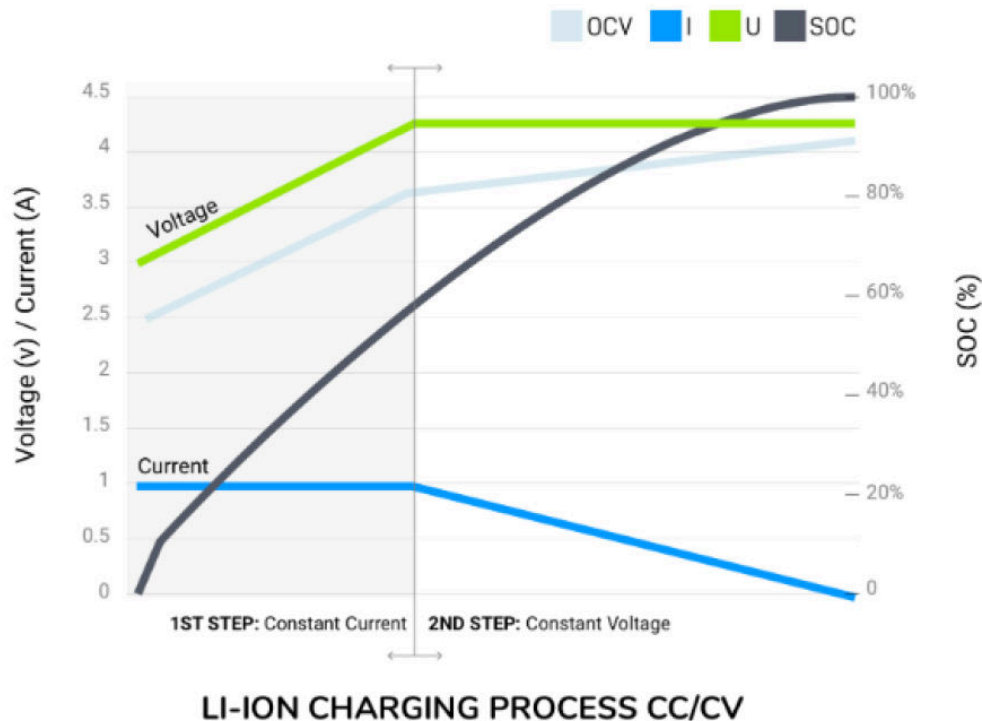
² In the Samsung IPR, PO asserted that in litigation claim construction briefing, "Apple stated that claim 5 requires the battery to 'have the physical property of a

Third, statements by PO's own expert, Dr. Yao, confirm that CCV is a voltage applied to a battery, not an intrinsic battery voltage. Dr. Yao explains here that "[t]he applied voltage ... is always greater than the battery voltage" (EX2007, ¶111), and in district court, Dr. Yao cautions that "during normal use of a battery, the charging voltage *should not exceed* the charge cutoff voltage." APPLE-1042, 41. The only way to reconcile these statements is to recognize CCV as applied voltage, not battery voltage.

Similarly, Dr. Yao explains that in constant current/constant voltage (CC/CV) charging, applied voltage (green line in Dr. Yao's figure, *infra*) is higher than battery voltage (light blue line) (although noting that when charging is complete, "there is almost no difference"). EX2007, ¶114. In litigation, Dr. Yao

charge cut-off voltage." APPLE-1033, 4. But Apple made this statement in support of its argument for why PO's proposed construction was improper. *See* APPLE-1040, 11 ("Plaintiff's proposed construction introduces the new requirement that a battery be "configured" ("i.e., designed and manufactured") (*id.*) to be charged at a charge cut-off voltage of 4.2 V, not just that it have the physical property of a charge cut-off voltage set at 4.2 V, as claim 5 requires") (emphasis removed).

confirms that this maximum applied voltage is the CCV: “the battery is charged ...until it reaches a maximum configured voltage,” *i.e.*, **CCV** (*see* POR, 21), “at which point it is charged at that voltage until charging is complete.” EX2043, 42; *see id.* (describing that in constant current charging, “[o]nce the battery reaches a predetermined voltage (*i.e.*, **the charge cut-off voltage**), the charging stops”); APPLE-1041, 40:16-18 (Dr. Yao testifying in the Samsung IPR that “[t]he charging voltage applied to a battery the same value as charge cut-off voltage when the battery reach equilibrium state”); *see* APPLE-1034, 22:17-23:9 (Dr. Yao confirming consistency in his opinions between the Samsung IPR and the present proceeding).



EX2007, ¶114

Accordingly, the Board should reject PO's attempt to engraft an implied limitation on the construction of "charge cutoff voltage" that would limit it to an internal property of the battery as opposed to the voltage to which the battery is designed to be charged as applied to the battery.

II. YAMAKI-SAKAMOTO RENDERS OBVIOUS CLAIMS 5-10

PO's accusations of "hindsight bias" (POR, 26) are unavailing given the advantages that the Petition identified as motivating the Yamaki-Sakamoto combination. Petition, 11-13. These advantages—which remain unrebutted—demonstrate that the combination was not borne out of hindsight. *See In re*

Gartside, 203 F.3d 1305, 1319 (Fed. Cir. 2000) (“the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references”). And PO identifies no reasons why a POSITA might not have been motivated to pursue the Yamaki-Sakamoto combination, instead advancing a meritless attack on the sufficiency of Yamaki’s disclosure and mischaracterizing Sakamoto and the combination. None of these attacks withstands scrutiny.

A. PO’s attacks on the sufficiency of Yamaki’s disclosure are unwarranted and legally incorrect

PO argues that Yamaki’s purportedly “limited” data mean that “a POSITA would not understand Yamaki to teach that it is safe or efficacious to exceed the conventional 4.2V charge cutoff voltage limit.” POR, 27. But PO’s position is belied by both Yamaki’s full disclosure and evidence establishing that a POSITA would have understood Yamaki to describe viable batteries. APPLE-1035, ¶¶6-8.

Yamaki explains that its positive electrode composition and a CCV of 4.4-4.8V yields “excellent cycle characteristics,” and presents a credible technical explanation for why this is the case. APPLE-1004, [0012]; *see* [0018]-[0019]; APPLE-1035, ¶7. Dr. Yao confirms that a POSITA would have understood these “excellent cycle characteristics” to describe a battery with long cycle life, *e.g.*,

“typically more than a few hundred cycles” (APPLE-1034, 38:17-39:9), thus obviating PO’s argument that Yamaki’s disclosure is insufficient to “allow meaningful conclusions as to ... rechargeability, performance, and safety.” POR, 27. That Yamaki’s examples are for only 10 cycles does not detract from these teachings. *See In re Snow*, 471 F.2d 1400, 1403 (Ct. Cust. & Pat. App. 1973) (“All the disclosure in a reference, not just the specific examples, must be evaluated for what it fairly teaches those of ordinary skill in the art.”).

To the extent that PO is implicitly denigrating Yamaki as non-enabling (which Petitioner does not concede), PO’s position is legally flawed. Prior art is presumed to be enabling absent a compelling reason otherwise, which PO has not provided.³ *See In re Sasse*, 629 F.2d 675, 681 (C.C.P.A. 1980). Moreover, in an obviousness ground, “a reference need not be enabled; it qualifies as a prior art, regardless, for whatever is disclosed therein.” *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1357 (Fed. Cir. 2003); *Canon Inc. et al. v. HS Asset and Technology, LLC*, IPR2018-00499, Paper 19 at 27-28 (July 23, 2019) (citing

³ The lack of evidence in this regard is particularly telling given that PO had the capability and inclination to perform such an inquiry, as evidenced by its having done so in the Samsung IPR. APPLE-1036, 43-46.

Symbol Techs., Inc. v. Opticon, Inc., 935 F.2d 1569, 1578 (Fed. Cir. 1991)

(“obviousness references do not need to be enabling”)). In the Yamaki-Sakamoto context, then, PO’s attempt to belittle the sufficiency of Yamaki’s disclosure (POR, 27-28) should be rejected: Yamaki can be relied upon properly for its undisputed disclosure of a battery having CCV above 4.2V. APPLE-1004, [0014]; Petition, 15-17.

B. PO’s arguments that a POSITA would not have been motivated to combine Yamaki and Sakamoto are rooted in a mischaracterization of the combination

PO’s argument that Sakamoto “teaches against raising the charge cutoff voltage” betrays a continued misunderstanding of the Yamaki-Sakamoto combination. POR, 28. As was previously established, the question raised in the Petition is the obviousness of modifying Yamaki’s battery—which already has a CCV above 4.2V—to implement a capacity ratio per Sakamoto. Petition, 10; Petitioner’s Reply to Patent Owner’s Preliminary Response, 3-4; Institution Decision, 29. In this context, there is no question of a motivation to “rais[e] the charge cutoff voltage,” as PO asserts, or indeed of a teaching away from so doing, because the starting point for the combination—Yamaki—*already has such a CCV*. POR, 28. *See Schwendimann v. Neenah, Inc.*, 82 F.4th 1371, 1384 (Fed. Cir. 2023) (“In the context of an obviousness challenge ..., describing one of the

references as ‘primary’ means that it is the reference to be modified by the ‘secondary’ or other references.”).

With the combination properly framed, PO’s arguments do not withstand scrutiny.

First, PO argues that Sakamoto teaches away from increasing CCV because doing so would lead to safety concerns. POR, 29. Even if accurate (which Petitioner does not necessarily concede), it is irrelevant in the Yamaki-Sakamoto context, which presupposes a battery already having CCV above 4.2V. And the Petition established that safety risks (to the extent there are any) would be *mitigated* by implementation of a capacity ratio such as Sakamoto’s—a point that stands unrebutted. Petition, 11-12.

Second, PO’s assertion that a “POSITA did not understand that adjusting the anode to cathode capacity ... would allow raising the charge cutoff voltage” (POR, 29; *see* 31) again fails to inform: nothing in Yamaki-Sakamoto involves “raising the charge cutoff voltage,” and capacity ratio thus need not motivate a change in CCV. Instead, the modification in Yamaki-Sakamoto is implementation of a particular capacity ratio—something that a POSITA would have been motivated to pursue for at least five unrebutted reasons. Petition, 11-13.

C. PO fails to acknowledge Sakamoto's capacity ratio disclosure and the motivations for implementing such a ratio

1. PO ignores the Petition's reliance on Sakamoto's specific disclosure of a capacity ratio

PO's argument that "a body of literature evidenc[es] that batteries were routinely designed with excess cathode capacity" (POR, 29) ignores that the advanced ground is based on the specific Yamaki-Sakamoto combination, not a generic combination of Yamaki and some arbitrary teachings in the art. That other batteries may have had more positive than negative capacity is not at issue here; the question is specifically the combination of Yamaki and Sakamoto. POR, 29; Petition, 14; APPLE-1003, ¶55.

There is no dispute that Sakamoto describes a battery with more negative than positive capacity. APPLE-1005, [0012]; Petition, 9. Yet tellingly, PO barely acknowledges the Petition's specific reliance on Sakamoto or the stated advantages of Sakamoto's capacity ratio (*see* Petition, 11-13), and it instead attempts to obfuscate by focusing instead on teachings outside the advanced ground.

2. PO ignores the stated motivations for the combination

Ignoring the numerous articulated reasons motivating a POSITA to implement a capacity ratio as described by Sakamoto, PO instead lodges generic complaints about the combination that are insufficient to rebut these stated motivations. Petition, 11-13.

PO argues that “there was no definitive guidance ... as to the appropriate ranges for setting the capacity ratio.” POR, 30. This is just not true. The Petition identified *five distinct reasons* providing such guidance. Petition, 11-13. PO does not even attempt to rebut any of these reasons.

Instead, PO cites to Yasunami’s disclosure that the ratio can be set “arbitrarily” as evidence that “POSITAs understood that they had great flexibility in setting the capacity ratio.” POR, 30, citing EX2030, [0032].⁴ But PO’s reliance on this statement is misplaced: PO appears to take Yasunami’s statement as a proxy for *all* knowledge of a POSITA, ignoring that other teachings in the art do counsel toward having more negative than positive capacity, and indeed would have been attractive to a POSITA specifically because of Yasunami’s indicated “flexibility” in this regard. Petition, 11-13.

PO also repeats its previous mistake of attempting to link the claimed ratio to the ability to increase CCV: “Petitioner provides no reason why a POSITA would have ... attempted to exceed the conventional 4.2V limit ... by adjusting the

⁴ Petitioner’s argument responsive to this point applies regardless of the presence or absence of the word “arbitrarily” in the Yasunami translation. *See* POR, 19; APPLE-1006, [0032]; EX2030, [0032].

capacity ratio.” POR, 31. Once again, PO fails to acknowledge Yamaki as the primary reference. Implementation of a ratio based on Sakamoto is motivated by advantages that this ratio would bring; there is no need to motivate a CCV increase.

D. PO’s argument that a POSITA would not have combined Yamaki’s and Sakamoto’s “fundamentally different” batteries is inaccurate and ignores relevant explanation in the Petition

PO’s argument that “the efficacy and safety of the Yamaki-Sakamoto combination would require substantial and rigorous testing” (POR, 33) is contradicted by its own expert, and fails to acknowledge the expected performance enhancement that would be provided by implementation of Sakamoto’s capacity ratio.

Dr. Yao testified that a POSITA would have understood Yamaki’s professed “excellent cycle characteristics” to indicate a battery with “long cycle life.” APPLE-1034, 38:17-39:9. And Dr. Yao contradicted PO’s position that experiments are needed to determine Yamaki’s viability, conceding that “I don’t think it’s relevant to do experiment.” APPLE-1034, 45:15-20. In fact, contrary to PO’s concerns about efficacy and safety, a POSITA would have expected the incorporation a capacity ratio as taught by Sakamoto to enhance both cycle life and

safety—explanations to which PO has provided no substantive rebuttal. Petition, 11-13; APPLE-1003, ¶¶173-174.

The doubts that PO attempts to cast on safety and efficacy are based on the incorrect assertion that Yamaki’s battery is “materially different” from Sakamoto’s. POR, 33. This is simply inaccurate: the plain disclosure of both references confirms the alignment of both materials (APPLE-1003, ¶¶178-181) and objective (*id.*, ¶174). And despite stating otherwise in his declaration (EX2007, ¶134), Dr. Yao under questioning acknowledged these similarities. APPLE-1034, 34:16-35:8, 36:7-37:12, 40:21-41:20.

III. YASUNAMI-KOYAMA RENDERS OBVIOUS CLAIMS 5-10

A. That Yasunami’s end-of-charge voltages render obvious the claimed CCV range withstands PO’s claim construction and criticality attacks

Yasunami’s end-of-charge voltages—charge cut-off voltages under its proper interpretation (*see* §I, *supra*)—render obvious the claimed CCV range. But even under PO’s unjustified construction, the claimed CCV range is nevertheless obvious over Yasunami’s end-of-charge voltages.

1. PO's assertions that Yasunami's end-of-charge voltage is not a CCV are inconsistent with the record and with its own expert's statements

Yasunami's end-of-charge voltage is a CCV because it is the voltage to which a battery is configured to be charged, *e.g.*, the maximum applied voltage during charging. Petition, 48-49; APPLE-1003, ¶¶187-191.

PO concedes Yasunami's end-of-charge voltage is an applied voltage, *i.e.*, a CCV as properly interpreted: "Yasunami discloses an *applied voltage* of 4.3V." POR, 50 (emphasis in original). And Dr. Yao, in litigation, confirms that the maximum applied charging voltage is a CCV. APPLE-1042, 42 (describing that in constant current charging, "[o]nce the battery reaches a predetermined voltage (*i.e.*, *the charge cut-off voltage*), the charging stops"), *id.* (describing that in CC/CV charging, "the battery is charged ...until it reaches a maximum configured voltage, at which point it is charged at that voltage until charging is complete"); APPLE-1003, ¶¶187-191.

2. Yasunami satisfies the claimed CCV range even under PO's proposed construction

But even under PO's proposed (and unjustified; *see* §I, *supra*) construction of CCV as a battery voltage, a POSITA would have understood or found obvious that Yasunami's end-of-charge voltage is substantially equivalent to the battery voltage, given the expected implementation of the end-of-charge voltage as the

applied voltage in a CC/CV charging process. APPLE-1003, ¶¶187-191; APPLE-1035, ¶¶9-19.

The experts agree that CC/CV charging of Yasunami’s battery is advantageous. Petition, 49; APPLE-1003, ¶190; EX2007, ¶191. Yet inexplicably, despite these advantages, Dr. Yao makes the contradictory—and conclusory—assertion that Yasunami instead implements solely constant current (“CC”) charging.⁵ EX2007, ¶186 (“the batteries in Yasunami were purportedly only charged with a constant current, and there was no constant voltage phase”). In fact, Yasunami provides no information on its charging protocol, and PO has pointed to no reason why Yasunami would be limited to CC charging, nor identified any aspect of Yasunami that would teach away from implementation of advantageous CC/CV processes. APPLE-1003, ¶¶190-191; Petition, 49.

⁵ Dr. Yao’s statement that “Mr. Hruska admits that the ‘end-of-charge voltage’ described in Yasunami is ‘in the context of constant current charging’ (EX2007, ¶190, citing APPLE-1003, ¶189) takes Mr. Hruska’s testimony out of context and in so doing, misrepresents his testimony. APPLE-1035, ¶12; APPLE-1003, ¶¶190-191.

During the constant voltage phase of CC/CV charging, the applied voltage is held constant, and the battery voltage asymptotically approaches the applied voltage such that when charging concludes, the battery voltage (CCV, under PO's proposed construction) substantially equals the applied voltage. APPLE-1003, ¶¶190-191; APPLE-1035, ¶¶13-15. Dr. Yao attempts to avoid acknowledging this similarity, arguing that a POSITA "would not have been able to determine with reasonable certainty the value of the battery voltage when the applied voltage reached 4.3V." EX2007, ¶187. But this overstates the uncertainty. As explained by Mr. Hruska, a POSITA would have known "with reasonable certainty" (*id.*) that there is negligible difference between battery voltage and applied voltage. APPLE-1035, ¶16. Notably, in the Samsung IPR, Dr. Yao confirmed this substantial equivalence, explaining that at the end CC/CV charging, "***there is almost no difference*** between the applied voltage and the OCV" (*i.e.*, the battery voltage). APPLE-1037, ¶91. And PO here concedes the same: "when the current approximates zero, and the battery voltage is ***practically equal*** to the applied voltage, the charging stops." POR, 53.

That is, a POSITA would recognize that when Yasunami's CC/CV charging concludes, the battery voltage (CCV, under PO's proposed construction) is effectively equal to Yasunami's end-of-charge voltage. APPLE-1003, ¶¶190-191; APPLE-1035, ¶¶13-16; APPLE-1037, ¶91.

3. Yasunami's 4.3V end-of-charge voltage falls within the claimed range under either construction

When Yasunami's end-of-charge voltage is properly recognized as a CCV, PO's attempts to discount Yasunami's disclosure of a 4.3V end-of-charge voltage falls flat: 4.3V lands squarely within the claimed range. POR, 51, 56; APPLE-1003, ¶¶187-191; APPLE-1006, [0073]. But even to the extent that PO's unjustified read of CCV is adopted, a POSITA would have recognized Yasunami's battery voltage (CCV, under PO's proposed construction) to be substantially equal to the 4.3V end-of-charge voltage (*e.g.*, within about 0.01V, as explained by Mr. Hruska), thus still within the claimed range. APPLE-1035, ¶¶13-16.

4. PO fails to demonstrate criticality of the claimed CCV range sufficient to rebut obviousness in view of Yasunami's overlapping range

PO argues against the Petition's showing of obviousness based on the significant overlap between Yasunami's end-of-charge voltage and the claimed CCV ranges by asserting both that "the prior art teaches away from the claimed range" and that the '641 Patent "presents surprising data" showing unexpected results. POR, 57-58. Neither of these positions withstands scrutiny.

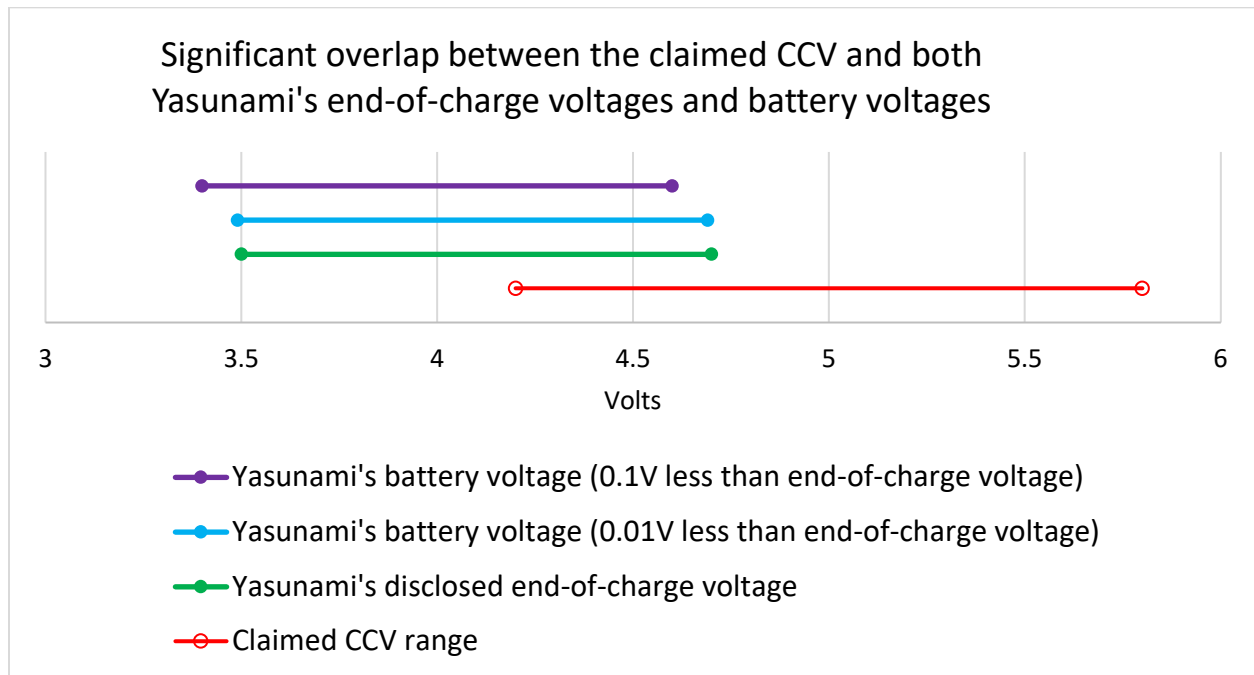
First, PO's assertions that "the prior art teaches away from the claimed range, as it was conventional wisdom that the charge cutoff voltage ... was limited to 4.2V" is simply not true. Yasunami itself demonstrates viable batteries having

CCVs above 4.2V. APPLE-1006, [0073]. And so do other references. *See* APPLE-1004, [0014]-[0015].

Second, the '641 Patent's experiments, cited by PO as allegedly revealing "surprising data" about battery performance at CCV above 4.2V, are insufficient to conclude that 4.2V is a critical endpoint justifying a finding of non-obviousness. POR, 57-58. The '641 Patent data result from poorly designed experiments that conflate effects of CCV and capacity ratio (among other factors), making it impossible for a POSITA to determine whether the purportedly observed results are attributable to CCV, capacity ratio, or both. APPLE-1001, 10:29-36; APPLE-1035, ¶¶20-24. Nevertheless, even to the extent that these results could somehow be attributed to CCV variation, the '641 Patent simply does not provide enough data to allow any conclusion to be drawn regarding a threshold for unexpected results at CCV above 4.2V. APPLE-1035, ¶¶20-24; APPLE-1003, ¶¶195-196.

Importantly, Yasunami's end-of-charge voltage range of 3.5-4.7V has such extensive overlap with the claimed CCV range as to render it obvious even if PO's construction is adopted. There is negligible difference between Yasunami's end-of-charge voltage and the battery voltage (CCV, according to PO) when CC/CV charging concludes. APPLE-1003, ¶¶190-191; APPLE-1035, ¶¶13-16; APPLE-1037, ¶91. As such, even supposing Yasunami's battery voltages were slightly lower than the disclosed 3.5-4.7V end-of-charge voltages (typically about 0.01V

less, as explained by Mr. Hruska—but even if they were $\sim 0.1\text{V}$ less, a full order of magnitude greater difference), they still would overlap with and thus render obvious the claimed CCV range, as illustrated in Mr. Hruska’s graphic *infra*. APPLE-1035, ¶¶17-18.



B. PO fails to establish that a POSITA would not have combined Yasunami and Koyama

1. Yasunami does not teach away from the combination, which is motivated by unrebutted advantages

PO’s argument that “Koyama’s proposed approach is exactly the approach that Yasunami teaches against” (POR, 60) fails to recognize the full scope of Koyama’s teachings and the advantages that would have arisen from implementation of these teachings in Yasunami’s battery.

PO attempts to seize upon Yasunami's statement that "reducing the amount of positive electrode active material ... places limits on the discharge capacity" of batteries having carbonaceous electrode materials (APPLE-1006, [0002]), arguing that given the (purported) already reduced energy density of batteries with Yasunami's lithium transition metal oxides as compared to those with these typical carbonaceous materials, "[a] POSITA thus would be careful not to adopt an approach—such as the one disclosed in Koyama—that would further reduce energy density." POR, 60. But PO fails to recognize that Koyama explicitly teaches the applicability of advantages of its capacity ratio not only for carbonaceous electrodes, but also for those composed of lithium transition metal oxides—the very composition of Yasunami's electrodes. APPLE-1007, [0008]-[0009]; APPLE-1003, ¶¶178-181; APPLE-1035, ¶¶25-29. Dr. Yao confirms his reliance on this (inaccurate) difference in reaching his conclusion on combinability. APPLE-1034, 74:11-16 ("Q. And this difference in the type of anode active material that is used is a reason that you believe that a POSITA would not have been motivated to combine the teachings of Yasunami and the teachings of Koyama; is that right? A. Yeah, that's correct."); EX2007, ¶202.

Given Koyama's demonstration that its capacity ratio is viable in batteries with lithium transition metal oxide electrodes—such as Yasunami's—the relied-upon statements in Yasunami do not rise to the level of "teaching against" the

combination, as PO contends. POR, 60. *See In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) (“references taken in combination teach away since they would produce a “seemingly inoperative device,” citing *In re Spinnoble*, 405 F.2d 578, 587, 160 USPQ 237, 244 (CCPA 1969)). That is, far from being “redundant and indeed counterproductive” (POR, 61) to incorporate a capacity ratio based on Koyama into Yasunami’s battery, a POSITA in fact would have recognized the potential for a reduction in energy density as one among a variety of factors to be considered, and would have weighed the numerous **unrebutted** benefits of implementing such a capacity ratio (Petition, 43-45) against any potential reduction in energy density. APPLE-1035, ¶¶26-27. *See Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (holding that “[a] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.”); *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000) (“The fact that the motivating benefit comes at the expense of another benefit...should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another.”); *In re Urbanski*, 809 F.3d 1237, 1244 (Fed. Cir. 2016); *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012)

2. The Petition disproves PO's position that Yasunami indicates that capacity ratio was an "unimportant" design parameter

PO's argument that a POSITA would not have been motivated to pursue the Yasunami-Koyama combination "because Yasunami teaches that the capacity ratio is a trivial design parameter" (POR, 61) ignores Petition's enumeration of the advantages of implementing a capacity ratio such as Koyama's.

First, PO's assertion Yasunami's purported teaching that capacity ratio "can be set 'arbitrarily'" means that "a POSITA would not have had reason to implement the ratio described by Koyama" rests on the implicit assumption that the motivation for a combination of references must be found in the references themselves. POR, 61.⁶ But this is not correct. A combination can be motivated even by reasons that are not identified by the references in the combination. *See DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006) ("we have held that there exists in these situations a motivation to combine prior art references even absent any hint of suggestion in the references themselves"). And indeed, the Petition enumerated various

⁶ Once again, Petitioner's responsive argument applies regardless of the presence or absence of the word "arbitrarily" in the Yasunami translation. POR, 19; APPLE-1006, [0032]; EX2030, [0032].

advantages of a ratio as taught by Koyama in the context of Yasunami's battery, e.g., good charging performance, cycle life characteristics, and safety. Petition, 43-44. These benefits were not contested—or even acknowledged—by PO.

Second, PO's argument that Yasunami's teaches "that virtually any ratio is acceptable, thus teaching a POSITA that the ratio is not relevant to the charge cutoff voltage" is not the correct inquiry. POR, 61. Petitioner did not need to have demonstrated that implementation of a capacity ratio based on Koyama would impact a feature that is recited in the claims (CCV); only that a POSITA would have recognized the capacity ratio to bring advantages to the combination. Which, again, was demonstrated abundantly in the Petition, and which PO did not contest. Petition, 43-45; APPLE-1003, ¶¶238-243; APPLE-1035, ¶¶26-29.

Third, PO further asserts that "Koyama's approach reduces energy density." POR, 61. Even if true, a POSITA would have known how to balance any purported reduction in energy density against the numerous unrebutted advantages of Koyama's approach, as discussed *supra*. APPLE-1035, ¶¶26-27.

3. PO's failure to recognize similarities between Yasunami and Koyama undermines its argument that a POSITA would not have expected success

PO's position that a POSITA would not have expected success in combining Yasunami with Koyama because "the battery system in Yasunami is fundamentally

different from the one in Koyama” (POR, 62) overlooks key disclosure in Koyama confirming similarity of the materials systems, as previously discussed. *See* §III.B.1. POR, 62.

Moreover, PO’s questioning of whether a POSITA would have expected success based on a perceived inability to “predict the performance of a battery with a higher voltage based on its performance at lower voltages” (POR, 62) once again betrays an essential misunderstanding of the combination. There is no question raised in this proceeding about predicted performance of a lower voltage battery at higher voltage; the battery of Yasunami (the primary reference) already operates at a CCV above 4.2V.

IV. CLAIMS 11-14 ARE RENDERED OBVIOUS BY BOTH YAMAKI-SAKAMOTO AND YASUNAMI-KOYAMA

Petitioner’s position that the capacity retention features of claims 11-14 are not entitled to patentable weight stands unrebutted by PO. Petition, 23, 59. Nevertheless, even to the extent these features are found to be limiting, PO has failed to present any convincing reason why a POSITA would not have found them to be obvious in view of both Yamaki-Sakamoto and Yasunami-Koyama.

A. A POSITA would have found obvious that the Yamaki-Sakamoto and Yasunami-Koyama batteries have the recited capacity retention capabilities

PO's argument that "[t]he cycle life limitations of claims 11-14 are not necessarily present in the structure of claim 5" ignores what a POSITA would have found to be obvious in the context of the '641 Patent disclosure. POR, 37; *see* 63.

The '641 Patent attributes its purported performance improvements solely to two features: CCV and capacity ratio—both of which are satisfied by the Yamaki-Sakamoto and Yasunami-Koyama combinations. APPLE-1001, 3:3-15; POR, 11 (“the inventors improved utilization of existing cathode materials by adjusting the anode to cathode capacity ratio to a range such that allowed raising the charge cut-off voltage safely above 4.2V”). Dr. Yao further confirmed that these alleged improvements can be attributed solely to these two features:

2 **Q. Besides adjusting the capacity ratio and**
3 **exceeding the voltage of 4.2 volts, does the**
4 **'641 patent mention anything else that it does to**
5 **obtain improved battery performance?**

6 MR. ZHOU: Object to form.

7 THE WITNESS: I believe that's -- those
8 two major -- two things are what they emphasize in
9 the claims.

10 BY MR. IN:

11 **Q. What about in the specification, are any**
12 **other factors mentioned in the specification as**
13 **contributing to improved performance?**

14 A. As far as I understand, no.

APPLE-1034, 32:2-14.

The only aspect of claims 11-14 that is not explicitly described by either combination is the cycle life result itself—a result that PO (and the '641 Patent itself) has linked exclusively to those elements that *are satisfied* by the combinations. Thus, a POSITA, recognizing satisfaction by Yamaki-Sakamoto and Yasunami-Koyama of the CCV and capacity ratio characteristics to which the '641 Patent attributes the recited cycle life features, would have found it obvious that the cycle life features themselves are likewise satisfied. *See Alcon Rsch., Ltd. v. Apotex Inc.*, 687 F.3d 1362, 1369 (Fed. Cir. 2012) (A claimed property “is not an additional requirement imposed by the claims” where patent discloses that it is “a property necessarily present” where other claim limitations are present (quoting

In re Kubin (Fed. Cir. 04/03/09)); *Persion Pharms. LLC v. Alvogen Malta Operations Ltd.*, 945 F.3d 1184 (Fed. Cir. 2019).

Indeed, this conclusion is logical: it is inappropriate for PO to be entitled to a claim to a result that requires more to achieve than what is taught, and by extension, PO cannot demand more of the art than what is described by the '641 Patent with respect to the recited capacity retention features. *See In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994).

B. A desire for good cycle life would have motivated a POSITA to do routine experimentation using well-established parameters that impact cycle life

PO's position that Yamaki's data do not "allow reasonably reliable conclusions concerning a battery's capacity retention over hundreds of cycles" (POR, 40) is not responsive to the Petition's challenge, which does not assert that the Yamaki-Sakamoto battery meets the recited cycle life limitations, but instead explains that a POSITA would have found it merely a matter of routine experimentation to achieve such a battery, guided by Yamaki's and Sakamoto's shared goal of good cycle life. Petition, 27-30.

There is no dispute that Yamaki and Sakamoto both aim to improve cycle life. APPLE-1004, [0014]; APPLE-1005, [0012]; APPLE-1003, ¶105; APPLE-1034, 36:7-37:12, 40:21-41:20. Nor is there disagreement that the POSITA had a

vast library of parameters available in service of achieving this objective. APPLE-1003, ¶106; APPLE-1034, 39:4-9. And PO's own corroborating references confirm that the routine adjustment of parameters to achieve better cycle life was conventional. *See* EX2007, ¶155 (characterizing EX2021 as teaching that "to avoid such sudden decay [in capacity], one should make a proper *choice of carbon and electrolyte*"). Given these parameters, and the objective of improving cycle life in the Yamaki-Sakamoto battery—which otherwise aligns with the disclosed '641 Patent batteries—there is no inventiveness to merely determining the optimal parameters to achieve that goal. *See In re Aller*, 220 F.2d 454, 456 (C.C.P.A. 1955) ("where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation").

PO raised similar objections to the Petition's assertion that a POSITA would have worked to achieve good cycle life of the Yasunami-Sakamoto battery. POR, 63-64. But here, too, motivated by Yasunami's desire to achieve good cycle life (APPLE-1006, Abstract) in a Yasunami-Koyama battery that otherwise aligns with aspects of the '641 Patent batteries, a POSITA would have known to perform routine experimentation with a library of testing parameters in service of this objective. APPLE-1003, ¶¶224-229.

V. CONCLUSION

For all the foregoing reasons, Petitioner respectfully submits that the Board should find the Challenged Claims unpatentable.

Respectfully submitted,

Date: October 9, 2024

/W. Karl Renner/

W. Karl Renner, Reg. No. 41,265
Hyun Jin In, Reg. No. 70,014
Gretchen DeVries, Reg. No. 72,505
Fish & Richardson P.C.
60 South Sixth Street, Suite 3200
Minneapolis, MN 55402
T: 202-783-5070
F: 877-769-7945

Counsel for Petitioner

CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioners' Reply to Patent Owner's Response totals 5,461, which is less than the 5,600 allowed under 37 CFR § 42.24.

Respectfully submitted,

Date: October 9, 2024

/W. Karl Renner/
W. Karl Renner, Reg. No. 41,265
Hyun Jin In, Reg. No. 70,014
Gretchen DeVries, Reg. No. 72,505
Fish & Richardson P.C.
60 South Sixth Street, Suite 3200
Minneapolis, MN 55402
T: 202-783-5070
F: 877-769-7945

Counsel for Petitioner

CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(1) and 42.6(e)(4)(iii), the undersigned certifies that on October 9, 2024, a complete and entire copy of this Petitioner's Reply to Patent Owner's Response and its supporting exhibits was provided via email to the Patent Owner by serving the email correspondence addresses of record as follows:

James T. Carmichael, Reg. No. 45,306
Stephen McBride, Reg. No. 78,396
Minghui Yang, Reg. No. 71,989

CARMICHAEL IP, PLLC
8607 Westwood Center Drive Suite 270
Tysons, VA 22182
Tel: 703-646-9255

jim@carmichaelip.com
stevemcbride@carmichaelip.com
mitch@carmichaelip.com
RJIPRs@Carmichaelip.com

/Crena Pacheco/

Crena Pacheco
Fish & Richardson P.C.
60 South Sixth Street, Suite 3200
Minneapolis, MN 55402
pacheco@fr.com