

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
Patent No. 7,749,641

PATENT OWNER'S PRELIMINARY RESPONSE

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I. INTRODUCTION

Patent Owner RJ Technology LLC (“Patent Owner”) submits this Preliminary Response to Petitioner Apple Inc.’s (“Apple”) August 23, 2023 Petition (Paper 2) requesting *inter partes* review of claims 5–14 (the “Challenged Claims”) of U.S. Patent No. 7,749,641 (the “’641 Patent”).

The claims of the ’641 Patent recite—among other elements—an improved lithium-ion battery for which (i) the charge cut-off voltage is “greater than 4.2 V but less than 5.8 V” (the “claimed voltage range”) and (ii) the ratio of positive electrode material to negative electrode material is “from 1:1.0 to 1:2.5 as calculated by a theoretic capacity with a charge cut-off voltage set at 4.2V” (the “claimed capacity ratio range”).

As the ’641 Patent explains in detail, the prior art regarded 4.2V as the upper boundary voltage to which a lithium-ion battery could be recharged without suffering significant performance loss. The patented invention identifies a novel combination in which the two claimed ranges operate *in tandem* to raise that boundary without suffering significant performance losses seen in prior art batteries, while also conferring key benefits:

The present invention provides a new method for *improving capacity, average operating voltage and specific energy of a secondary lithium ion cell or battery*. This method is achieved *by means of properly adjusting the ratio between a positive*

material and negative material, which is calculated by theoretical specific energy, *and properly increasing charge cut-off voltage*. Abstract (emphasis added)

As Apple’s Petition affirms, no reference teaches these elements *in tandem*. Instead, the Petition (at most) purports to present these elements separately—in references directed either to unrelated or even incompatible approaches to lithium-ion battery performance improvement—and asserts, without identifying any reason to combine, that a POSA would have combined those references to arrive at the claimed invention.

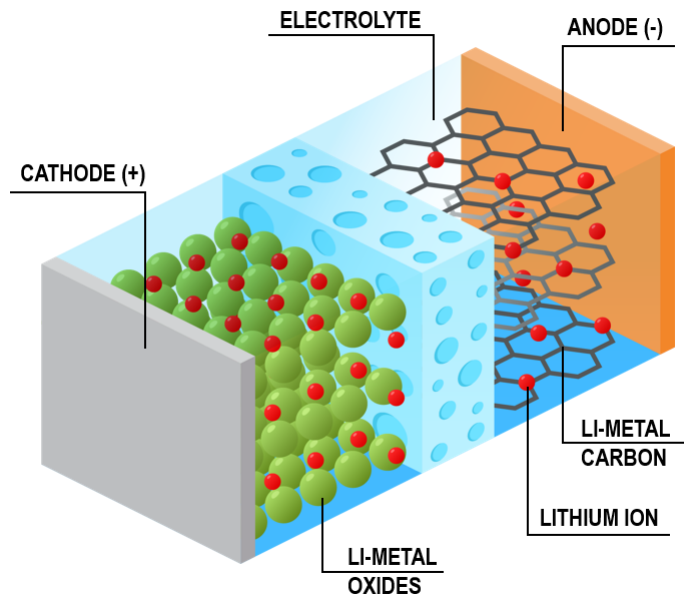
As explained in detail below, Apple fails to demonstrate that a POSA would have had reason to combine the prior art to practice a lithium-ion battery possessing the claimed elements *in tandem*, and therefore fails to demonstrate that independent claim 5 is obvious. Thus, Patent Owner respectfully requests denial of institution.

II. BACKGROUND

A. The History Behind RJ Technology’s Invention

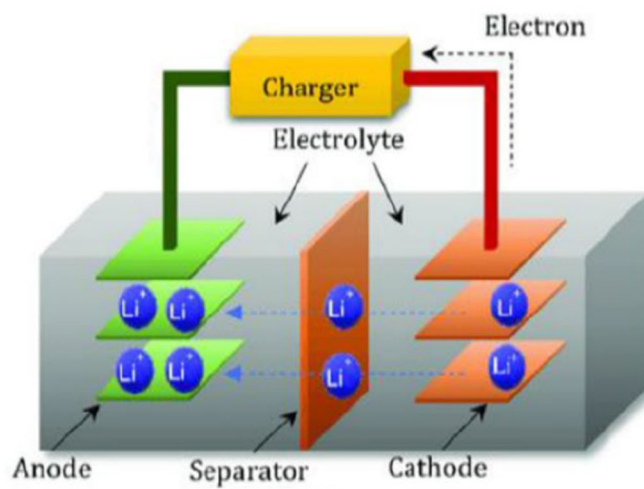
Introduced commercially in the early 1990s, lithium-ion batteries are the now-ubiquitous power source for mobile phones, electric cars, laptops, and other electronic devices. At a basic level, as shown below, the batteries include a positive electrode (a cathode), a negative electrode (an anode), and a chemical layer between them (the electrolyte, which is often a solution). ’641 Patent at 2:38–41, 1:36–63. The cathode is typically comprised of a lithium compound, such as lithium metal

oxide, whereas the anode is typically comprised of a carbon-based material, such as graphite.



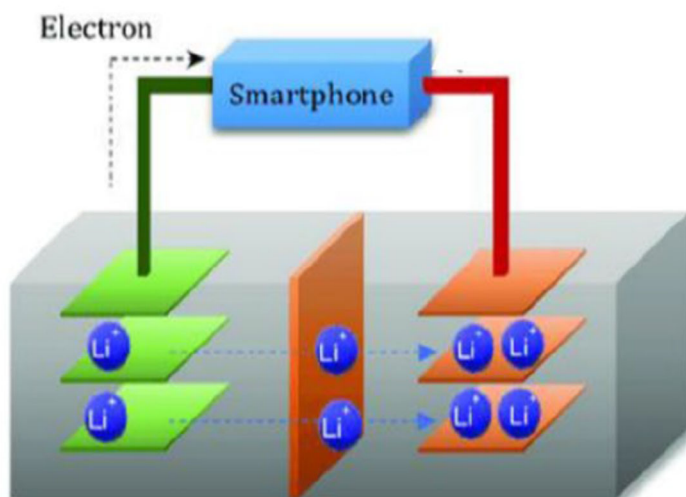
As shown in the diagram below, when the battery is charged lithium atoms in the cathode lose an electron, resulting in lithium ions that flow through the electrolyte and become embedded in the anode material, while at the same time electrons flow through the charging circuit where they rejoin the lithium ions:

Illustration of Charging the Battery



Once charged, the battery can be used to power a device, as shown in the next diagram below. The battery provides electricity (the flow of electrons) by reversing the flow of the lithium ions and electrons as compared to the charging cycle. The electrons leave the anode flowing through the device and towards the cathode, while lithium ions flow back through the electrolyte to the cathode, rejoining the electrons.

Illustration of Discharging the Battery (Powering a Device)



Prior to the invention of the '641 Patent, battery engineers had worked unsuccessfully to increase the lithium-ion battery capacity (the amount of energy held on a charge) without increasing the size of the battery or sacrificing performance. '641 Patent at 1:19–35. Such prior art efforts included, for example, changing the electrode materials, the electrolyte, or the cell shape. *Id.*

The '641 Patent inventors took a different approach than the prior art, focusing on the charge cutoff voltage and the ratio of electrode materials. *Id.* at 1:19–63, 2:63–67. Voltage can be thought of as a measurement of the force at which electrons are pushed through a circuit. Increasing the charging voltage pushes a larger number of lithium ions into the anode, thereby increasing capacity (at least in the short term) by cramming more lithium into the electrode without adding material. But increasing the voltage can also cause the batteries to degrade, which in turn can reduce the capacity of the battery over successive charges. *Id.* at 1:57–63. To avoid significant capacity loss caused by this degradation, 4.2V was seen at the time of the invention as the conventionally accepted maximum cutoff voltage for lithium-ion batteries. *Id.* at 1:46–49.

The '641 Patent describes the inventors' unique solution to increasing capacity without suffering such degradation. The patent discloses an improved battery design, including with respect to the chemistry of lithium-ion batteries and parameters like charge cutoff voltage, overcharge protection, and overcharge

release. Key among their innovations was the determination through experimentation that capacity could be improved without sacrificing performance by “increasing the charge cut-off voltage” above 4.2V and simultaneously “adjusting the ratio of positive electrode material to negative electrode material.” *Id.* at 3:7–12, 55–65. This unique and previously unknown combination of battery design elements was found to be novel and patentable by the patent examiner, resulting in issuance of the ’641 Patent.

B. The ’641 Patent

The ’641 Patent is titled “Secondary Lithium Ion Cell or Battery, and Protecting Circuit, Electronic Device, and Charging Device of the Same” and describes “improving [the] capacity, average operating voltage, and specific energy of a secondary lithium-ion cell or battery [by] adjusting the ratio between a positive material and a negative material, which is calculated by theoretical specific energy, and properly increasing charge cut-off voltage.” ’641 Patent, abstract. The invention “provide[s] a secondary lithium ion cell or battery, wherein the single secondary lithium ion cell has an [sic] charge cut-off voltage of greater than 4.2 V but less than 5.8 V, and the ratio of positive electrode material to negative electrode material of the single cell is from 1:1.0 to 1:2.5, preferably from 1:1.15 to 1:2.5, as calculated by the specific capacity with the charge voltage limited to 4.2 V.” ’641 Patent, 3:26-33. It is this combination of a higher, claimed charge cut-off voltage *in*

tandem with the claimed capacity ratio range that delivers improved performance characteristics compared to prior art batteries.

In particular—contrary to the prior art, which failed to (i) recognize the interplay between charge cut-off voltage and capacity ratio and (ii) design batteries consistent with this interplay—the inventors of the '641 Patent recognized that it was possible to improve a number of important battery performance characteristics (for example, capacity, average operating voltage, and specific energy of a secondary lithium-ion battery), without degrading battery performance (which was known in the art to occur when the charge cut-off was increased above 4.2V). Accordingly, the '641 Patent combines two claimed elements, *in tandem*: (i) a higher charge cut-off voltage range and (ii) a lower ratio of positive electrode material to negative electrode material (as determined at 4.2V). This teaching is reflected throughout the patent, including in the following excerpts:

As to the common opinion in the art that increasing the charge cut-off voltage above 4.2 V may greatly shorten the recycle life, the inventor of the present invention conducted a large number of experiments and studies to elevate the charge cut-off voltage and the capacity of cell. *Contrary to this opinion, the inventor unexpectedly found that the efficacy of electrode active materials is greatly increased by increasing the charge cut-off voltage and properly adjusting the ratio of positive electrode material to negative electrode material of single lithium ion cell.* Consequently, the specific energy, capacity and

average operating voltage of secondary lithium ion cell or battery are improved, while the performance of cell is substantially not changed. The present invention is fulfilled based on the aforesaid discovery.

'641 Patent, 3:3–16 (emphasis added).

Contrary to the prior art, the charge cut-off voltage of the single cell of said secondary cell or battery is greater than 4.2 V but less than 5.8 V, and the ratio of positive electrode material to negative electrode material calculated by the theoretical capacity under the charge cut-off voltage of 4.2 V is 1:1.0 to 1:2.5. As compared to the prior secondary lithium ion cell or battery cell, the capacity, energy density and output voltage of the present secondary lithium ion cell or battery are greatly improved, while its recycle life is equivalent to that of the prior art cell. For achieving better effect, the aforesaid charge cut-off voltage used in the present invention is preferably in the range from 4.3 V to 5.2 V, more preferably in the range from 4.3 V to 4.8 V. In addition, the ratio of positive electrode material to negative electrode material of said single lithium ion cell, which is calculated by the theoretical capacity under the charge cut-off voltage of 4.2 V, is 1:1.5 to 1:2.5.

'641 Patent, 7:24–41 (emphasis added).

Critically, the '641 Patent discloses that including anode material such that the ratio of positive electrode material to negative electrode material is within the claimed capacity ratio ranges allowed raising the charge cut-off voltage within the claimed charge cut-off voltage ranges without jeopardizing the performance of the

battery—a well-known concern in the prior art in connection with charging lithium-ion batteries above 4.2V. '641 Patent, 6:29–34.

C. Prosecution History

The '641 Patent is the U.S. national stage of PCT application No. PCT/CN02/00696 filed September 28, 2002, which claims priority to Chinese application No. CN01141615 filed September 28, 2001. The '641 Patent issued on July 6, 2010, after overcoming a series of rejections made by the Office.

Apple concedes that the Examiner made rejections based on the same theories presented in the Petition. Like Apple's Petition, the Examiner identified prior art allegedly disclosing a battery having a charge cut-off voltage above 4.2 V (Tanaka, US5487960, and Kobayashi, US6558848) and identified prior art allegedly disclosing a battery having a ratio of positive to negative electrode material within a range of 1:1.15 to 1:2 (Idota, US5260148). Like Apple's Petition, the Examiner then suggested that a POSA would have combined these separate teachings to arrive at a battery with both the claimed charge cut-off voltage and ratio of positive electrode material to negative electrode material.

However, after further analysis the Examiner concluded that the prior art discouraged the skilled artisan from combining these teachings because “charging a secondary lithium ion battery [having the specified ratio of positive electrode material to negative electrode material] above 4.2V would cause electrolyte

breakdown, reduced recycle properties, and/or structural changes in the electrode materials.” Paper 2, 3. As the cited art “teaches that life cycle property of a cell drastically decreases when the charging voltage increases beyond 4.2V,” the skilled artisan would have had “an expectation...that the resulting battery would display inferior capacity and/or cycleability” and “one of ordinary skill...would not have predicted that the resulting cell would have high capacity.” *Id.* Nothing in Apple’s Petition refutes any of these conclusions; thus, the Board should deny institution.

D. Petitioner’s Cited References

The Petition asserts the following references with respect to independent claim 5, at issue in this preliminary response:

1. Yamaki (Ex. 1004) (Combined with Sakamoto *infra*)

Japanese publication 2001-167763 to Yamaki is titled “Lithium Secondary Battery” and describes a “lithium secondary battery having a positive electrode 1 containing a Co-based oxide including Li and Co as a positive electrode active material [and] a negative electrode 2.” Ex. 1004, 3. Yamaki describes the “maximum potential” of such a battery configuration “can be from 4.4 V to 4.8 V in terms of metallic Li while also suppressing deterioration in the reversibility of charging and discharging as more charging and discharging cycles are performed.” Ex. 1004, [0014]. “[T]he discharge capacity of the positive electrode active material can be improved by setting the maximum potential of the positive electrode during

charging to 4.4 V or more in terms of metallic Li. As a result, the amount of positive electrode active material in the battery can be reduced, and the amount of negative electrode active material can be increased.” *Id.*, [0015]

2. Sakamoto (Ex. 1005) (Combined with Yamaki *supra*)

Japanese publication H09-293536 to Sakamoto et al. is titled “Non-Aqueous Electrolyte Secondary Battery” and describes a range of negative electrode to positive electrode between 1.05 and 1.3. Ex. 1005, 3. Sakamoto purports to select this range because “if the reversible capacity balance is 1.05 or less, the reversible capacity balance may reach 1 or less locally in the electrode due to variations in electrode manufacturing, etc. [and if] the reversible capacity balance is greater than 1.30, too much of the compound does not participate in charging and discharging, and the amount of the compound that can be charged and discharged must be substantially reduced when a battery with a constant volume is inserted.” Ex. 1005, [0008]. Sakamoto teaches further that its selected capacity ratio provides added safety to the battery:

- “By setting the reversible capacity balance of the negative electrode and the positive electrode to the range in the present invention, lithium is not deposited even when overcharged. This means a secondary battery can be provided that is safe due to low risk of heat being generated and an explosion occurring, and that has good cycle characteristics after repeated charging and discharging.” *Id.*

3. Yasunami (Ex. 1006) (Combined with Koyama *infra*)

Japanese publication H07-122298 to Yasunami is titled “Method for Charging and Discharging Non-Aqueous Secondary Batteries” and describes “a non-aqueous secondary battery having a large discharge capacity, a high discharge operating voltage, and good charge/discharge cycle characteristics.” Ex. 1006, 3. Yasunami teaches the following with respect to its disclosed voltage ranges:

- “The end-of-charge voltage is preferably in the range from 3.5 to 4.7 V, more preferably from 3.7 to 4.5 V, and even more preferably from 3.8 to 4.4 V to realize a 3-V class battery voltage. If it is lower than 3.5 V, the battery voltage will be low, and if it is higher than 4.7 V, the positive electrode active material and the electrolyte may decompose.” Ex. 1006, [0034].

4. Koyama (Ex. 1007) (Combined with Yasunami *supra*)

Japanese publication 2000-260472 to Koyama et al. is titled “Non-Aqueous Electrolyte Secondary Battery” and describes a “secondary battery consisting of a positive electrode, a negative electrode, and a nonaqueous electrolyte, wherein the capacity ratio (B/A) between the electrode capacity A of the positive electrode and the electrode capacity B of the negative electrode is $1.3 < (B/A) \leq 2.5$.” Ex. 1007, 3. Koyama cites Sakamoto as disclosing “the ratio of the reversible capacities of the positive and negative electrodes (negative electrode/positive electrode) is 1.05 to 1.30 in order to ensure sufficient Li ion storage capacity in the negative electrode,

and thus eliminate Li deposits and reduce cycle degradation” but suggests there exists a need for batteries having “better charging characteristics than” Sakamoto. Ex. 1007, [0003]. Koyama teaches the following with respect to the battery capacity ratio:

- “If the capacity ratio (B/A) is less than 1.3, the improvement in charging characteristics is insufficient. Therefore, a value of 1.4 or higher is preferred. Meanwhile, if the capacity ratio (B/A) exceeds 2.5, the increase in the ratio of the negative electrode in a fixed volume battery container causes the absolute volume of the positive electrode to decrease in relative terms, resulting in a decrease in battery capacity and an increase in irreversible capacity, which in turn reduces the actual capacity that can be drawn upon.” *Id.*, [0007].

III. CLAIM CONSTRUCTION

In *inter partes* reviews filed after November 13, 2018, the Board construes claim terms based on their ordinary and customary meaning in accordance with *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). 83 Fed. Reg. 51340 (October 11, 2018). Under *Phillips*, claims must be so construed as to sustain their validity, if possible. The specification is the “best source for understanding a technical term,” to be supplemented, “as needed, by the prosecution history.” *Id.* at 1315.

For the purposes of institution, Patent Owner agrees that no term requires express construction. Pet., 4-5. See *Nidec Motor Corp. v. Zhongshan Broad Ocean*

Motor Co., 868 F.3d 1013, 1017 (Fed. Cir. 2017) (noting that the Board need only construe terms “that are in controversy, and only to the extent necessary to resolve the controversy”). Patent Owner explicitly reserves the right to construe claim limitations should the Board institute review.

IV. PERSON OF ORDINARY SKILL IN THE ART

Apple states that a “person of ordinary skill in the art relating to the subject matter of the ’641 Patent as of September 28, 2001 (“POSA”) would have held a Bachelor’s degree in chemistry or chemical engineering, with at least 4 years of experience in cell design, electrochemical techniques, and battery materials development. A Master’s Degree can be substituted for some of the relevant experience. Equivalent training with battery specific experience can accommodate other degreed fields.” Paper 2, 4.

For purposes of this Preliminary Response only, Patent Owner does not dispute Apple’s definition, except noting that other majors may provide equivalent education and experience designing, testing, and building lithium-ion batteries.

V. GROUNDS AT ISSUE IN THIS PRELIMINARY RESPONSE

Apple asserts two obviousness grounds against the sole challenged independent claim in the ’641 Patent (claim 5): Ground 1 based on Yamaki and Sakamoto and Ground 2 based on Yasunami and Koyama. The Petition introduces additional references including Abraham and Richardson as allegedly disclosing

elements of dependent claims 9 and 10 but does not rely on additional references for any element of the independent claim; thus, Patent Owner does not address Abraham and Richardson in this response. As discussed below, Apple's obviousness grounds fail because a POSA would not have combined Yamaki and Sakamoto, nor Yasunami and Koyama.

For purposes of this Preliminary Response only, Patent Owner does not address the prior art at issue in any grounds other than Apple's obviousness grounds against the independent claim (i.e., Grounds 1 & 2).

VI. APPLE'S OBVIOUSNESS GROUNDS FAIL

Apple asserts that two combinations—Yamaki-Sakamoto and Yasunami-Koyama—render independent claim 5 of the '641 Patent¹ obvious. As to each of these combinations, Apple asserts that a POSA would have combined one reference allegedly disclosing the claimed charge cutoff voltage and another reference allegedly disclosing the claimed capacity ratio (together, the "claimed limitations"). Patent Owner disputes that these limitations are disclosed in the cited prior art and

¹ Claim 5 is the only challenged independent claim of the '641 Patent. For purposes of this preliminary response, Patent Owner addresses both Apple's Yamaki-Sakamoto and Yasumani-Koyama grounds challenging claim 5, from which all other challenged claims depend.

reserves the right to address Apple’s assertions as to whether the asserted references disclose the claimed voltage range and capacity ratio at a later time should the Petition be granted. However, even assuming that Apple’s assertions that the prior art separately discloses each of these two claimed limitations—*i.e.*, “that each of its elements was, independently, known in the art”—Apple has failed to provide an “apparent reason” to combine the prior art teachings “in the fashion claimed by the patent at issue,” as needed to prove obviousness. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Without such a reason to combine, Apple cannot show that the prior art taught the combination of the claimed charge cut-off voltage *in tandem* with the claimed capacity ration, *i.e.*, the specific combination that the ’641 patent teaches produces an improved lithium-ion battery.

The law is clear that “[t]he factual inquiry whether to combine references must be thorough and searching, and the need for *specificity* pervades our authority on the PTAB’s findings on motivation to combine.” *In re Nuvasive, Inc.*, 842 F.3d 1376, 1381-82 (Fed. Cir. 2016) (*citing In re Lee*, 277 F.3d 1338, 1343 (Fed. Cir. 2002)) (emphasis added). As explained below, Apple’s grounds lack the specificity required to sustain its obviousness challenges. In addition, even if there were any merit to Apple’s assertions that a POSA would have had reason to create the combinations in its grounds (there is not), Apple has failed to demonstrate that such a POSA would have had a reasonable expectation of success of achieving the

invention of the '641 Patent. Accordingly, the Board should reject Apple's grounds and decline to institute.

A. Apple has failed to establish that a POSA would have had reason to combine Yamaki with Sakamoto

Apple asserts that a (i) POSA would have combined the teachings of Yamaki with Sakamoto to make the lithium-ion battery of claim 5, and (ii) such a POSA would have had reason to combine Yamaki with Sakamoto by a purported need to improve lithium-ion battery performance metrics such as “cycle performance,” safety, and “resistance to overcharging.” Paper 2, 11–12. Apple's assertion fails as a matter of law.

As a threshold matter, the purported need for battery performance improvement that Apple asserts is precisely the type of *generic* need that the Federal Circuit has held insufficient to provide reason to combine *specific* prior art references to practice a *specific* claimed invention. *See Forest Lab's, LLC v. Sigmapharm Lab's, LLC*, 918 F.3d 928, 935 (Fed. Cir. 2019) (“a generic need for more antipsychotic treatment options did not provide a motivation to combine these particular prior art elements”). Apple has failed to point to any specific battery characteristics or performance improvements that would have motivated a POSA to combine Yamaki and Sakamoto, specifically.

On their face, Yamaki and Sakamoto are purportedly directed to only two of

a broad array of lithium-ion battery characteristics (and related improvements) that a POSA would have understood to potentially bear upon battery performance. Though both references purportedly aim to improve battery performance, *i.e.*, broadly share a common goal, Apple fails to point to any disclosure that would connect these references to any one or more specific types of battery performance improvement. Without such specificity (*i.e.*, a reason for concluding that these two references together could effectuate a specific performance improvement), their common, *generic* goal of performance improvement cannot provide the required motivation to a POSA to select them from a sea of available prior art and combine them in the manner taught by the '641 patent. At the time of the invention, artisans were pursuing numerous disparate techniques for the performance improvements Apple points to, including modification of the electrode materials, the composition of the electrolyte, and the dimension of the cell. Apple's identification of a generic desire to improve performance without identifying why a POSA would have selected from the numerous potential variations and permutations of different approaches the particular solution disclosed in the '641 Patent, is insufficient as a matter of law.

Federal Circuit precedent is clear and well-established on this very point: in determining whether a POSA would have combined two references with discrete teachings, the correct inquiry is not whether a POSA, "with two (and only two) references sitting on the table in front of him, would have been motivated to combine

... the references in a way that renders the claimed invention obvious[; rather, the] real question is whether that skilled artisan would have plucked” those references out of the sea of prior art in order to combine them. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1337 (Fed. Cir. 2016); *see also Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993-94 (Fed. Cir. 2017) (“that reasoning seems to say no more than that a skilled artisan, once presented with the two references, would have understood that they *could be* combined. And that is not enough: it does not imply a motivation to pick out those two references and combine them to arrive at the claimed invention.”) (emphasis in the original).

And, here, Apple has failed to show any specific reason for combining Yamaki and Sakamoto. Accordingly, having pointed only to the generic (and commonplace) need for performance improvement in its Petition, Apple has failed to provide the required reason to combine Yamaki and Sakamoto to arrive at the specific combination of the claimed charge cut-off voltage and capacity ratio limitations, to which the ’641 Patent inventors arrived through systematic experimentation, contrary to the conventional wisdom at the time of the invention.

Furthermore, far from providing a reason to combine Yamaki and Sakamoto, both of these references—on their face—describe incompatible battery-design approaches, which would have deterred a POSA from attempting to combine them.

First, Yamaki and Sakamoto teach fundamentally incompatible approaches to

battery design with respect to energy density. Yamaki *increases the energy density* of lithium-ion batteries by developing a new cathode material capable of being charged to higher voltages. In contrast, Sakamoto *reduces the energy density* of a fixed volume lithium-ion battery in favor of safety. Thus, a POSA aiming to increase energy density—*i.e.*, the improvement taught by Yamaki—would not have reduced energy density in favor of safety—*i.e.*, the battery design tradeoff taught by Sakamoto.

The contrasts between Sakamoto and Yamaki are evident from the face of these two references, and the Board need not look beyond them to glean as much. For example, Sakamoto teaches that, in contrast to the prior art approach of increasing energy density, it is preferable (and safer) to increase the capacity of anode relative to the cathode, which decreases energy density in a fixed volume lithium-ion battery:

- The prior art approach was to “increas[e] the volumetric and gravimetric energy densities by increasing the ratio of the reversible capacity of a positive electrode to the reversible capacity of a negative electrode ... so that the reversible capacity is almost equal.” Ex. 1005, [0005].
- However, this prior art approach led to deterioration of cycle life because “deposit of lithium occurs on the negative electrode during overcharge.” Ex. 1005, [0006].

In contrast to the prior art, Sakamoto teaches that by increasing the reversible capacity ratio of the anode relative to the cathode, “a high-performance battery can be obtained that experiences less deterioration after repeated charging and discharging, and that is safer.” Ex. 1005, [0007].

For a battery with fixed volume (such as the Sakamoto battery), increasing the amount of anode in the battery—as taught by Sakamoto—also requires reducing the amount of cathode (since less cathode can be fitted into a fixed volume system with more anode). Decreasing the amount of cathode in turn reduces the lithium ions available in the battery for charging and discharging. Thus, in the Sakamoto battery, greater safety (attained with cathode amount reductions) is obtained at the expense of energy density.

Sakamoto’s approach thus stands in contrast to the approach of the ’641 Patent—*i.e.*, improving energy density while maintaining performance. Further, Sakamoto nowhere provides a reason for concluding or otherwise discloses that energy density could be improved by increasing the charge cutoff voltage above the then-established limit of 4.2V. *See* Ex. 1005, [0016] (“The batteries . . . were subjected to . . . a charge upper limit of voltage of 4.2 V . . .”).

Likewise, Sakamoto’s approach stands in contrast to Yamaki, which aims to increase energy density. Indeed, higher energy density is the central goal of Yamaki:

- Yamaki states that the prior art limited “the maximum potential of

the positive electrode during charging” to “about 4.3 V in terms of metallic Li, and the discharge capacity of LiCoO_2 in the battery is limited to 160 mAh/g or less,” even though when “all of the Li in the LiCoO_2 is released and the theoretical capacity reaches about 274 mAh/g.” Ex. 1004, [0006]–[0007].

- Yamaki states that this is because “when the potential of the positive electrode exceeds 4.3 V relative to metallic Li, the crystal structure of the LiCoO_2 undergoes a rhombohedral-to-monoclinic phase transition, impairing the reversibility of Li ion insertion and ejection.” Ex. 1004, [0008].
- Yamaki states that it is “*an object of [Yamaki] to solve this problem by providing a lithium secondary battery with high energy density and excellent cycle characteristics by specifying a Co-based oxide to be used as the positive electrode material and a conductive material to be used in the positive electrode.*” Ex. 1004, [0012] (emphasis added).
- Yamaki purports to disclose a battery configuration in which “the maximum potential of the positive electrode during charging can be from 4.4 V to 4.8 V in terms of metallic Li while also suppressing deterioration in the reversibility of charging and discharging as more charging and discharging cycles are performed.” Ex. 1004, [0014].

It is thus clear from the face of Yamaki and Sakamoto that these two references represent distinct technical paths within the field of lithium-ion battery development. Yamaki focuses on increasing energy density, while Sakamoto trades

off energy density in exchange for safety. Thus, Apple's assertion that a POSA guided by Yamaki's objectives would have combined Yamaki with Sakamoto is refuted by the references themselves, does not make sense, and bears all the hallmarks of hindsight bias.

Second, Yamaki and Sakamoto are directed to different parts of the lithium-ion battery—the cathode (Yamaki) and the anode (Sakamoto); and Apple fails to adduce any disclosures providing a reason as to why a POSA would (or even could) combine Yamaki and Sakamoto in a single combination directed to both of those parts.

In particular, Yamaki is directed to solving specific problems relating to the *cathode material* of lithium-ion batteries when the charge cutoff voltage is increased above 4.2V. These problems include the detrimental phase transition of the cathode and the electrolyte decomposition that occurs on the surface of the cathode. As Yamaki states:

- “A factor in cycle deterioration is that when the potential of the *positive electrode* exceeds 4.3 V relative to metallic Li, the crystal structure of the LiCoO_2 undergoes a rhombohedral-to-monoclinic phase transition, impairing the reversibility of Li ion insertion and ejection.” Ex. 1004, [0008] (emphasis added).
- “Another factor is that oxidative decomposition of the organic solvent and lithium salt constituting the organic electrolyte occurs

on the surface of the highly crystalline carbon material serving as the positive electrode conductive material when it has reached a high potential due to charging. This does not impede the practical use of lithium secondary batteries of the prior art at a charge potential of 4.3 V in terms of metallic Li, but charge-discharge efficiency drops significantly when the charge potential is raised.” Ex. 1004, [0009] (emphasis added).

Yamaki thus exclusively focuses on improvement of the cathode. *See* Ex. 1004, [0012] (identifying the solution as “specifying a Co-based oxide to be used as the positive electrode active material and a conductive material to be used in the positive electrode”); [0013] (specifying the alleged invention is on the Co-based oxide cathode material and the surface layer of that material).

In contrast, Sakamoto concentrates on the anode, proposing a battery design that uses a surplus of anode material to improve safety at the known expense of energy density. *See, e.g.,* Ex. 1005, [0006] (identifying “deposit of lithium occur[ing] on the *negative electrode* during overcharge” as the problem to be solved) (emphasis added); [0007] (stating that with the alleged invention, “lithium ions can be sufficiently occluded in the *negative electrode* during charging or overcharging, and deposition of lithium is less likely to occur”) (emphasis added).

That Yamaki and Sakamoto are directed to different and discrete parts of the structure and operation of a lithium-ion battery (the cathode and anode, respectively)

further demonstrates the lack of connection between the two references, and that a POSA would not have adapted and/or improved the Yamaki battery (which was focused on cathode improvements) in light of the anode-focused Sakamoto.

Indeed, Apple has not articulated a rationale for which a POSA would seek to modify the claimed anode to cathode capacity ratio of the Yamaki battery—*i.e.*, an aspect of lithium-ion batteries that is not identified as an area of improvement by Yamaki—*at all*, let alone a rationale for which a POSA would attempt to modify Yamaki by looking to Sakamoto. Absent such a rationale, Apple’s challenge fails as a matter of law. *See Cisco Systems, Inc. v. K. Mizra LLC*, IPR2021-00593, Paper 41 at *36–37 (PTAB Sep. 19, 2022) (“[Petitioner] does not provide a sufficient explanation why a person of ordinary skill in the art would have been motivated to combine [the prior art]. [Petitioner’s] rationale and all the other reasons for the proposed combination proffered by Petitioner establish, at most, that [the prior art] *could* have been combined to meet limitations [1.8] and [1.9], rather than a person of ordinary skill in the art *would have been* motivated to make the proposed combination. This is insufficient.”) (emphasis in original); *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“obviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention”) (*citing InTouch Techs., Inc. v. VGO Commc’ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014)).

Third, Apple contends that Yamaki had already achieved a battery with excellent cycle life on the basis of data purportedly showing good capacity retention after merely 10 cycles. *See* Paper 2, 26. Apple’s contention, however, guts its obviousness challenge: assuming (as Apple contends) that Yamaki’s battery were effective in this respect, a POSA would **not** have had reason to further adapt Yamaki by turning to Sakamoto’s teachings, particularly since Sakamoto teaches away from Yamaki’s stated approach and goal of increasing energy density. *See Cisco*, IPR2021-00593, Paper 41 at *35-36 (“Neither Petitioner nor Dr. Reddy explains adequately why a person of ordinary skill in the art would have been motivated to look to Lewis to introduce such significant changes to the architecture or design of Gleichauf’s network when Gleichauf alone already provides all of the alleged benefits or advantages of the proposed combination identified by Petitioner.”) (*citing Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1369 (Fed. Cir. 2012) (finding that if “each device independently operates effectively, a person having ordinary skill in the art, who was merely seeking to create a better device... would have no reason to combine the features of both devices into a single device”) and *In re Anova Hearing Labs, Inc.*, 809 Fed. Appx. 840, 843 (Fed. Cir. 2020) (noting that when a primary prior art reference already provides a solution to the problem solved by the challenged patent, there must be evidence as to why there would be a reason to modify that primary reference to include an additional or

redundant solution)).

In short, if the Board accepts what Apple alleges as true (*i.e.*, that Yamaki had already developed a lithium-ion battery with higher energy density, a higher charge cut-off voltage, and excellent cycle life) then it is also true that a POSA would not modify Yamaki in light of Sakamoto, since (i) there would be no need to adapt Yamaki, and (ii) Sakamoto teaches against Yamaki's approach in any event.

Fourth, Apple incorrectly contends that a single paragraph in Yamaki provides a reason to combine with Sakamoto; but Apple's contention is based on a flawed reading of that paragraph, which does nothing more than capture the purported benefits of Yamaki itself. In particular, Apple asserts that paragraph 15 of Yamaki provides a rationale for a POSA to increase the amount of anode, supposedly to practice the claimed capacity ratio range. Paper 2, 12–13. In other words, Apple reads paragraph 15 of Yamaki as a statement of guidance for further improvement to the Yamaki battery. This is incorrect. Paragraph 15 of Yamaki reads as follows:

- In other words, the discharge capacity of the positive electrode active material can be improved by setting the maximum potential of the positive electrode during charging to 4.4 V or more in terms of metallic Li. As a result, the amount of positive electrode active material in the battery can be reduced, and the amount of negative electrode active material can be increased. Therefore, a lithium secondary battery with a higher energy density can be obtained in a

limited battery volume. Ex. 1004, [0015].

As an initial matter, this paragraph is simply describing the manner in which the Yamaki battery achieves its purported benefits: (i) the charge voltage is increased thereby allowing for less cathode (since less cathode is needed to reach the same energy levels in light of the higher charge voltage applied in Yamaki) and (ii) the decrease in cathode allows for more anode active material in the fixed volume battery cell. Far from calling for additional modifications (let alone modifications in light of Sakamoto), Paragraph 15 of Yamaki is simply describing Yamaki's already disclosed approach.

Further, Paragraph 15 does not provide a reason for practicing the claimed capacity ratio range. Indeed, Yamaki is completely silent on the values of the ratios of the electrode materials and does not disclose in any manner that these ratios should be adjusted to any specific value. For example, a POSA reading Yamaki's disclosures about increasing the amount of anode in a lithium-ion battery to practice the Yamaki battery is not provided with either: (i) the capacity ratio of that battery (*i.e.*, whether it is 1, greater than 1, or less than 1) or (ii) the amount of anode to be added to that battery (or the resulting capacity ratio for that battery). Apple concedes as much. Paper 2, 12. And, it follows from Apple's concession that Yamaki does not provide a reason to a POSA to conclude whether it is desirable to practice capacity ratios within the claimed range or outside of the claimed range. This

omission is fatal to Apple's contention that Yamaki provides a reason to combine its teachings with the ratios disclosed in Sakamoto. Given that Yamaki fails to provide any specificity as to the capacity ratio values in its battery, a POSA would not have turned to Sakamoto (which teaches against Yamaki's energy density increase) to find those values.

B. Apple has failed to establish that a POSA would have had a reasonable expectation of success in combining Yamaki with Sakamoto

Apple asserts that because Yamaki and Sakamoto both deal with similar materials of lithium-ion batteries, a POSA would have had a reasonable expectation of success in combining them to produce the claimed invention, *i.e.*, a lithium-ion battery that uses the claimed charge cut-off voltage *in tandem* with the claimed capacity ratio. Apple's assertion is conclusory and fails as a matter of law. *See, e.g., Samsung Elecs. Co., Ltd. v. Elm 3DS Innovations, LLC*, 925 F.3d 1373, 1383 (Fed. Cir. 2019) (holding that in a complex field, "...specific evidence that a person of ordinary skill in the art would have reasonably expected success in combining..." prior art elements is required).

As an initial matter, the batteries in Sakamoto are strictly limited to a conventional system, where the charge cutoff voltage is limited to 4.2 V (*see* Ex. 1005, [0016] (all examples of Sakamoto were charged to 4.2 V)), while Yamaki's batteries are purportedly not so limited. Further, Apple concedes that both Yamaki

and Sakamoto are silent as to whether their respective batteries are suitable to be combined. Paper 2, 14. Accordingly, Apple's expectation of success rests on the assertion that a POSA would *assume* that the two types of batteries could be combined.

However, methods and improvements that may be suitable for traditional 4.2V battery systems cannot be presumed to be equally applicable or successful in high-voltage systems. *See Samsung*, 925 F.3d at 1383 (finding that the claims were not obvious as the prior art process disclosed in the first reference was incompatible with the prior art process disclosed in the second reference). Indeed, neither reference contains any reason as to whether or why it is appropriate to presume that the system disclosed in one is compatible with the system disclosed in the other. For example, neither Yamaki nor Sakamoto contain any disclosures about the use of batteries designed for lower voltages (e.g., as in Sakamoto) with higher voltage thresholds (e.g., as in Yamaki). Sakamoto does not contemplate let alone provide a rationale for its system's integration with the higher voltage thresholds of Yamaki. Without such a rationale as to why Sakamoto's methods may be suitable for high-voltage batteries, a POSA would not have had a reasonable expectation of success in combining Sakamoto with Yamaki's battery.

Similarly, Yamaki does not provide any reason as to why or how adjusting the capacity ratio of the electrodes would affect the performance of a high-voltage

system as disclosed in Yamaki. Apple’s reliance on paragraph 15 of Yamaki is again misplaced. Yamaki, when read in its entirety and in proper context, does provide a reason for increasing the amount of negative electrode relative to the amount of positive electrode, let alone provide a reason for adjusting the capacity ratio so that the negative electrode has more capacity than the positive electrode. *See supra* section VI.A. Having failed to supply this critical information, Apple cannot establish a reasonable likelihood of success. *See, e.g., Eli Lilly & Co. v. Teva Pharms. Int’l GmbH*, 8 F.4th 1331, 1347 (Fed. Cir. 2021) (finding no reasonable expectation of success when the Board considered “whether the references included any other ‘information’, ‘direction’, or ‘specific’ suggestion that would have led to a reasonable expectation of success” and found no such data were disclosed).

C. Apple has failed to establish that a POSA would have had reason to combine Yasunami with Koyama

As with its first combination (Yamaki-Sakamoto), Apple incorrectly asserts that a POSA would have had reason to combine Yasunami with Koyama to improve battery performance, *i.e.*, the same, generic goal. *See* Paper 2, 43–45.

As a threshold matter (and as also explained *supra* for the Yamaki-Sakamoto combination), the generic goal of battery performance improvement is insufficient to establish that a POSA would have had reason to combine specific references such as Yasunami and Koyama. *See KSR*, 550 U.S. at 418; *Forest Lab’ys*, 918 F.3d at

935. This is true especially in view of the numerous other approaches that had been tried in the art to obtain these same performance improvements.

Further, as explained in detail below, Yasunami expressly teaches against Apple's proposed combination. *First*, Yasunami (on which Apple relies for the claimed charge cut-off voltage limitation) expressly teaches away from the solution disclosed in Koyama (on which Apple relies for the claimed capacity ratio limitation).

In particular, Yasunami explains that prior art batteries—which according to Yasunami, typically used negative electrode active materials such as lithium metal, lithium alloys, and carbonaceous materials—had a tendency to form dendrites, which the prior art tried to address by “reducing the amount of positive electrode material” Ex. 1006, [0002]:

- “When [lithium metal and lithium alloys] are used, lithium metal grows in dendrite form during charging and discharging, causing internal short circuits, and because the activity of dendritic metal is high, there is an increased risk of ignition.” Ex. 1006, [0002].
- “Because carbonaceous materials are conductive, lithium metal may be deposited on carbonaceous materials during overcharge or rapid charging, resulting in the deposition of dendritic metal.” *Id.*
- “In order to avoid this problem, methods have been adopted to prevent overcharging by reconfiguring chargers and reducing the

amount of positive electrode active material.” *Id.*

Yasunami teaches against the prior art approach of reducing the amount of positive electrode (*i.e.*, cathode) material, explaining that this approach reduces discharge capacity. *Id.* In particular, Yasunami teaches against using carbonaceous materials in the anode active material, explaining that such materials in the anode further reduce capacity per volume on account of those materials “have a relatively low density.” *Id.* (“because carbonaceous materials have a relatively low density, the discharge capacity per volume is low. As a result, the discharge capacity is constrained by both the restrictions placed on the amount of active material used and the low capacity per volume”).

In contrast to Yasunami, Koyama teaches (i) increasing relative anode capacity, thereby reducing cathode capacity (*i.e.*, the opposite of Yasunami’s teaching against reducing cathode capacity) and (ii) using carbonaceous materials as the anode active materials (*i.e.*, the precise type of materials disfavored by Yasunami). As Koyama explains:

- Conventional lithium-ion batteries were focused on “improving discharge capacity and cycle characteristics.” Such batteries were not suitable for “hybrid vehicles equipped with hybrid engines,” which “must have high charging characteristics as well as discharge characteristics.” Ex. 1007, [0004].
- Koyama specifically teaches increasing the relative capacity of the

anode—and *reducing the relative capacity of the cathode*—even beyond the levels taught in Sakamoto (discussed *supra*, which discloses a ratio of 1.05 to 1.30) to attain specific “charging characteristics” that are needed for hybrid vehicles. Ex. 1007, [0003], [0004]. Koyama teaches a ratio higher than 1.3 but lower than or equal to 2.5. *Id.*, [0006].

- Further, Koyama teaches several embodiments that used “carbon powder” as the anode active material, a class of carbonaceous materials disfavored by Yasunami. *Compare* Ex. 1007, [0014] (using “carbon powder” as the negative electrode active material”) *with* Ex. 1006, [0002], [0044] (“the negative electrode active material of [Yasunami] is a negative electrode active material whose concept is fundamentally different from lithium metal and carbonaceous materials”).

Given that Yasunami expressly teaches against the approach of Koyama (decrease of cathode capacity & use of carbonaceous materials), a POSA would have been deterred from combining these two references.

Second, Apple misleadingly asserts that Yasunami somehow “encourages” a capacity ratio as described in Koyama. Paper 2, 44. Apple is wrong. Even assuming that Yasunami taught a particular capacity ratio as Apple asserts (it does not), Yasunami also teaches that the capacity ratio can be “arbitrarily” set “according to the type of active materials to be combined.” *See* Ex. 2001, [0032]. Thus, as explained below, rather than provide a reason to a POSA for practicing any particular

capacity ratio, for example, the ratio of Koyama, Yasunami (at most) discloses that the ratio of electrode materials depends upon the active materials and does not point to any specific range or value.

As an initial matter, Apple asserts that paragraph 19 of Yasunami somehow discloses the capacity ratio of the Yasunami battery to support the contention that Yasunami discloses a capacity ratio consistent with the one in Koyama. Paper 2, 40. Apple's assertion is incorrect. Paragraphs 10 to 20 of Yasunami describe the preparation of the anode active material, while paragraphs 21 to 30 describe the preparation of the cathode active material. For the anode, Yasunami states that preferably it should be lithium metal oxide with extra lithium ions inserted. *See* Ex. 1006, [0017]. Paragraphs 18 and 19 in turn describe how to insert the lithium ions into the metal oxide. Paragraph 18 states that lithium ions can be electrochemically inserted "in a redox system," such as "a closed system (battery)" (*id.* at [0018]), and Paragraph 19 provides further details about how to construct such a battery, e.g., how much cathode and anode should be used. It is evident from the context, *i.e.*, paragraphs 17 and 18, that paragraph 19 is directed to the ratio of positive to negative electrode active material in "a close system (battery)" used to prepare the anode—**not** the capacity ratio of the final Yasunami battery, as Apple misleadingly asserts.

But even if paragraph 19 disclosed a ratio of the battery taught by Yasunami, paragraph 19 explicitly states that "[t]here are no particular restrictions on the use

ratio” between the cathode and anode in its battery design. Ex. 1006, [0019] (stating that *any* ratio, being equal to 1, larger than 1, or smaller than 1, is “preferred”). Yasunami thus teaches that the ratio is a design parameter that can be set with virtually no impact on battery performance. In short, Yasunami provides no guidance to a POSA as to the appropriate values of the capacity ratio; thus, a POSA would have had no reason or reason to combine Yasunami and Koyama to produce a battery with Yasunami’s charging voltage and Koyama’s capacity ratio.

Apple’s assertion that Yasunami discloses the capacity ratio is further undercut by the fact that Apple has relied upon a materially incorrect translation of the prior art. When translated correctly, Yasunami discloses that the battery capacity ratio can be set “*arbitrarily*,” *i.e.*, without regard to battery performance characteristics:

- The ratio of the positive electrode active material to the negative electrode active material used in the non-aqueous secondary battery of the present invention can be set **arbitrarily** according to the type of active materials to be combined.

See Ex. 2001 at [0032] (emphasis added).²

² Apple’s translation omits the word “arbitrarily” that is included in the original Japanese text, thus distorting the actual meaning of this passage. *See* Ex. 1007 at [0032].

Thus when the correct translation is used, Yasunami's express teachings point away from combining its battery with the approach described in Koyama. Contrary to Apple's assertion that Yasunami provides a reason for adapting its ratio, e.g., to the value taught in Koyama, Yasunami teaches that the capacity ratio does not impact battery performance but is only affected by the battery active materials. Thus, a POSA reviewing Yasunami would have understood that there is no reason to adapt Yasunami to practice the ratio taught in Koyama for the purpose of practicing the charge cut-off voltage purportedly disclosed in Yasunami or the claimed charge cut-off voltage range.

D. Apple has failed to establish that a POSA would have had a reasonable expectation of success in combining Yasunami with Koyama

As with the Yamaki-Sakamoto combination, Apple asserts that a POSA would have had a reasonable expectation of success in combining Yasunami and Koyama because the two use similar materials to build lithium-ion batteries. Even if true, the mere fact that two battery systems have similarities (e.g., because they use similar materials) is insufficient to show, let alone establish, that a POSA combining two such systems would enjoy a reasonable expectation of success. As also discussed above, a specific reason is needed to establish a reasonable expectation of success, and Apple's assertion as to the similarities of the materials used—which is conclusory and unsupported in the art—fails as a matter of law. *See, e.g., Samsung,*

925 F.3d at 1383; *Eli Lilly & Co.*, 8 F.4th at 1347 (requiring the Board to consider whether there is “‘information’, ‘direction’, or ‘specific’ suggestion that would have led to a reasonable expectation of success”).

In any event, a POSA reading both references would have understood them to disclose materially different battery systems, *i.e.*, the opposite of Apple’s assertion. *First*, on its face, Yasunami creates substantial doubt about whether it can be combined with Koyama. For example, Yasunami explains that, for its purported invention to work, “the valence of the transition metal” in the negative electrode must change during charging and discharging. Ex. 1006, [0044]. According to Yasunami, such a valence change (which would occur for Yasunami’s purportedly innovative anode material, *i.e.*, lithium-containing transition metal oxide), would *not* occur for traditional anode materials such as lithium metal, lithium alloys, or carbonaceous materials. *Id.* It is for this reason that Yasunami teaches that its anode material is “fundamentally different” from conventional materials such as lithium metal and carbonaceous materials, and those conventional anode materials are not within the scope of Yasunami’s purported invention. *Id.*

In contrast with Yasunami, Koyama claims that its alleged invention can be applied to various conventional anode materials (e.g., lithium metal, lithium alloys, carbonaceous materials) that Yasunami explicitly excludes from its list of compatible materials. Ex. 1007, [0009]. Indeed, all examples of Koyama used

carbon powder as the anode material, which Yasunami teaches against. Ex. 1007, [0014].

These disclosures would suggest to a POSA that Koyama's method—which applies to *conventional* anode materials—would not work on Yasunami's battery, the purported improvements of which depend upon electrochemical properties of materials which Yasunami describes as novel and *unconventional*. A POSA would thus understand that it would not be possible to adapt Koyama's method to work with Yasunami's battery without sacrificing Yasunami's core advantages (or introducing an altogether new set of problems). *See Samsung*, 925 F.3d at 1383.

Second, Koyama's battery system is limited to the traditional charge cutoff voltage no higher than 4.2 V. There is no rationale given in Yasunami for concluding that Koyama's method could be successfully applied to batteries with higher charge cutoff voltages. The opposite is also true. Yasunami is completely silent on how changing the battery's capacity ratio would affect battery performance (irrespective of changes to the charge cutoff voltage) and teaches only that the ratio can be set “arbitrarily” for different types of materials. Ex. 1007, [0032]. Without any specific rationale for concluding that the methods disclosed in Yasunami and Koyama may be compatible when employed *in tandem*, a POSA would not have a reasonable expectation of success. *See, e.g., Eli Lilly & Co.*, 8 F.4th at 1347 (finding the challenged claims were not unpatentable for obviousness because the prior art

references did not disclose any information or data showing the combination would be effective for treating a specific disease).

VII. APPLE’S PETITION SHOULD BE DENIED UNDER §325(d)

Finally, the Petition should be denied under 35 U.S.C. 325(d) because, as explained in Section II.C. above, the Office allowed the ’641 Patent over substantially the same arguments presented in the Petition, and the Petition does not identify any material errors in prosecution that would suggest a different result. *Advanced Bionics LLC v. MED-EL Elektromedizinische Gerate GmbH*, IPR2019-01469 Paper 6 (PTAB Feb. 13, 2020).

As the Petition concedes, the Office initially rejected the ’641 Patent because Idota (US5,260,148) allegedly described a battery having a specific ratio of positive electrode material to negative electrode material, and Tanaka (US5487960) or Kobayashi (US6558848) allegedly described a charge cut-off voltage higher than 4.2V. Thus, both the Office’s rejection and the Petition are premised on substantially the same argument: that a POSA would have combined prior art that allegedly discloses a charge cut-off voltage higher than 4.2V and prior art that allegedly discloses a battery having a specific ratio of positive electrode material to negative electrode material to arrive at the claimed invention. Accordingly, the Petition concerns substantially the same prior art arguments as previously presented to the Office and meets the first prong of *Advanced Bionics. Id.*, 8-10.

Despite this, the Petition argues that it makes “substantially distinct” arguments from those considered during prosecution because “the issue that arose during prosecution was whether it was proper to introduce a higher charge cut-off voltage into Idota’s battery” but “this is not the question raised by the combinations advanced in this Petition.” Paper 2, 71. Instead, the Petition argues that “the primary reference is already an operable secondary lithium battery with a charge cut-off voltage within the claimed range; that battery is then implemented such that its positive/negative electrode materials are provided in a certain ratio.” *Id.* This argument, however, merely takes issue with which prior art represents the primary reference and which prior art represents the secondary reference (*i.e.*, how the prior art is presented). Instead of suggesting that it would have been obvious to modify a prior art battery allegedly satisfying the recited ratio to meet the charge cut-off voltage, the Petition inverts the order and argues that it would have been obvious to modify a prior art battery allegedly satisfying the recited charge cut-off voltage to meet the ratio. These are not substantially different arguments. Rather, they are the same argument repackaged with a different designation of “primary reference” and “secondary reference.” *See Schwendimann v. Neenah, Inc.*, 82 F.4th 1371, 1384 (Fed. Cir. 2023) (“We have made clear that ‘where the relevant factual inquiries underlying an obviousness determination are otherwise clear,’ characterizing references as ‘primary’ and ‘secondary’ is merely a matter of presentation with no

legal significance.”). As the Federal Circuit has held, it is irrelevant in which order the proposed combination is made—the prior art discourages combining a teaching of the recited charge cut-off voltage with the recited ratio in the same way that it discourages combining a teaching of the recited ratio with a teaching of the recited charge cut-off voltage as found by the Examiner. Paper 2, 3 (“Reasons for allowance acknowledged Applicant’s argument that because the cited art ‘teaches that life cycle property of a cell drastically decreases when the charging voltage increases beyond 4.2V..., one of ordinary skill...would not have predicted that the resulting cell would have high capacity.’”).

Apple’s Petition also satisfies the second prong of *Advanced Bionics*. The Petition makes no showing of any material error in the Examiner’s determination of non-obviousness based on the substantially identical teachings of the prior art. Paper 2, 70-72. Apple presents no evidence that a secondary lithium-ion battery having a charge cut-off voltage greater than 4.2V as allegedly taught by Yamaki or Yasunami would maintain its capacity and cycleability when modified to achieve the ratio of Koyama or Sakamoto. Indeed, neither Koyama nor Sakamoto state that their ratios are applicable to charge cut-off voltages higher than 4.2V. Thus, nothing in the Petition contradicts the Examiner’s conclusion that the prior art discouraged such a combination. Ex. 1002, 23–34 (“the cited art teaches that life cycle property of a cell drastically decreases when the charging voltage increases beyond 4.2V...”).

Respectfully, Apple's Petition unambiguously meets both prongs of *Advanced Bionics*, and the Petition should be denied under 325(d).

VIII. CONCLUSION

Given that Petitioner's obviousness grounds as to the only challenged independent claim (claim 5) based on Yamaki and Sakamoto fail, so do all other grounds that Petitioner advances with respect to each of the remaining challenged claims, all of which depend from claim 5. Similarly, given that Petitioner's obviousness grounds as to claim 5 based on Yasunami and Koyama fail, so do all other grounds that Petitioner advances with respect to each of the remaining challenged claims. Accordingly, for this reason and the foregoing reasons set forth in this response, Patent Owner respectfully requests that institution be denied.

Date: November 28, 2023

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITS

This Patent Owner's Preliminary Response ("POPR") consists of 9648 words, excluding table of contents, table of authorities, certificate of service, this certificate, or table of exhibits. The POPR complies with the type-volume limitation of 14,000 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).

Dated: November 28, 2023

/Minghui Yang/
Minghui Yang
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CERTIFICATE OF SERVICE

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

**PATENT OWNER'S PRELIMINARY RESPONSE
EXHIBIT 2001**

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