

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner,

v.

RJ TECHNOLOGY, LLC,
Patent Owner.

Case: IPR2023-01183
U.S. Patent No. 7,749,641

REPLY DECLARATION OF MARC JUZKOW

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I, Marc Juzkow, hereby declare as follows:

I. BACKGROUND

1. My name is Marc Juzkow, and I have been retained on behalf of Samsung Electronics Co., Ltd. to provide my opinions on the patentability of the claims of United States Patent No. 7,749,641 (“the ’641 patent”). I understand that this declaration may be submitted to the Patent Trial and Appeal Board at the United States Patent and Trademark Office as part of an *inter partes* review (“IPR”) proceeding related to the ’641 patent. I am being compensated at my customary rate for the time I spend on this matter. My compensation is not contingent on the content of my opinions nor the outcome of the *inter partes* review proceeding. I have no direct financial interest in any of the parties or this proceeding.

2. In formulating my opinions, I have relied on my knowledge, training, and experience in the relevant field, which I previously summarized in connection with my first declaration filed in the IPR proceeding of the ’641 patent (EX1002, ¶¶3-11), and which I incorporate herein by reference.

3. This is my second declaration in this matter and responds to the opinions set forth in the declarations of Dr. Yan Yao (EX2006) and Dr. Yanliang Liang (EX2031).

II. MATERIALS CONSIDERED

4. In developing my opinions, I have considered and relied upon the materials cited in my first declaration, the Patent Owner Response (“POR”) submitted by RJ Technology, LLC (“RJ Tech” or “Patent Owner”) and the exhibits cited therein, including the declarations provided by Dr. Yan Yao (EX2006) and Dr. Yanliang Liang (EX2031). I have also considered and relied upon the materials cited herein, including the following materials:

Exhibit No.	Description
1037	Comparison of EX2022, ¶18 and EX2006, ¶49
1038	Plaintiff RJ Technology LLC’s Opening Claim Construction Brief in <i>RJ Technology, LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 70 (Jun. 23, 2023).
1039	Exhibit 3 to RJ Technology LLC’s Responsive Claim Construction Brief in <i>RJ Technology, LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 74-5 (Jul. 14, 2023).
1040	Kajiyama et al., “Layered Li-Co-Mn Oxide as a High-Voltage Positive Electrode Material for Lithium Batteries,” J. of the Electrochemical Society, 148 (9) A981-A983 (2001)
1041	Transcript of the <i>Markman</i> hearing in <i>RJ Technology, LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 91 (Jul. 31, 2023).
1042	Transcript of Dr. Yanliang Liang, Ph.D., dated July 2, 2024
1043	Transcript of Dr. Yan Yao, Ph.D, dated August 8, 2024
1045	Jang et al., “Stabilization of LiMnO ₂ in the α -NaFeO ₂ Structure Type by LiAlO ₂ Addition,” <i>Electrochemical and Solid-State Letters</i> , 1(1) 13-16 (1998) (“Jang”)

Exhibit No.	Description
1046	Ammundsen et al., “Formation and Structural Properties of Layered LiMnO ₂ Cathode Materials,” J. of the Electrochemical Society, 147 (11) 4078-4082 (2000) (“Ammundsen”)
1047	Ceder et al., “Identification of cathode materials for lithium batteries guided by first-principles calculations,” Nature, Vol. 392, 16 April 1998, 694-695 (“Ceder”)
1048	Exhibit A-3 to RJ Technology’s Disclosure of Asserted Claims and Infringement Contentions in <i>RJ Technology LLC v. Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.</i>
1050	Declaration of Dr. Yan Yao in Support of RJ Technology LLC’s Responsive Claim Construction Brief in <i>RJ Technology, LLC v. Apple Inc.</i> , No. 8:22-cv-1874-JVS-JDE, Dkt. 74-1 (Jul. 14, 2023).

III. SUMMARY OF MY OPINIONS AND ANALYSIS

5. Based on my consideration of the materials identified above, my perspectives about the knowledge of a person having ordinary skill in the art (“POSITA”) in the field of secondary lithium-ion batteries, and my assessment of the ’641 patent including its claims, I have formed the following opinions.

6. Dr. Liang’s testing purporting to evaluate Uemura (EX1009) is unreliable and unscientific for multiple reasons. These reasons include: 1) he performed the testing only once, which is insufficient to form reasonable conclusions about Uemura’s process for synthesizing certain cathode materials, 2) he failed to include proper controls, which further undermines the reliability of his testing, 3) he

failed to follow Uemura's teachings in numerous respects without acknowledging or justifying the reasons for the variations (i.e., he produced something *other than* Uemura's materials), 4) he failed to consider and record material aspects of the testing, which further undermines its reliability, and 5) he failed to record where he obtained certain "standards" from and used his own testing as an alleged "standard."

7. Given these flaws in Dr. Liang's testing, it is my opinion that Dr. Yao should not have relied on Dr. Liang's testing. But, because he did, Dr. Yao's opinions concerning the non-enablement of Uemura that rely on the testing of Dr. Liang are flawed and incorrect. One failed attempt to synthesize three different layered cathode materials using a different process than that described by Uemura is not evidence of undue experimentation and/or non-enablement.

8. Dr. Yao's opinions concerning the non-enablement of Uemura rely on his misrepresentations of the art and are incorrect.

9. Dr. Yao's opinions regarding the capacity of inactive materials are wrong because inactive material, by definition, doesn't have capacity and does not affect intercalation. Dr. Yao's opinions apparently stem from the fact that he failed to consider Uemura's teachings regarding the use of complex oxide or nitride in the negative electrode.

10. RJ Tech's assertions regarding the charge cutoff voltage of Uemura being below 4.3V are inaccurate.

IV. LEGAL PRINCIPLES

11. In rendering my opinions, I incorporate by reference the same instructions regarding the law that I received in connection with my first declaration. EX1002, ¶¶35-48.

12. I understand and have been informed that prior art patents and publications are presumed to be enabling. I understand that the party challenging the enablement of the prior art must come forward with evidence that the prior art is not enabling.

13. I understand and have been informed that disclosure is enabling if it discloses how to make and use the invention without undue or unreasonable experimentation. I further understand and have been informed that the enablement requirement does not require the disclosure to disclose how to use a perfected or commercially viable embodiment if such a requirement is not reflected in the patent's claims.

14. I have been told that whether experimentation is “undue” or unreasonable should look to a variety of factors. Among these factors are (1) the breadth of the claims, (2) the nature of the invention, (3) the state of the prior art, (4) the level of one of ordinary skill, (5) the predictability in the art, (6) the amount of direction provided by the inventor, (7) the existence of working examples in the specification, and (8) the quantity of experimentation needed to make or use the

invention based on the content of the disclosure. Other factors may also be considered. I have been further informed that it is improper to conclude that a disclosure is not enabling based on an analysis of only one of the above factors while ignoring one or more of the others.

15. Additionally, when evaluating whether the prior art is enabling, I am told that the proper inquiry is whether the prior art enables the portions of its disclosure alleged to teach the claim being challenged.

V. DETAILED DISCUSSION OF MY OPINIONS

16. In the sections below, I explain in detail my opinions relating to certain statements and positions of RJ Tech, Dr. Liang, and Dr. Yao.

A. Dr. Liang's testing is unreliable

17. The Patent Owner attempts to show that Uemura is not enabled because Dr. Liang did not successfully synthesize three example cathode materials of Uemura. However, Dr. Liang's testing is not based on sound scientific principles or practices and does not even reflect Uemura's teachings. Thus, Dr. Liang's testing is unreliable to show whether Uemura is enabled or not.

18. As an initial matter, it is important to note that Dr. Liang only attempted to synthesize the cathode materials of Uemura's Examples 1-3 one time. Dr. Liang then tried to synthesize those materials using an "improved" process. EX1042,

112:5-113:12; EX1043, 217:12-218:5. One failure to synthesize the materials is not evidence that the material cannot be made without undue experimentation.

19. Dr. Liang did not employ all of Uemura's process parameters or techniques as discussed below. While Uemura obtained a "brown slurry" and "brown powder," (EX1009, ¶¶0071)), Dr. Liang obtained "deep gray powders," (EX2031, ¶¶18, 20). This should have told Dr. Liang that he was not making the materials of Uemura, but instead was making something different.

20. The experiments conducted by Dr. Liang were the first time that he had ever attempted to synthesize layered complexes based on lithium, manganese, and other metals. EX1042, 44:5-9, 45:10-46:7. A POSITA would have made multiple attempts to synthesize the cathode materials using Uemura's disclosed processes before concluding that it was impossible to do so. But, Dr. Liang tried once, did not follow the directions provided by Uemura, and then abandoned Uemura's process in favor of still another process.

21. Additionally, Dr. Liang failed to use proper experimental controls to ensure that the attempted synthesis was performed correctly. This further undermines his testing and renders it unscientific. A POSITA would have known that basic scientific principles and best practices require the using one or more controls when synthesizing and testing a new electrode material. Without such a control, Dr. Liang was unable to show that his system could synthesize any active

cathode materials with a known, predictable property. Thus, he was unable to rule out flaws in equipment, environmental conditions, or other causes of his inability to reproduce Uemura's examples 1-3.

22. An experimental control for electrode synthesis typically includes a known reference material that is produced alongside an exploratory material. By producing and testing the control material with positive results, one can ensure that proper procedures were followed and that any results, positive or negative, for the exploratory material can be trusted. If the control material does not perform as expected, then it can be assumed that there was something wrong in the cell preparation, and the experiment should be run again until good control results for the known reference material are obtained.

23. Dr. Liang testified that he considers his "synthesis and cell characterization of a layered compound according to Kajiyama" as a control (EX1042, 122:12-123:13). However, the experiment that Dr. Liang describes in his declaration is not a proper experimental control. Instead, it refers to his attempt to synthesize a material like Example 2 of Uemura using the method of Kajiyama (EX2031, ¶¶37-46)—a process that is not Uemura's process. But that material didn't perform as is indicated in Kajiyama or Uemura (as might be expected because Dr. Liang used a hodgepodge of Kajiyama, Uemura, and other processes to produce the material in the subject experiment). This is not an experimental control because the

resulting material did not have properties that were known in advance and against which Dr. Liang's synthesis of the material could be compared. Compare EX2017, p.40 (indicating that the Kajiyama's material was able to be "charged and discharged at a constant current of 0.1 mA at room temperature in a voltage range between 3.5 and 5.2V") with EX2031, ¶45 (admitting that with Dr. Liang's cell, "before the voltage reaches 4V, there is evidence of side reactions and the battery starting to degrade"). Furthermore, it cannot function as a control for any of the experiments where he allegedly tried to synthesize the cathode materials using Uemura's disclosures because it was based on a separate method.

24. Additionally, Dr. Liang never attempted to prepare a known cathode material, such as lithium manganese dioxide, using the methods of Uemura to test whether known results could be obtained using the Uemura procedure. Therefore, a POSITA would recognize that Dr. Liang never fully tested Uemura's stated procedures (to the extent Uemura was followed by Dr. Liang, which it was not) against a proper experimental control material. Therefore, Dr. Liang's failure to include any proper controls in his testing would lead a POSITA to ignore his results as unreliable.

25. Dr. Liang also failed to record material aspects of his testing. For example, the ramp rate is something that is important to synthesizing a layered cathode material. However, Dr. Liang admitted that he is "not familiar with the

term,” failed to identify in his declaration how quickly he heated the samples between room temperature and 500 degrees centigrade and from 500 degrees Celsius to 900 degrees Celsius, and could not provide the specifics at his deposition. EX1042, 113:13-114:5. Moreover, Dr. Liang admitted that he formed no opinions on whether the temperatures and times for heating active compounds are important when preparing cathode materials (EX1042, 98:4-99:19). Despite this, Dr. Liang utilized an annealing step that is not described in Uemura or in the Kajiyama reference he relied on. EX1042, 102:10-105:17. A POSITA would understand that ramp rate and temperature are well-known to be important to achieving the proper crystalline structure to a POSITA (*see, e.g.*, EX1045, p.15 (indicating that certain materials are “known to be unstable under the temperature and atmospheric conditions of this study” and form different crystalline forms))), and Dr. Liang’s failure to recognize this and to use his own untested and unspecified method further renders his testing unreliable to a POSITA.

26. Additionally, Dr. Liang failed to identify what databases he pulled his alleged “standards” for comparison from. EX1042, 80:2-6, 91:11-14. It’s notable that he used unidentified standards for rock salt and spinel, but he decided not to use any “standard” for layered material. Instead, he used his own experimental data as a standard for layered material (EX1042, 84:5-17).

27. For at least these reasons, Dr. Liang's single failed attempt to synthesize Uemura's cathode material of examples 1-3 is not definitive evidence that Uemura's examples are not enabled and/or required undue experimentation to synthesize. Indeed, as discussed below, numerous publications concerning the synthesis of such materials have been reported in the prior art. *See* EX1045, EX1046, EX1047. As discussed below, Dr. Yao's failure to address or even consider any of these issues in simply relying on Dr. Liang's testing undermines the reliability of his analysis because these are issues that any POSITA would consider.

B. Dr. Liang failed to follow Uemura's process in several significant ways

28. Dr. Liang indicated that he was "asked to perform testing based on experimental procedures described in Uemura." EX2031, ¶14. Despite being asked to do so, he did not follow Uemura's process in his attempted electrode synthesis.

29. First, Dr. Liang pre-heated the material he produced to 500 degrees C and held that temperature for several hours, a pre-annealing step that Uemura did not prescribe but Liang performed based on his "own experience." EX1042, 102:10-104:8, 105:15-19 ("It was my decision to add this pre-annealing step")). Uemura did not describe this step and Dr. Liang does not explain what significance this step would have had on Uemura's process or the resulting materials.

30. Second, Dr. Liang produced “deep gray powders” (EX2031, ¶18) instead of a “brown slurry” or “brown solid body” as reported by Uemura (EX1009, [0071]).

31. This color difference would suggest to a POSITA that some error was made in reproducing Uemura’s material. There are a variety of reasons that the color could be different, but it does suggest that a material that was not the material produced by Uemura was made. Additionally, while Uemura discloses the use of citric acid or ammonium bicarbonate during the coprecipitation method (EX1009, ¶[0059]), Dr. Liang apparently did not use either material. A POSITA trying to replicate a procedure but achieving a material of a different color would recognize that an error in synthesis likely occurred. This would lead the POSITA to repeat the same experiment or modify parameters to try to achieve the proper color. Dr. Liang did not do this.

32. Next, Dr. Liang did not measure, or make any obvious attempt to control, the particle size of the powder he produced. EX1042, 128:17-22. Uemura reports grinding the material “to 20 μ m or smaller in average particle diameter,” but Dr. Liang does not report doing so. EX1009, ¶[0071]. A POSITA would know that particle size of materials used in electrode synthesis can have a considerable effect on subsequent steps in the process. For example, smaller particles often react more quickly and more thoroughly with other materials due to their increased surface area

per unit of mass and volume. Indeed, Uemura indicates controlling the particle size is important “because, in the case where an average size of the manganese compound is large, reaction of the manganese compound and the lithium compound becomes significantly slow, and it becomes difficult to obtain a uniform product.” EX1009, ¶[0056].

33. Fourth, Dr. Liang did not form a disk of the resulting electrode material by applying two tons per square centimeter prior to performing tests on the material (EX2031, ¶25; EX1042, 120:5-7 (“I mixed the electrode I used with a hand-operated pestle-and-mortar method without going through a high-pressure pelleting step”)), as specified by Uemura (EX1009, [0075]).

34. A POSITA would understand that this application of pressure forms the electrode material into a solid body for further testing. This step is critical when using PTFE binders and acetylene black conducting material (as in Uemura, EX1009, ¶[0075]) to ensure good contact between the cathode particles and the conductive additive. *See* EX1023, 18:51-55 (teaching the use of compression molding when making a positive electrode comprising acetylene black and tetrafluoroethylene), 23:58-62. The applied pressure affects the physical and electrochemical properties of the material as the particles fuse with each other and/or with the binder material. Without this pressurization step, the formation of conductive paths in the cathode could be incomplete.

35. Fifth, Dr. Liang did not heat the disk, or any other produced material, of the electrode material “at 150° C. for 16 hours” to make the positive electrode, as set forth by Uemura (EX1009, ¶[0075]).

36. A POSITA would understand that this heating step described in Uemura removes moisture and ensures dryness of the cathode before assembling the cell. *See* EX1023, 17:50-57 and 18:59-60 (teaching that for electrodes with acetylene black and tetrafluoroethylene, “[b]efore use, the pellet was dried in the above-described dry box by means of a far infrared heater at 150°C. for 3 hours”). Moisture can be detrimental to cell performance in that it will result in HF production in the electrolyte and moisture will react on the surface of the lithium electrode reducing its electrochemical capacity.

37. Sixth, Dr. Liang used a molybdenum current collector for his battery testing (EX2031, ¶25), not a stainless steel (“SUS thin plates”) current collector as stated in Uemura (EX1009, ¶[0079]).

38. Using molybdenum would be recognized by a POSITA as an unusual choice for a current collector when a cell is charged to high voltage. Molybdenum collectors can oxidize particularly at the high voltages which Dr. Liang used. Stainless steel is known to be much more stable than molybdenum, even at high voltages, which is why its recognized as the industry standard. Dr. Liang provides

no basis from departing from both Uemura and the industry standard with his choice of electrode material.

39. Seventh, Dr. Liang used an electrode with different dimensions than Uemura. Dr. Liang used a self-standing electrode with a diameter of 7.14mm (EX2031, ¶25), while Uemura disclosed a disk with a 12mm diameter (EX1009, ¶[0075]).

40. Eighth, Dr. Liang used an electrolyte with a different concentration (EX2031, ¶[0025]) than Uemura (EX1009, ¶[0078] (disclosing use of “LiPF₆ with a concentration of 1 mol/l to a mixed solvent of ethylene carbonate and dimethyl carbonate with a volume ratio of 2:1”) even though modifying the electrolyte can have a material effect on performance, particularly at higher voltages as is reflected in the Guyomard reference that I discussed in my earlier declaration.

41. Ninth, Dr. Liang used a different separator (polyethylene) (EX2031, ¶25) than Uemura, which used a polypropylene film (EX1009, ¶[0078]).

42. Tenth, Dr. Liang failed to consider the use of a material, e.g., carbon black, acetylene back, or citric acid, to control the partial pressure of oxygen in the baking atmosphere as taught by Uemura (EX1009, ¶[0062]). Controlling the partial pressure of oxygen in the baking atmosphere is important in achieving a highly crystalline layered material, which Dr. Liang admittedly did not achieve. *See, e.g.*, EX1045, p.14 (teaching that partial pressure impacts the solid state structure of

layered $\text{LiAl}_x\text{Mn}_{1-x}\text{O}_2$). Indeed, Uemura discloses that “baking must be performed in an atmosphere with a low oxygen density.” EX1009, ¶[0060].

43. Because of these numerous deviations from Uemura’s procedures, a POSITA would not consider Dr. Liang’s testing a true attempt to “replicate” the experimental procedures of Uemura and would further discount the relevance of his testing as evidence of non-enablement and/or undue experimentation on this basis.

C. Dr. Yao’s Non-Enablement Opinions Are Conclusory, Flawed, and Incorrect

44. Dr. Yao’s failure to consider and address the issues with Dr. Liang’s testing described above, as well as the significant deviations from the procedures taught by Uemura, undermine Dr. Yao’s conclusion that certain cathode materials of Uemura are non-enabled and/or require undue experimentation to produce. Indeed, while Dr. Yao indicates “Dr. Liang followed the procedure laid out there to synthesize those cathode active materials” (EX2006, ¶148), that assertion is not accurate.

45. Moreover, Dr. Yao’s assertions that Examples 1 to 4 of Uemura are “representative” of Examples 5-17 (EX2006, ¶147) lacks any analysis and is incorrect based on Uemura’s explicit teachings. For example, Uemura discloses that Examples 1-9 were made by the coprecipitation method, whereas Examples 10-17 were synthesized by the use of a solid-phase mixing method—a different synthesis method that neither Dr. Liang nor Dr. Yao address. (EX1009, ¶¶69-73). Moreover,

Dr. Yao cites no evidence to assert that examples containing cobalt are “representative” of compounds that contain nickel, iron, aluminum, chromium, gallium, or vanadium, instead of cobalt. *See* EX1009, Fig. 3.

46. With respect to the literature at the time, Dr. Yao asserts:

Many attempts have been made to prepare layered structures of LiMnO_2 and its doped modifications by using direct synthesis such as the one described in Uemura (coprecipitation method). Those attempts have consistently failed to produce layered LiMnO_2 with good crystallinity.

EX2006, ¶151; *see also id.*, ¶149. Dr. Yao further asserted “previous successful attempts at synthesizing materials such as $\text{Li}_x\text{Mn}_{0.5}\text{Co}_{0.5}\text{O}_2$ all used the ion-exchange method, which Uemura does not use” and “even to 2019, the field still has not successfully . . . prepare[d] cathode active material similar to the ones in Examples 3-4.” *Id.*, ¶151. But, Dr. Yao’s statements about the literature at the time are incorrect.

47. For example, Jang¹ discloses that “ LiMnO_2 of the $\alpha\text{-NaFeO}_2$ structure type has previously been obtained only by the ion-exchange of lithium salts with

¹ Jang et al., “Stabilization of LiMnO_2 in the $\alpha\text{-NaFeO}_2$ Structure Type by LiAlO_2 Addition,” *Electrochemical and Solid-State Letters*, 1(1) 13-16 (1998) (“Jang”). EX1045.

α -NaMnO₂. In this paper, we show that LiAl_xMn_{1-x}O₂ solid solutions can be crystallized in this structure under conditions where neither pure endmember does.”² Specifically, Jang created LiAl_{0.25}Mn_{0.75}O₂ through a precipitation method.³ Jang cycled the cathode material between “2.0 and 4.4V” at a C/5 rate and a C/15 rate.⁴ Jang found that the material had a high capacity and was highly cyclable:

However, the resulting material shows excellent cycleability and high reversible capacity when cycled over both voltage plateaus, unlike the LiMn₂O₄ spinels. A composition LiAl_{0.25}Mn_{0.75}O₂ exhibited 148 mAh/g reversible capacity at C/5 rate (450 Wh/kg energy density) and 182 mAh/g at C/15 rate (545 Wh/kg). m-LiAl_xMn_{1-x}O₂ solid solutions may therefore be attractive cathode materials for low-cost, high-energy-density lithium rechargeable batteries.⁵

Thus, Jang shows 1) ion-exchange is not the only method to produce layered lithium manganese oxide materials, 2) such materials could not even be made well before 2019, and 3) layered lithium manganese oxide materials could be charged to over 4.3V.

² EX1045, Abstract.

³ EX1045, p.13.

⁴ EX1045, pp.15-16.

⁵ EX1045, p.16.

48. As another example, Ammundsen⁶ describes “LiAl_xMn_{1-x}O₂ and LiCr_xMn_{1-x}O₂ compounds ($x \leq 0.10$) with an α -NaFeO₂ layer-type crystal structure have been prepared by a high temperature *solid-state route*.”⁷ Ammundsen noted that he the new synthesis method “allows well-ordered layered phases to be obtained that have electrochemical properties equivalent to those shown by materials previously prepared *by a coprecipitation freeze-drying route*” citing to a previous publication from Ammundsen.⁸ “Charge-discharge studies were performed between 4.4V and 2.0V with an Arbin series BT2043 automated battery cycler.”⁹ Ammundsen reported “the capacity retention at 55°C is higher (>90% over 200 cycles for both the Al- and the Cr- substituted material.”¹⁰ Thus, Ammundsen also directly contradicts Dr. Yao’s assertions that that 1) ion-exchange is the only method

⁶ Ammundsen et al., “Formation and Structural Properties of Layered LiMnO₂ Cathode Materials,” J. of the Electrochemical Society, 147 (11) 4078-4082 (2000) (“Ammundsen”). EX1046.

⁷ EX1046, Abstract (emphasis added).

⁸ EX1046, p.4078.

⁹ EX1046, p.4078

¹⁰ EX1046, p.4080 and Figure 5.

to produce such materials, 2) such materials could not even be made in 2019, and 3) such materials could not be charged to 4.3V.

49. Notably Ammundsen is referenced and cited in the Guo reference relied upon in the POR. EX2039, p.231 (“Ammundesen et al. [7] have recently developed a high-temperature solid-state synthesis for $\text{LiAl}_x\text{Mn}_{1-x}\text{O}_2$ and $\text{LiCr}_x\text{Mn}_{1-x}\text{O}_2$ which allows well-ordered layered phases to be obtained.”).

50. As a third example, Ceder¹¹ predicted and verified experimentally that aluminum substitution in $\text{Li}(\text{Co},\text{Al})\text{O}_2$ cathode materials “raises the cell voltage while decreasing both the density of the material and its cost.”¹² Specifically, “[f]or $\text{Li}(\text{Al}_{0.33}\text{Co}_{0.67})\text{O}_2$ and $\text{Li}(\text{Al}_{0.67}\text{Co}_{0.33})\text{O}_2$ in the $\alpha\text{-NaFeO}_2$ structure, our first-principles calculations predict an average Li intercalation potential of respectively 4.2 and 4.7V. Given the consistent underestimation of experimental voltages by the calculations, *the true potential is probably ~0.2V higher.*”¹³ Ceder then “developed a method to synthesize homogenous $\text{Li}(\text{Co},\text{Al})\text{O}_2$ solid solutions in

¹¹ Ceder et al., “Identification of cathode materials for lithium batteries guided by first-principles calculations,” Nature, Vol. 392, 16 April 1998, 694-695 (“Ceder”). EX1047.

¹² EX1047, p.694.

¹³ EX1047, pp.694-695 (emphasis added).

the α -NaFeO₂ structure” using a co-precipitation freeze-drying procedure.¹⁴ Ceder cycled the cell between 2.0 and 4.4V and noted that “it is likely that more capacity could be found at higher potentials.”¹⁵ Thus, Ceder also contradicts Dr. Yao’s assertions that 1) ion-exchange is the only method to produce such materials, 2) such materials could not even be made in 2019, and 3) such materials could not be charged to 4.3V.

51. Dr. Yao also asserts that because the cathode in Dr. Liang’s test cell “started to degrade” before it was charged to 4V, that the cathode materials described in Uemura “cannot be safely charged to 4.3V.” EX2031, ¶154. This assertion is inconsistent with exhibits that were submitted as part of Patent Owner’s response. *See, e.g.*, EX2009, 501 (indicating “the electrolyte was stable in contact with this [LiMnO₂] electrode up to at least 4.4V”); EX2017, p.40 (charging and discharging a Li_xCo_{0.5}Mn_{0.5}O₂ cell “in a voltage range between 3.5 and 5.2V”); EX2023, p.3653, Table I (showing LiMn₂O₄ cathodes charged to voltages well above 4.3V); EX2030, ¶33 (citing several references disclosing charge cut-off voltages greater than 4.2V); EX2038, Abstract (cycling LiMn_{0.7}M_{0.3}O₂ cells between 2-4.4V).

¹⁴ *Id.* at 695.

¹⁵ *Id.* at 695.

D. Dr. Yao incorrectly discounts the anode capacities of Uemura's examples

52. Dr. Yao attempts to reduce the reported capacities of Uemura's example anode materials by subtracting capacities allegedly attributable to inactive material (EX2006, ¶¶140-142). However, a POSITA would understand the term "inactive material" in relation to battery electrodes as material that doesn't have or affect capacity. Just because a material in an anode is "non-carbon content," as stated by Dr. Yao, does not mean that materials is "inactive." By definition and as understood by a POSITA, an active electrode material has capacity, and an inactive electrode material does not have capacity.

53. A POSITA would know that some non-carbon content of an anode, such as the nitrides and complex oxides described by Uemura, affect the capacity of the anode and are thus active materials. Uemura teaches, "The negative electrode material describe above is not limited to a carbon material, but various complex oxide or nitride can be also used." EX1009, ¶[0029]. Uemura further teaches, "As a negative electrode material of the rechargeable lithium battery of this embodiment, complex oxide, nitride or the like can be employed." EX1009, ¶[0053]. Therefore, Uemura explicitly discloses that nitrides and complex oxides affect the capacity of the battery.

54. A POSITA would understand the capacity of an electrode to be the total capacity.

55. For these reasons, Dr. Yao was wrong to subtract the irreversible capacities from the total capacities in his calculations of the capacity ratios of Uemura.

E. RJ Tech’s Assertions Regarding the Charge Cutoff Voltage of Uemura are Incorrect

56. Uemura discloses that its batteries were repeatedly charged to 4.3V and then discharged to 2.0V by applying a constant current of 0.5mA/cm²:

The charge-discharge was repeatedly performed at a constant current of 0.5 mA/cm and a voltage ranging from 4.3 V to 2.0 V at an atmospheric temperature of 60° C.

EX1009, ¶[0081].

57. RJ Tech mistakenly argues that Uemura discloses “an applied voltage equal to 4.3V” (POR at 28; EX2006, ¶¶118-120). But Uemura does not disclose an applied voltage and RJ Tech cites nothing supporting that position. Uemura indicates that the batteries were charged using a constant current of 0.5 mA/cm² until the battery reached a voltage of 4.3V and then it was discharged until the battery reached a voltage of 2.0V. EX1009, ¶[0081]. Thus, Uemura discloses that the battery was charged to a maximum voltage of 4.3V.

58. This understanding of Uemura is consistent with what Dr. Yao and Uemura previously told the Court regarding the use of constant current charging:

- “Constant Current (CC): The battery is charged at constant current *until it reaches the charge cut-off voltage.*” (EX1032,

p.9 (emphasis added));

- “in many laboratory settings, batteries are charged at a *constant current* without a constant voltage stage. *Once the battery reaches a predetermined voltage (i.e., the charge cut-off voltage), the charging stops.*” (EX2022, ¶33 (emphasis added));
- “the voltage at which the charging switches to constant voltage in CC/CV is the charge cutoff voltage” (EX1050, ¶4).

59. As shown by RJ Tech’s own statements, a POSITA would understand that constant current charging involves the use of a constant current—not an applied voltage—until the battery reaches the charge cutoff voltage.

60. Regardless, even under RJ Tech’s interpretation of the claim construction of “charge cutoff voltage” in the POR, Uemura discloses charging the batteries to an open circuit voltage of 4.3V by disclosing that the batteries were repeatedly charged to 4.3V and then discharged to 2.0V. EX1009, ¶[0081]. Thus, a POSITA reviewing Uemura’s disclosure would understand that “4.3V to 2.0V” refers to the voltage of the battery at the fully charged and discharged states of the battery.

F. Dr. Yao’s Opinions Regarding Theoretic Capacity at 4.2V for LiMnO₂

61. Dr. Yao indicates that “270 mAh/g is more appropriate to use” as the theoretic capacity of LiMnO₂ at 4.2V based on Armstrong. EX2006, ¶134.

62. Notably, the 270 mAh/g value is determined using a charging current of “10 $\mu\text{A cm}^{-2}$. EX2009, p.500. When Armstrong applied a “much higher current density of 0.5 mA cm^{-2} ” (a current density 50 times higher) he obtained a specific capacity of 200 mAh/g. *Id.*

63. Notably, Uemura also used the “much higher current density” of 0.5 mA/ cm^2 . Dr. Yao asserted that Uemura’s current density equated to a C-rate of C/3-C/4. EX2006, ¶119n.64 (“According to the capacity data reported in Uemura, the charging for each of the examples in Fig. 3 lasted between 3-4 hours.”).

64. Thus, the current density that Dr. Yao relies on for achieving the theoretic capacity of LiMnO_2 at 4.2V is a C-rate of C/150-C/200, meaning it will take 150-200 hours per each charge and discharge of the battery. Using a C-rate of C/150-C/140 is not disclosed by the ’641 patent, is not required by the claims of the ’641 patent, and is inconsistent with charge-discharge conditions that a POSITA would apply.

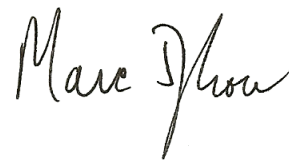
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VI. DECLARATION

65. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. If called to testify as to the truth of the matters stated herein, I could and would testify competently.

66. I declare under penalty of perjury that the foregoing is true and correct.

67. Executed on this 16th day of August, 2024, in Livermore, CA.



Marc Juzkow