

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ZHUHAI COSMX BATTERY CO., LTD.,

Petitioner

v.

NINGDE AMPEREX TECHNOLOGY LTD.,

Patent Owner

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Case: IPR2025-00389

U.S. Patent No. 11,923,498

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**DECLARATION OF JAMES L. KASCHMITTER**

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## **I. INTRODUCTION**

1. I have been retained by Ningde Amperex Technology Ltd. (“ATL” or “Patent Owner”) as an independent technical expert in this proceeding before the United States Patent and Trademark Office (“PTO”) Patent Trial and Appeal Board (“PTAB”) regarding U.S. Patent No. 11,923,498 (the “’498 Patent”).

2. I understand that Zhuhai CosMX Battery Co., Ltd. (“Petitioner”) filed a petition for Inter Partes Review of the ’498 Patent (“Petition”), in which Petitioner asserts that:

- Claims 1-3, 6, 8, 17, and 19 are obvious over U.S. Patent Application Publication No. 2011/0111276 to Sato (“Sato”) and Japanese Patent Application Publication 2000/067907 to Takemura (“Takemura”)
- Claims 4, 5, 7, and 18 are obvious over Sato, Takemura and Japanese Patent Application Publication JP 2003/068271 to Nakamura (“Nakamura”)
- Claims 20 and 22 are obvious over Sato, Takemura, U.S. Patent Application Publication 2011/0104539 to Oh (“Oh-539”), and U.S. Patent Application Publication 2010/0035144 to Oh (“Oh-144”)
- Claims 9-11, 14, and 16 are Obvious Over Sato, Takemura, and Japanese Patent Application Publication No. 2010-055906 to Kobayashi (“Kobayashi”)

- Claims 12, 13, and 15 are Obvious Over Sato, Takemura, Kobayashi, and Nakamura
- Claim 21 is Obvious Over, Sato, Takemura, Kobayashi, Oh-539, and Oh-144
- Claims 1-3, 9-11, 17 are obvious over Takemura, Oh-539, and Kobayashi
- Claims 20-22 are obvious over Takemura, Oh-539, Kobayashi, and Oh-144

3. I have been asked, for purposes of Patent Owner's Preliminary Response, to analyze and respond to Petitioner's assertion that Independent Claims 1 and 17 are obvious over Sato and Takemura (Ground 1) and that Claims 1 and 17 are obvious over Takemura, Oh-539, and Kobayashi.

4. As explained below, in my opinion, the Petition fails to show that Claims 1 and 17 of the '498 Patent are rendered obvious. As I explain below, I understand that the deficiencies I identify in Ground 1 and/or Ground 17 apply to every Ground.

5. I am being compensated at my customary consulting rate of \$650 per hour. My compensation is in no way contingent on the nature of my opinions or the outcome of this or any other proceeding. I have no other interest in this proceeding.

## **II. BASIS FOR OPINIONS**

### **A. Qualifications**

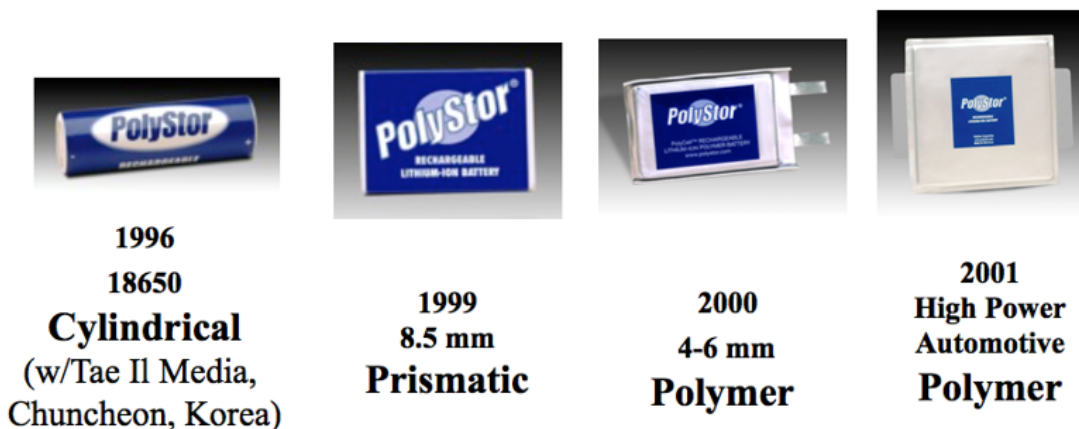
6. My qualifications and professional experience are described in my resume, a copy of which is provided with this Declaration as Ex. 2016. Also provided with this Declaration as Ex. 2017 is a list of my papers and presentations. The following is a summary of my qualifications and professional experience.

7. I am a consultant, engineer, inventor, and entrepreneur with over 30 years of experience with energy storage and generation, including theoretical principles, manufacturing methods, battery testing, packaging, application engineering, economics, and development of requirements and specifications for lithium-ion batteries. I received a B.S. in Physics from the University of Utah in 1972, and an M.S.E.E. from Stanford University in 1976.

8. I have held various senior and managerial engineer positions in industry, academia, and federal laboratories, including at Stanford Telecommunications, Berkeley Scientific Labs, Elxsi Corporation, nChip Corporation, and the Lawrence Livermore National Laboratory. During almost a decade at the U.S. Department of Energy's Lawrence Livermore National Laboratory, I was Project Leader for the Strategic Defense Initiative Office ("SDIO": President Reagan's "Star Wars" project) LLNL Advanced Power Group and Lead Engineer for the DOD/VHSIC laser pantography project, and developed

and co-invented the carbon aerogel supercapacitor, as well as leading the development of Lithium-ion batteries for the SDIO and new materials for use in Lithium-ion batteries and fuel cells, among other projects.

9. I have also founded and co-founded several technology companies. At PolyStor Corporation, which I co-founded with a Technology Reinvestment Program grant issued under President Clinton, and where I was CEO and President for close to a decade, I was the lead inventor of a unique 18650-type lithium-ion battery cap and electrode design that provided improved safety, and led the development and commercial-scale manufacturing of various types of lithium-ion batteries, including a 18650 cylindrical model, an 8.5 mm prismatic model, a 4-6 mm lithium-ion-polymer model, and a high power automotive lithium-ion polymer model, which are shown below.



10. Furthermore, I led PolyStor's expansion and growth to become the only U.S. company manufacturing and selling lithium-ion batteries in large-scale

commercial volumes at a capacity of 6 million cells per year. In 2000, I led Polystor's development of high-power large-format lithium-ion batteries for the U.S. Advanced Battery Consortium with Ford, GM, Chrysler, and AeroVironment. I also led PolyStor's commercialization, as the first company in the world to do so, of high-capacity Lithium Nickel Cobalt Oxide (LiNiCoO<sub>2</sub>) cathodes for PolyStor's prismatic and polymer cells. In addition, I led PolyStor's commercial development and manufacturing of lithium-ion and lithium-ion-polymer batteries for Ericsson, Motorola, and other electronics companies.

11. At PowerStor Corporation, where I was CEO and President for three years, I led the commercialization of the Carbon Aerogel Supercapacitor for electrodes, with DARPA funding.

12. At UltraCell Corporation, where I was CEO and President for six years, I led the development and introduction of the world's smallest 25W micro-fuel cell for the U.S. Army and other entities. UltraCell's product was the only micro fuel cell at the time to complete and pass the rigorous testing requirements of the U.S. Army.

13. At SpectraPower, where I have been CEO for over twenty years, I lead the contract-based research and development of, and consulting on, Lithium-ion, Lithium-metal, and Nickel Zinc (NiZn) batteries, supercapacitors, and other types of energy storage devices. SpectraPower has the capabilities to design and build Lithium-ion pouch cells from raw materials to finished product, and test them, in a

4,000 ft<sup>2</sup> facility in Livermore, CA. Our customers include major companies, U.S. government agencies, startup companies and venture capitalists.

14. During my over thirty years of experience in the field of batteries and supercapacitors, including at the companies and research facilities described above, I have worked with almost every, if not all, aspects of battery manufacturing, including joining and welding methods between cells and within cells.

15. In addition, and in every year for the past five years, I have presented a tutorial on “Li-Ion Cell Design and Manufacturing: Processes, Equipment and Quality Control” at the International Battery Seminar and Exhibit held annually in Florida as well as once at the Advanced Automotive Battery Conference in Mainz, Germany and in San Diego, CA and Las Vegas, NV.

16. I have also published papers and given presentations on lithium-ion battery design and manufacturing and other aspects of the '498 Patent. Below are some of my exemplary papers and presentations on lithium-ion battery design and manufacturing and other aspects of the '498 Patent:

- “Validating Performance with Advanced Prototyping” James Kaschmitter, Steve Pierce, Aubert Demaray; Soteria Battery Innovation Group Meeting, Orlando, FL March 20, 2023.
- “Advanced Electrolytes for Extreme Fast Charging”, April 17, 2023, Report to the U.S. Department of Energy; William Chueh, Mike Toney,

Yi Cui, Johanna Nelson Weker, SLAC National Accelerator Laboratory, James Kaschmitter, SpectraPower LLC, Robert Kee, Colorado School of Mines.

- “Fundamentals and Manufacturing of Lithium Rechargeable Batteries”, 1st Li-Ion-Solid Electrolyte & Lithium Metal (Liquid & Solid Electrolyte) Rechargeable Cell Manufacturing Seminar, August 19-20, 2019.
- “Ultra-High Temperature Li-ion Battery”, J. Kaschmitter and Victor Koch, 35th Annual International Battery Seminar & Exhibit March 26-29, 2018 Fort Lauderdale, FL.
- “Thin Film Solid State Li Metal Battery with High Energy Density and Cycle Life”, E. Demaray, J. Kaschmitter and P. Khoklov, NASA Aerospace Battery Workshop 2016.
- “High Speed Li Polymer Battery Manufacturing and R&D Foundry Services”, The 29th International Battery Seminar & Exhibit, March 12 - 15, 2012, Fort Lauderdale, Florida.
- “Cycle Life Testing of Lithium-Ion Batteries for Small Satellite LEO Space Missions”, S.T. Mayer, J. H. Feikert and J. L. Kaschmitter, AIAA Conference on Small Satellites, Sept 13-16, 1993, Utah State University, Logan, UT. LLNL Preprint # UCRL-JC 114996.

17. I am also a named inventor or co-inventor on numerous patents relating to batteries and other aspects of the '498 Patent. Below are some exemplary patents on which I am a named inventor or co-inventor:

- US 5,402,306 Aquagel Electrode Separator for Use in Batteries and Supercapacitors Mar 28, 1995.
- US 5,336,274 Method for Forming a Cell Separator for Use in Bipolar-Stack Energy Storage Devices Aug 9, 1994.
- US 5,393,619 Cell Separator for Use in Bipolar-Stack Energy Storage Devices Feb 28, 1995.
- US 5,402,306 Aquagel Electrode Separator for Use in Batteries and Supercapacitors.
- US 5,609,972 Cell Cap Assembly having Frangible Tab Disconnect Mechanism.
- US 9,673,478 Multi-Layer Coatings For Bipolar Rechargeable Batteries With Enhanced Terminal Voltage, June 6, 2017.
- US 10,818,909 B2 “Energy Storage Device with a First Metal Layer Formed from a Precursor Layer upon Charge and Diffused into a Cathode during Discharge” October 27, 2020.

- US 11.824,183, “Energy Storage Device with a First Metal Layer formed from a Precursor Layer upon Charge and Diffused into a Cathode during Discharge,” November 21, 2023.

**B. Materials Considered**

18. The opinions contained in this Declaration are based on the documents I reviewed, as well as my education, years of professional experience, and knowledge. In forming my opinions expressed in this Declaration, I further reviewed the Petition, all exhibits or other material cited therein, and any additional exhibits or other material cited in this declaration.

19. This Declaration presents the opinions I have formed at the present time, and I reserve the right to revise, supplement, or amend my opinions stated in this Declaration based on any new information that I may be asked to review.

**III. LEGAL STANDARDS**

20. In this section, I describe my understanding of certain legal standards. I have been informed of these legal standards by Patent Owner’s legal counsel. I am not an attorney and I am relying only on instructions from Patent Owner’s legal counsel for these legal standards.

**A. Claim Construction**

21. My opinions concern what I believe a person of ordinary skill in the art (“POSITA”) would have understood the meaning of certain claim terms to be based on the patent documents.

22. I have been informed that assessing the validity of a patent claim requires a two-step analysis. The first step involves the proper interpretation or construction of the claim language in order to determine its scope and meaning. The second step requires comparing the claim, as properly construed, to the alleged prior art to determine whether the limitations of the claim are met by the prior art.

23. My methodology for determining the meaning of claim phrases was first to study the patent carefully. In particular, I studied the claims themselves, followed by the background, detailed specification, figures, and other patent content. Next, I reviewed the prosecution history looking for any clarifications or limitations that might be attached to claim terms. In some circumstances, I looked at other documents, such as references applied by the patent office.

24. I understand that in an *inter partes* review, claim terms are to be given their ordinary and customary meaning as understood by a person of ordinary skill in the art in the context of the entire disclosure at the time of the invention. I understand that one must be careful not to read a specific embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. I

further understand that any special definition for a claim term must be set forth with reasonable clarity, deliberateness, and precision.

25. I have been informed that this standard is the same as that used in United States district courts, in which claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the art at the time of the invention having taken into consideration the language of the claims, the specification, and the prosecution history of record under the *Phillips* claim construction standard.

**B. Prior Art Status**

26. I understand that the “priority date” of a patent is the date on which it is filed, or the date on which an earlier-filed patent application is filed if the patentee claims the benefit of priority to that earlier-filed patent application. I understand that a particular claim is entitled to claim the priority date of an earlier-filed application if the earlier-filed application provides written description of the subject matter of that particular claim.

27. I understand that a U.S. or foreign patent or patent application qualifies as prior art to an asserted patent if the date of issuance or publication of the patent or publication is prior to the priority date of the challenged patent.

28. I understand that a printed publication, such as an article published in a magazine or trade publication, qualifies as prior art to the challenged patent if the date of publication is prior to the priority date of the asserted patent.

29. I understand that to qualify as prior art, a reference must contain an enabling disclosure that allows one of ordinary skill to practice the reference's disclosure without undue experimentation.

**C. Obviousness**

30. I understand that a claimed invention is not patentable if the claimed invention would have been obvious to a person of ordinary skill in the field of the invention at the time of the patent claim's effective filing date.

31. I have been informed and understand that the obviousness analysis requires evaluating the claim language as a whole, including comparing each and every limitation of the properly construed claim language to the prior art.

32. I understand that a person of ordinary skill in the art provides a reference point from which the prior art and claimed invention should be viewed. This reference point prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious.

33. I understand that in order to show obviousness based on a single reference or a combination of references, a particular motivation to modify the

reference or combine the teachings in the references, and a reasonable expectation of success must be shown.

34. I understand that the obviousness inquiry includes consideration of various factors, such as the scope and content of the prior art, the differences between the prior art and the claims at issue, the knowledge of a person of ordinary skill in the pertinent art at the time of invention, and any objective factors indicating non-obviousness.

35. I am informed that objective factors indicating non-obviousness, also known as secondary considerations, may include (1) a long felt but unmet need in the prior art that was satisfied by the alleged invention of the patent; (2) commercial success or lack of commercial success of processes covered by the patent; (3) unexpected results achieved by the alleged invention; (4) praise of the alleged invention by others skilled in the art; (5) taking of licenses under the patent by others; and (6) deliberate copying of the alleged invention. I also understand that there must be a relationship or nexus between any such secondary indicia and the alleged invention.

36. I understand that in order to rely on a reference for obviousness, the reference must be analogous art. I also understand that to be analogous art, the reference must be either (1) from the same field of endeavor as the claimed subject matter, regardless of the problem addressed, or (2) if not in the same field of

endeavor, reasonably pertinent to the particular problem with which the inventor is involved. I am also familiar with the premise that for a reference to be reasonably pertinent, it must have logically commended itself to an inventor's attention at the time of invention.

#### **IV. TECHNOLOGY OVERVIEW**

##### **A. Secondary Batteries**

37. A battery is a device that converts chemical energy directly into electrical energy. The basic electrochemical unit is called a "cell," which consists of two electrodes, one called the negative electrode or anode, and the other called the positive electrode or cathode, a separator, an electrolyte, and a container. A secondary battery, also referred to as a rechargeable battery or storage battery, is a type of electrical battery that can be charged, discharged, and recharged multiple times.

38. Among the different types of secondary batteries, the lithium-ion battery has received a great deal of attention because it provides one of the highest energy densities of all available systems. In particular, lithium is the lightest metal and, thus, produces lighter batteries. Lithium also has a high specific capacity and specific energy.

**B. Introduction to Lithium-Ion Batteries and Components**

39. Lithium-ion batteries convert chemical energy into electrical energy by shuttling lithium ions back and forth between an anode and a cathode during cycling. The anode and the cathode each include an active material coated on a current collector, as well as a metal lead (or “tab”) which conducts current between the current collector and an external circuit.

40. The anode and the cathode are physically separated by a separator, which is a porous material that allows lithium ions to pass through it while preventing direct contact between the anode and the cathode. The electrolyte, which typically includes a lithium salt dissolved in an organic solvent, serves as a medium through which the lithium ions move between the anode and the cathode.

41. When the cell is discharged, lithium atoms in the negative active material are oxidized and released into the electrolyte. The lithium ions move through the electrolyte to the cathode and intercalate into the positive active material. Oxidation of the lithium atoms in the negative active material releases electrons into the current collector and the lead, which is in electrical communication with the current collector, carries the electrons through the external circuit, thereby generating an electric current. During charging, lithium ions are deintercalated from the positive active material and returned to intercalate into the anode by the reverse electrochemical process. The amount of available active material in the battery’s

electrodes determines the amount of lithium ions that can be stored and transferred during cycling and, as such, also determines the batteries capacity and energy output.

**C. Lithium Plating**

42. On charge, electrons move through an external circuit from the cathode (positive electrode) to the anode (negative electrode), while positively charged Li-ions move inside the cell from the cathode, through the electrolyte, to the anode where they intercalate (enter into the interstitial planes in the graphite). A phenomenon called “lithium plating” occurs when the Li-ions cannot intercalate into the anode, and so are deposited as metallic lithium on the surface of a battery’s anode, causing an unsafe condition which can cause battery failure, fire or explosion. Li-ions which are unable to intercalate into the anode active material will plate on the nearest part of the anode or its current collector that is at a negative potential and form a coating of Lithium metal on the surface.

**D. The ’498 Patent**

43. The ’498 Patent discloses lithium-ion batteries that solve problems in the prior art. For example, leads can cause an increase in thickness which limits energy density. Ex. 1001, 1:36-48. Recesses in active material can be used to reduce the thickness of the battery. *Id.*, 1:52-54. But while recesses can reduce thickness, they create additional problems such as thickness variation around the sides, edges,

and corners of the recesses, high internal resistance, and safety performance issues due to lithium precipitation. *Id.*, 1:49 – 2:3. In particular, the '498 Patent claims:

A lithium-ion battery, comprising:

a positive electrode comprising a positive current collector and a positive electrode active material layer containing  $\text{LiCoO}_2$ , wherein the positive electrode active material layer is formed on the positive current collector, the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

a negative electrode comprising a negative current collector and a negative electrode active material layer containing graphite or silicon, wherein the negative electrode active material layer is formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

a separator disposed between the positive electrode and the negative electrode; and

an electrolyte,

wherein, a top surface of the positive lead is provided with a first insulating glue layer, a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer, the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

*Id.*, Claim 1.

44. The '498 Patent explains that prior art batteries suffer from thickness, efficiency, and reliability issues due to lithium deposition:

The arrangement of the recess on the positive plate and/or the negative plate can reduce the thickness of the lithium-ion battery. However, when the recess is defined at one end of the positive plate or the negative plate along a length direction thereof, thickness variation around the recess is much larger than the thickness variation of the film afar from the recess. Particularly, the arrangement of the recess may generate a number of corners. The film around the corners is readily peeled off, especially when the negative active material adopts an expansive substance, such as silicon. The structure as previously described may lead to a high internal resistance of the lithium-ion battery and affect the capacity of the lithium-ion battery. In addition, there is no insulating layer provided on the positive area corresponding to the positive recess or the negative recess, internal short circuit and lithium precipitation may potentially occur to the lithium-ion battery, which will inevitably affect the safety performance of the lithium-ion battery.

Ex. 1001, 1:27-34.

45. The '498 Patent then explains that its objective "is to provide a battery which has high energy density and desirable safety performance." Ex. 1001, 2:10-12. To that end, the '498 Patent discloses a particular arrangement of leads, recesses, and insulating tape on the anode and cathode of the battery. The cathode, which is referred to in the '498 Patent as a positive electrode plate, includes a positive lead 13 soldered and seated in a first recess 14. As illustrated in FIG. 1 of the '498 Patent (reproduced below), due to the arrangement of the first recess 14 on the positive electrode plate, the positive lead 13 does not increase the thickness of the positive electrode plate.

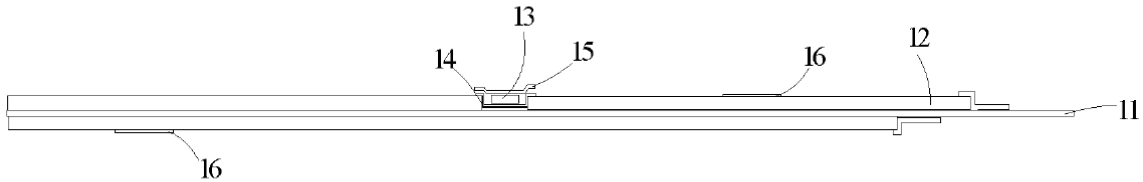


FIG. 1

Similarly, the anode, which is referred to in the '498 Patent as a negative electrode plate, includes a negative lead 23 soldered and seated in a second recess 24. As illustrated in FIG. 3 of the '498 Patent (reproduced below), due to the arrangement of the second recess 24 on the negative electrode plate, the negative lead 23 does not increase the thickness of the negative electrode plate.

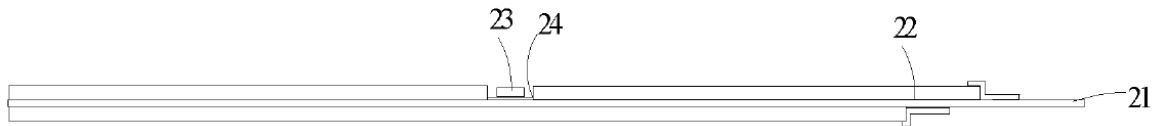


**FIG. 3**

46. As illustrated in FIG. 5 of the '498 Patent (reproduced below), the arrangement of the first recess 14 and the second recess 24 prevents bulging in the thickness direction of the battery due to the presence of the lead 13 and the lead 23, respectively. By preventing bulging in the thickness direction, the arrangement of the first recess 14 and the second recess 24 reduces the device footprint, while maintaining high energy density.

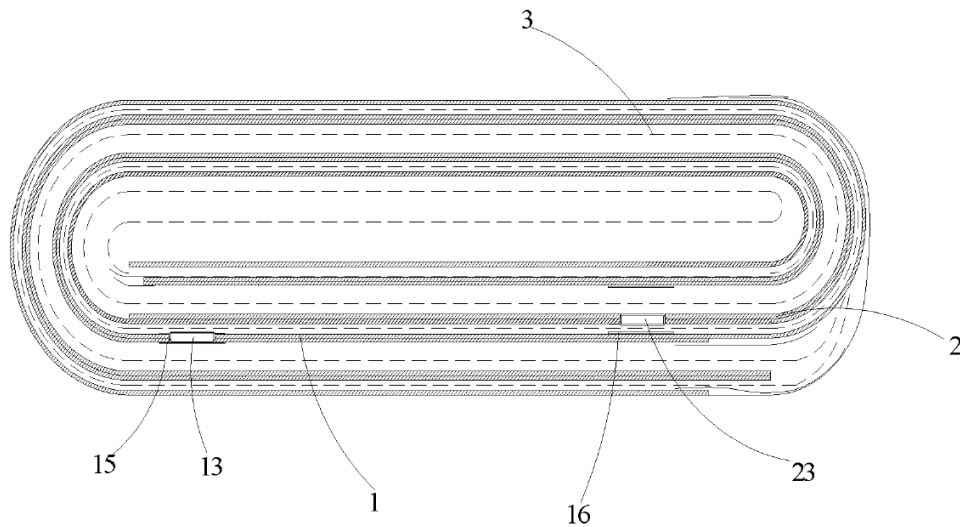


**FIG. 5**

47. The '498 Patent also provides for various insulating glue layers to prevent short circuits and improve safety. For example, as illustrated in FIG. 5, the upper surface of the positive lead 13 (on the positive electrode plate 1) is provided with an insulating glue layer 15. The placement of the insulating glue layer 15 prevents direct contact between the positive lead 13 and other conductive materials, which can cause short circuits. Additionally, to prevent lithium deposition and the formation of lithium metal dendrites on the negative lead 23, which can also cause short circuits, a surface of the positive active material of the positive electrode plate 1 opposite the second recess 24 is provided with a second insulating glue layer 16. This placement of the second insulating glue layer 16 with the specified dimensions on the cathode active surface across from the anode tab (located in the second recess 24) is contrary to the norm in the industry, which is to tape only the anode tab in

order to block lithium deposition on the anode tab and anode area over which the tape is placed.

48. Due to the particular arrangement of leads, recesses, and insulating tape, the '498 Patent provides an efficient, dense battery, while effectively balancing reliability issues:

Compared with the prior art, due to the arrangement of the first insulating glue layer formed on the upper and lower surfaces of the positive lead and the second insulating glue layer pasted on the surface of the positive film corresponding to the second recess, occurrence of internal short circuit and lithium precipitation in the lithium-ion battery is remarkably reduced, and safety performance of the lithium-ion battery is improved remarkably in the premise of desirable energy density.

Ex. 1001, 4:57-65.

49. In my opinion the placement of tape on the '498 Patent directly on the “positive active material layer” and “opposite the second recess” itself is distinct for at least the following reasons. First, it prevents lithium deposition in the opposite way that was conventionally done—by covering the area over the positive active layer, it blocks lithium ions from flowing *out of the cathode active area that is covered by tape*. In my experience, tape is conventionally only placed over the anode tabs which blocks lithium ions from *plating as lithium metal onto the anode tabs*. When the tape is applied on the surface of the positive active material, lithium ions are inhibited from flowing out of the cathode from the area where the tape covers it.

Second, blocking lithium-ion transport by placing tape directly on the surface of the positive active layer, instead of over the opposing tab, is counter-intuitive in that it reduces the active material portion of the electrode available for storing energy, which would reduce the cell's energy density. Decreasing the amount of active material capable of storing energy typically will decrease the cell's capacity to store energy. However, one of the problems with taping only the anode tab is that the cathode active area across from the anode tab will still yield Li-ions when the cell is being charged, but with no corresponding anode active material for the Li-ions to intercalate into, so they will intercalate or plate at the closest anode location at a low potential. Thus, there is a tendency for lithium to plate at the un-taped area around the anode tab. One way to avoid this would be to raise the n/p ratio of the electrode pair. The negative to positive (n/p) ratio is an important parameter in Li-ion cell design. It is calculated by taking the ratio of the areal capacity (mAh/cm<sup>2</sup>) of the anode ("n") to the cathode ("p"). For good cell safety, the n/p ratio must always be >1.0 throughout the entire life and usage profile of the cell, and throughout all of the cell electrode area in the cell. If the n/p falls below 1.0, even on a localized basis, lithium metal plating can occur because there is insufficient anode active material for the li-ions to intercalate into, resulting in plating. Typical industry practice is for the n/p ratio to be ~ 1.05 – 1.20. As the ratio gets larger, safety increases, but cell energy density and cost decrease. The '498 patent's unique solution addresses this

problem, increasing energy density, and maintaining safety by placing specifically sized tape on the cathode active material across from the anode recess to prevent it from sourcing li-ions which might plate on the anode. Since the anode tab is recessed, below the level of the anode active material, and since there is no cathode active material directly across from the anode tab, li-ions will preferentially intercalate into the anode active material around the tab without providing excess lithium which might plate onto the anode surface. Thus, the cell design of the '498 Patent can achieve a lower n/p ratio for high energy density, while maintaining good safety.

## **V. PRIORITY DATE**

50. I understand the '498 Patent has a priority date of January 17, 2014, which Petitioner does not challenge. Pet., 2.

## **VI. LEVEL OF ORDINARY SKILL IN THE ART**

51. Each of the arguments below should be considered from the standpoint of a person of ordinary skill in the art in the field of the '498 Patent.

52. I understand that Petitioner provides the following definition of a person of ordinary skill in the art:

A POSA is presumed to be aware of all pertinent art. The POSA possesses the “understandings and knowledge reflected in the prior art” and thinks along conventional wisdom. *See Abbott Labs. v. Andrx Pharm., Inc.*, 452 F.3d 1331, 1336 (Fed. Cir. 2006).

For the '498 patent, a POSA at the time of the alleged invention would have had a Bachelor's Degree in Physics or an Engineering field relevant to battery technology (e.g., Electrical or Mechanical Engineering) and at least two years of industry experience in lithium-ion battery manufacturing and/or design. EX1003, ¶¶27-30.

Pet. at 3.

53. For purposes of this declaration in support of Patent Owner's Preliminary Response, I offer no independent opinion of the level of ordinary skill in the art but have adopted the definition proposed by Petitioner. I reserve the right to further address the level of ordinary skill in the art if this proceeding is instituted.

54. Each of the arguments below should be considered from the perspective of a POSITA in the field of the '498 Patent and during the relevant time frame (e.g., January 2014). During that time frame, I possessed at least the qualifications of a POSITA, as defined above.

## **VII. THE BOARD SHOULD NOT INSTITUTE INTER PARTES REVIEW**

55. I understand that for an *inter partes* review to be instituted, the Petition must establish that there is a reasonable likelihood that at least one challenged claim is unpatentable. For at least the reasons I explain below, it is my opinion that the Petition fails to do so.

**A. Ground 1: Sato and Takemura Do Not Render Obvious Claims 1-3, 6, 8, 17, and 19**

56. Petitioner contends that Sato and Takemura render obvious claims 1-3, 6, 8, 17, and 19 of the '498 Patent. These claims recite:

1. A lithium-ion battery, comprising:

a positive electrode comprising a positive current collector and a positive electrode active material layer containing  $\text{LiCoO}_2$ , wherein the positive electrode active material layer is formed on the positive current collector, the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

a negative electrode comprising a negative current collector and a negative electrode active material layer containing graphite or silicon, wherein the negative electrode active material layer is formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

a separator disposed between the positive electrode and the negative electrode; and

an electrolyte,

wherein, a top surface of the positive lead is provided with a first insulating glue layer, a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer, the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

2. The lithium-ion battery of claim 1, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is  $\frac{1}{4}$ - $\frac{3}{4}$  of a length of the positive electrode active material layer; and a distance between a center of the second recess and one end of the negative electrode active material layer is  $\frac{1}{4}$ - $\frac{3}{4}$  of a length of the negative electrode active material layer.

3. The lithium-ion battery of claim 2, wherein, the distance between the center of the first recess and the one end of the positive electrode active material layer is half of the length of the positive electrode active material layer; and the distance between the center of the second recess and the one end of the

negative electrode active material layer is half of the length of the negative electrode active material layer.

6. The lithium-ion battery of claim 1, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.

8. The lithium-ion battery of claim 1, wherein a width of a portion of the positive lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.

17. A lithium-ion battery, comprising:

a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector, the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

a negative electrode, comprising a negative current collector and a negative electrode active material layer being formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

a separator disposed between the positive electrode and the negative electrode; and

an electrolyte, wherein, a first location of a top surface of the positive lead is provided with a first insulating glue layer;

second location of a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer; the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

19. The lithium-ion battery of claim 17, wherein a width of a portion of the first lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the first lead located on one side of the first lead.

57. Petitioner fails to establish that there is a reasonable likelihood at least one challenged claim of Ground 1 is unpatentable, for the reasons below

**1. The Petition Fails to Show That Sato and Takemura Render Obvious Claim 1**

**a. Takemura Teaches Away from the Arrangement of Tape in FIGS. 8 and 9, Which Show the Prior Art Takemura Claims to Improve Over**

58. I understand that Dr. van Sacken relies on Sato as a primary reference, arguing Sato discloses most of the elements of claim 1—for example, a “battery,” “negative electrode,” “separator,” “positive electrode,” “first recess,” “second recess,” and “first insulating glue layer.” Ex. 1003 ¶¶ 115-137.

59. I understand that Dr. van Sacken acknowledges that Sato does not disclose certain elements pertaining to the claimed “second insulating glue layer,” at least regarding its sizing as compared to a second recess:

Sato discloses an additional polypropylene adhesive tape. EX1005, ¶[0137]; EX1003, ¶149.

Sato discloses placing the additional polypropylene adhesive tape in the vicinity of the negative lead to prevent lithium plating, *Sato is silent about the adhesive tape having a width larger than a width of the second recess and a length larger than a length of the second recess.* However sizing an insulating tape to overlap the entirety of a recess and extend over portions surrounding all four sides of the recess was well known, as evidenced by Takemura.

Ex. 1003 ¶ 149.

60. To address Sato's shortcomings, I understand Dr. van Sacken relies solely on the background section of Takemura and, specifically, the tape of Takemura's Figures 8 and 9. Figures 8 and 9 of Takemura describe the so-called background or prior art. Specifically, I understand Petitioner relies on the following analysis of its expert, Dr. van Sacken:

As illustrated in both Takemura's Figure 8 and Figure 9, the insulating tape 7 is sized such that it overlaps (i) *all* the exposed metal on the negative current collector 6 and (ii) the edge of the negative active material 4 above and below the negative lead 2.

Thus, Takemura explicitly discloses that the insulating tape 7 has a width (measured along the length of the negative electrode cross-section in Figures 8-9) larger than the exposed metal on the negative current collector 6.

Ex.1003 ¶¶ 150-151; Pet. 36-37. Dr. van Sacken does not acknowledge that he is referring to the background.

61. I understand that Dr. von Sacken opines that a POSITA would be motivated to combine the tape of Takemura's Figures 8 and 9 with Sato's battery to prevent lithium plating. Specifically, I understand that Dr. von Sacken opines that "it would have been obvious to a POSA to locate Sato's insulating tape, as taught by Takemura, opposite to the negative lead connection on Sato's negative lead," because such a modification would have "ensured that Sato's negative lead 5L and adjacent exposed metal in Sato's recess (exposed portion 12) were protected from undesirable lithium plating." Ex.1003 ¶ 112. In view of Takemura's disclosure of

Figures 8 and 9, Dr. van Sacken opines that “it would have been obvious to a POSA to apply Sato’s additional polypropylene adhesive tape such that it had a width and length larger than the width and length of the exposed portion 12/14 (second recess) formed in Sato’s negative electrode active material layer 5B/9 accommodating the negative lead 11.” Ex.1003 ¶ 153.

62. For the reasons set forth below, I disagree and it is my opinion that a POSITA would not be motivated to combine the tape of Takemura’s Figures 8 and 9 with Sato’s battery. Dr. van Sacken and Petitioner are relying on the background of Takemura and do not take into account the complete disclosure of Takemura. Specifically, Petitioner and Dr. von Sacken overlook the fact that Takemura disparages the use of tape and, thus, undercuts the proposed combination by explicitly teaching that a POSITA should *minimize* or *eliminate* the use of tape—that is, that they should not use the structure depicted in Figures 8 and 9.

63. Takemura describes the tape of Figures 8 and 9 in the background section and then explicitly teaches not to use tape for a variety of reasons. Ex. 1006 ¶¶ [0002]–[0004], [0035].<sup>1</sup> In fact, Takemura uses the electrode structure of Figures

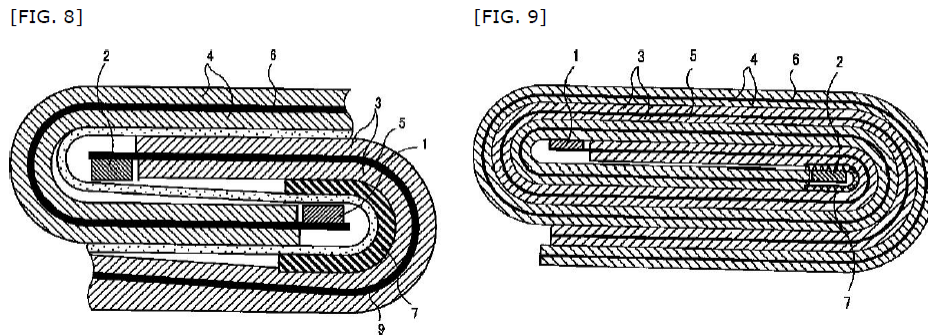
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<sup>1</sup> In FIG. 4, Takemura describes using a minimal amount of tape at the *winding end* of an electrode. Ex. 1006 ¶ [0022], FIG. 4. I understand this tape is not relied on by

8 and 9 in disfavored comparative example 1 against which it shows the benefits of its own invention. Ex. 1006 ¶¶ [0035] (Fig. 8 depicts an enlarged portion comparative example 1), [0031] (Fig. 9 depicts comparative example 1), [0003] (Fig. 9 depicts a conventional lithium-ion battery); *see also* Tables 1 and 2 (demonstrating that comparative example 1 has a reduced discharge capacity compared to the examples of Takemura's invention). Takemura describes comparative example 1 as a conventional lithium-ion battery with a positive and negative electrode with active material layers 3 and 4. *Id.* ¶¶ [0003], [0009], [0031] (Figure 9 depicts comparative Example 1). In this battery, the positive active material 3 is covered with masking tape 7. *Id.* ¶ [0008]. Comparative example 1 can be viewed in Figures 8 and 9 below.

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Petitioner. This tape has nothing to do with the claimed “first insulating glue layer” or the claimed “second insulating glue layer.” The claims recite that the “first insulating glue layer” is provided on “a top surface of the positive lead” and that the “second insulating glue layer” is located “opposite to the second recess across the separator in a thickness direction.” Takemura's FIG. 4 tape is not used over a lead (as in the claimed “first insulating glue layer,”) nor is it positioned opposite a recess (as in the claimed “second insulating glue layer”) or even opposite to a lead.



*Id.*, FIGS. 8, 9. Takemura explicitly disfavors Comparative Example 1, explaining how Takemura’s invention achieves advantages over the background including increasing discharge capacity and the rate of deterioration of discharge capacity after cycling as shown below in Tables 1 and 2.

|                          | Example 3 | Comparative Example 1 |
|--------------------------|-----------|-----------------------|
| Discharge Capacity (mAh) | 340       | 280                   |

Table 1

|                                           | Example 3 | Comparative Example 1 |
|-------------------------------------------|-----------|-----------------------|
| Initial Discharge Capacity (mAh)          | 340       | 280                   |
| Discharge Capacity After 100 Cycles (mAh) | 308       | 240                   |
| Deterioration (%) After 100 Cycles        | 90.6      | 85.7                  |

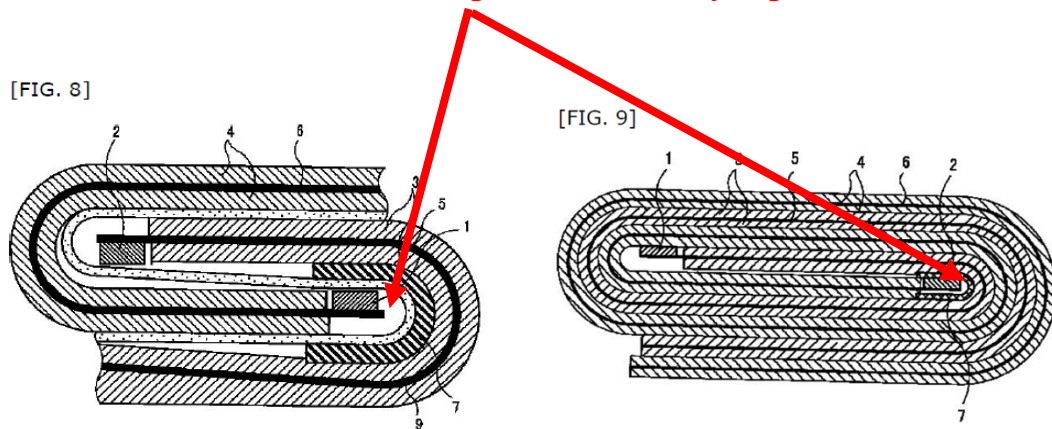
Table 2

*Id.* ¶¶ [0033]–[0037], Tables 1, 2.

64. Based on the problems identified with regard to comparative example 1, which is the battery of Figures 8 and 9, Takemura disclosed *eliminating or minimizing* the use of tape. Takemura explains that “[f]or the lithium-ion secondary

battery shown in Fig. 9, there has been [a] demand for improvements. . . . ***especially in order to make batteries smaller and thinner.***” *Id.* ¶ [0004]. Takemura describes that “[e]qually important” is to provide batteries with “higher energy densities.” *Id.* In the “Technical Problem” section, Takemura explains why the battery design of FIGS 8 and 9 and insulating tape 7 ***are inadequate and prevent batteries from becoming smaller.*** *Id.* ¶ [0010]. Indeed, Takemura explicitly teaches that “the presence of extra active material and ***masking tape*** in [the] positions [of FIGS. 8 and 9] leads to a decrease in energy density, an increase in the overall thickness of the battery.” *Id.* ¶ [0010]. In the batteries of Figures 8 and 9, “***extra space*** readily occurs . . . due to the thickness of current collector terminals 1, 2 ***and the insulating tape*** 7.” ¶ [0035]. The extra space caused by the insulating tape 7 can be viewed below.

**Takemura’s “Problem” of “extra space” caused by tape 7 in FIGS. 8 and 9**



65. After highlighting problems with the tape of comparative example 1, Takemura provides a solution, eliminating or minimizing tape, that solves the

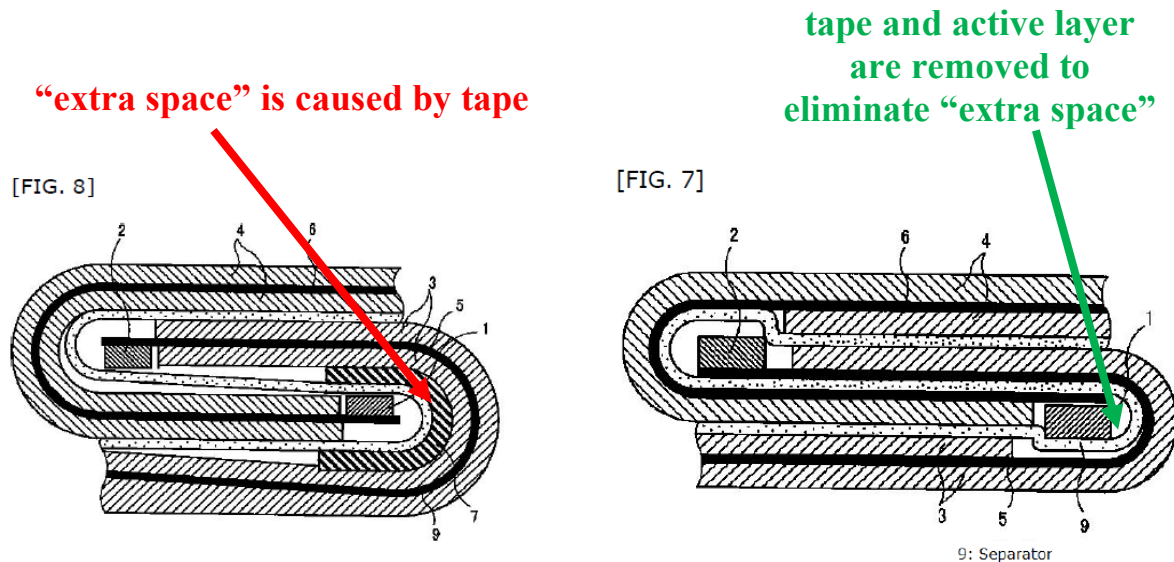
problems *caused specifically by the location and size of insulating tape 7* as illustrated in Figures 8 and 9. *Id.* ¶¶ [0004], [0035]. For example, in the “Solution to Problem” section, Takemura specifically describes the issues of increased thickness and lack of energy density of Figures 8 and 9 and provides its improved solution—*eliminating or minimizing* the tape, not *expanding* it. *Id.* ¶ [0035]. To “reduce excess thickness,” Takemura teaches *eliminating* portions of the active material and *eliminating or minimizing* insulating tape. *Id.* (teaching in Figures 8 and 9 that “extra space readily occurs in the innermost portion due to the thickness of current collector terminals 1, 2 and the insulating tape 7” but that “in FIG. 7, extra space is less likely to exist”). That is, Takemura is clear that the tape should be *eliminated or minimized*.

66. By using uncoated layers and *removing* the tape of Figures 8 and 9, Takemura teaches the POSITA that several advantages were achieved:

- “a higher discharge capacity was obtained,”
- “volumetric energy density was improved”
- “improve[d] cycle characteristics” were obtained
- “suppresse[d] battery degradation with respect to repeated use” was achieved, and
- an “extend[ed] battery life” was obtained.

*Id.* ¶¶ [0035]-[0036].

67. A comparison of Takemura's invention compared to the disparaged use of tape is illustrated below:



*Id.*, FIGS. 7, 8 (annotations added).

68. In view of the advantages disclosed by eliminating or minimizing insulating tape and further in view of the clear disparagement of Figures 8 and 9 (and the related disclosure), it is my opinion that Takemura teaches away from using the tape of Figures 8 and 9 (which show background art over which Takemura has improved) and, thus, Dr. von Sacken and Petitioner fail to demonstrate that a POSITA would combine Takemura's tape with the other references as they have now proposed and, further, that a POSITA would have modified "the insulating tape

[to have] a length larger than the length of the exposed metal on the negative electrode current collector.” *Id.*

69. I also disagree with Dr. von Sacken’s conclusion that prevention of lithium deposition is a motivation to use Takemura’s tape. Instead of using tape to prevent lithium deposition, Takemura teaches removing the active layer, thereby avoiding the “extra space” caused by the tape. Ex. 1006 ¶¶ [0035] (teaching removing tape to eliminate “extra space”), [0019] (teaching the uncoated portion “prevents lithium metal deposition”). Dr. von Sacken’s analysis simply ignores Takemura’s disparagement of tape and its teachings that removing the active layer is the preferred method to prevent lithium deposition. Ex. 1006, § IX.C (paragraphs 108–113). Takemura itself undercuts Dr. von Sacken’s rationale that a POSITA would be motivated to use Takemura’s tape to prevent lithium deposition because Takemura teaches an alternative approach that is better for preventing lithium deposition—removing the active layer. Ex. 1006 ¶ [0035]. In my opinion, Dr. von Sacken and Petitioner’s analysis fail to address this teaching or explain why a POSITA would disregard it.

70. In my opinion, the errors with Dr. von Sacken’s motivation to combine analysis are made even clearer when the proposed combination is viewed as a whole. Not only does Dr. von Sacken conclude that Takemura’s disfavored tape would be combined with Sato, Dr. von Sacken concludes that a POSITA would combine the

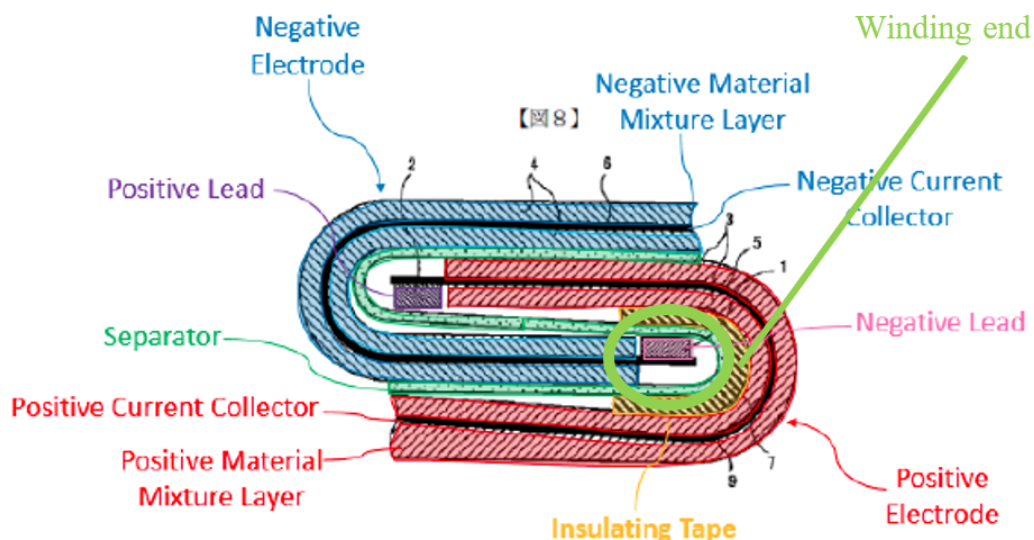
existing tape in Takemura's background figures (which Takemura teaches to minimize or eliminate in its invention) with even *more* tape. Ex. 1006 ¶ [0035]. Specifically, Dr. von Sacken opines that a POSITA would combine Takemura's tape with Sato's tape which Petitioner claims to have mapped to the claimed "first insulating glue layer." Ex. 1006 ¶ 134; Pet., 31-32. Given Takemura teaches a solution of eliminating tape (as I have discussed in detail above), Dr. von Sacken's combination with more tape contradicts the teachings of Takemura for this additional reason.

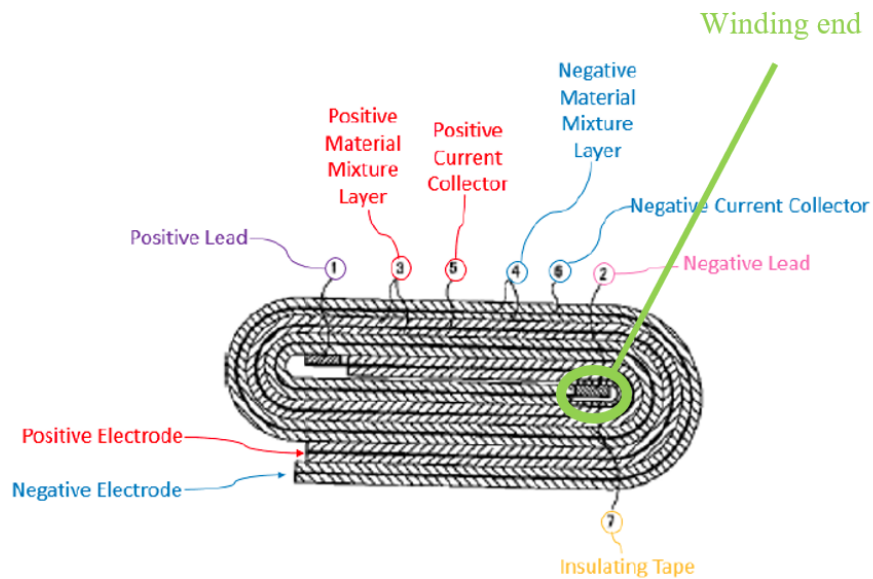
71. In sum, it is my opinion that Takemura disparages, and thus teaches away from, the ape placement of Figures 8 and 9, and therefore a POSA would not be motivated to combine the tape of Figures 8 and 9 of Takemura with Sato.

**b. Takemura does not render obvious a "second insulating glue layer" that "has a length larger than a length of the second recess"**

72. I understand Petitioner agrees that Sato and Takemura are silent *about the claimed length* of the "second insulating glue layer." Pet., 22 ("Takemura does not illustrate that the insulating tape has a length larger than the length of the exposed metal."), 36 ("*Sato is silent* about the adhesive tape having a width larger than a width of the second recess and a length larger than a length of the second recess."). Petitioner then asserts that, even though Takemura does not teach to do so, a POSITA would extend the tape in Figures 8 and 9 of Takemura so that it had "a

length larger than the length of the exposed metal on the negative electrode current collector” for several reasons. Pet., 37. But each of Petitioner’s alleged reasons for expanding the tape is undercut by Takemura itself. As such, in my opinion, Takemura (and Sato) do not render obvious “a second insulating glue layer” that “has a length larger than a length of the second recess.” I understand Petitioner relies on Takemura’s FIGS. 8 and 9 to teach “the second insulating glue layer has a width larger than a width of the second recess.” Pet., 36-38. As shown below in Petitioner’s annotated figures, Takemura’s insulating tape is wound around the winding end of the negative electrode.





Pet., 37 (showing annotated FIGS. 8, 9, light green annotations added).

73. First, I understand there is no dispute that Takemura is silent about the claimed the length of the “second insulating glue layer.” Pet., 38 (“Takemura does not illustrate that the insulating tape has a length larger than the length of the exposed metal. . . .”), 36 (“*Sato is silent* about the adhesive tape having a width larger than a width of the second recess and a length larger than a length of the second recess.”). Takemura discloses only the cross-sectional view of the battery in the width direction. Ex. 1006, FIGS. 8, 9.<sup>2</sup>

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<sup>2</sup> Even in the width direction, Takemura fails to disclose the size of its tape because, while FIG. 8 and 9 show the width direction, the *specification* is silent on the issue

74. Despite a lack of teaching in Takemura, I understand Petitioner asserts that a POSITA would have found it obvious to size the tape greater in the *length* direction “to minimize exposing the negative electrode metal to lithium ions released from the positive active material.” Pet. at 36. But, in my opinion, this is inapposite to the clear disclosure of Takemura.

75. As explained above, Takemura’s solution is to *eliminate* or *minimize* the use of tape—not to increase its coverage or size. Ex. 1006 ¶¶ [0035] (teaching in Figures 8 and 9 that “extra space readily occurs in the innermost portion due to the thickness of current collector terminals 1, 2 and the insulating tape 7” but that when removing tape “in FIG. 7, extra space is less likely to exist”), [0010] (“the presence of extra active material and *masking tape* in [the] positions [of FIGS. 8 and 9] leads to a decrease in energy density, an increase in the overall thickness of the battery); *supra*, Section VII.A.1.a. As such, it is my opinion that a POSITA would not have done the exact opposite of that taught by Takemura.

76. Takemura describes the tape of Figures 8 and 9 in the background section and then teaches not to use the battery design of these figures by making the battery of Figures 8 and 9, comparative example 1. Ex. 1006 ¶¶ [0002]–[0004],

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of size of the tape, let alone the sizing of it with a width larger than a width of any recess as claimed.

[0035]. In fact, Takemura uses the electrode structure of Figures 8 and 9 in disfavored comparative example 1 against which it shows the benefits of its own invention by comparison. Ex. 1006 ¶¶ [0035] (Fig. 8 depicts an enlarged portion comparative example 1), [0031] (Fig. 9 depicts comparative example 1), [0003] (Fig. 9 depicts a conventional lithium-ion battery); *see also* Tables 1 and 2 (demonstrating that comparative example 1 has a reduced discharge capacity). In comparative example 1, the positive active material 3 is covered with masking tape 7. *Id.* ¶ [0008]. Takemura explicitly disfavors Comparative Example 1, explaining how Takemura’s invention, eliminating or minimizing tape, achieves advantages over this invention including discharge capacity and the rate of deterioration of discharge capacity over time as shown in Tables 1 and 2. *Id.* ¶¶ [0033]–[0037], Tables 1, 2.

77. Takemura teaches that the tape in comparative example 1 causes a number of problems. “For the lithium-ion secondary battery shown in Fig. 9, there has been [a] demand for improvements. . . . ***especially in order to make batteries smaller and thinner.***” *Id.* ¶ [0004]. In the “Technical Problem” section, Takemura explains why the battery design of FIGS 8 and 9 and insulating tape 7 ***are inadequate and prevent batteries from becoming smaller.*** *Id.* ¶ [0010]. Indeed, Takemura explicitly teaches that “the presence of extra active material and ***masking tape*** in [the] positions [of FIGS. 8 and 9] leads to a decrease in energy density, an increase in the overall thickness of the battery.” *Id.* ¶ [0010]. In the batteries of Figures 8 and

9, “*extra space* readily occurs . . . due to the thickness of current collector terminals 1, 2 *and the insulating tape* 7.” ¶ [0035]. The extra space caused by the insulating tape 7 can be viewed below.

78. Second, Petitioner’s assertions are further undercut because Takemura does not disclose using tape in a recess at all. Instead, Figures 8 and 9 depict tape around a winding end at the “innermost portion.” Ex. 1006 ¶ [0035] (“In Comparative Example 1, as shown in the enlarged central portion of the electrode structure in FIG. 8, extra space readily occurs in the innermost portion due to the thickness of current collector terminals 1, 2 and the insulating tape 7”). A POSITA would understand that an end is not a recess. Indeed, these winding ends are different than the recesses of the ’498 Patent, each of which occur in the middle of the electrode. Ex. 1001, 5:24-30 (describing distance between recess and end of electrode), 6:60-7:2 (same), 7:27-36 (same), 7:60-8:3 (same), 8:15-25 (same), FIGS. 1 – 5 (showing recesses in middle). Unlike Figures 8 and 9 of Takemura, the recesses of the ’498 Patent are bounded on both sides by an active material layer. *Compare id. with* Ex. 1006 ¶ [0035], FIGS. 8, 9. Indeed as Claim 1 recites, the active material layer is “provided with” a second recess that has both a “width” and a “length.” In contrast, the active material layer Figures 8 and 9 of Takemura ends, the winding end is entirely outside of the active material layer and therefore has no boundary defining a width. Ex. 1006 ¶ [0035], FIGS. 8, 9.

79. Third, I note that tape placement and sizing is a complicated matter. In my experience, the tape commonly used in lithium-ion cells is typically ~25-50 microns thick. This thickness can become problematic when the tape is not sized and positioned carefully. Ex. 1006 ¶ [0010]. As Takemura teaches, tape can cause extra thickness (i.e., bulging) around the tape that decreases the density of the battery. *Id.* In my opinion, a POSITA would be dissuaded from adding any more insulating tape than was strictly necessary due to the cost of decreased energy density due to increased battery thickness.

80. In sum, Takemura fails to disclose the length of its tape, let alone disclose or render obvious tape that is longer than the second recess.

**c. Sato does not disclose a battery with both a “first recess” and a “second recess”**

81. In my opinion and as explained below, Sato never discloses a battery with an electrode having a first recess and another electrode having a “second recess”—only two different configurations of batteries, each with only one electrode having a recess: (1) one configuration having a recess on the positive electrode and no recess on the negative electrode and (2) another configuration having a recess on the negative electrode with no recess on the positive electrode. It is my opinion that the POSITA would not combine the two disparate configurations of Sato.

82. I understand that for Ground 1 (and for Ground 4 as discussed later) Petitioner relies on Sato as a primary reference. I understand that Petitioner asserts Sato discloses a battery with both a “first recess” on the positive active material layer and “a second recess” on the negative active material layer. I understand Petitioner relies on Sato to disclose a positive lead within a recess, and claims to map that recess to the claimed “first recess.”

Sato provides the positive active material layer (4B/9) with a first recess with an exposed portion 12/14 defined where “the mixture layer 9 is not formed on each of both surfaces of the current collector 10.” EX1005, ¶[0039]. Sato’s positive lead is coupled to positive electrode 4 by an extension lead 11/4L “connected to one of the surfaces of the exposed portion 12” of current collector 10.<sup>5</sup> EX1005, ¶¶[0039], [0093], [0111]- [0113]; EX1003, ¶¶120-122, 176.

Pet. at 26-27.

83. Similarly, I understand Petitioner relies on Sato to disclose a negative lead within a recess, and claims to map that to the claimed “second recess.”

84. Sato provides the negative active material layer (5B/9) with a second recess with exposed portion 12 defined where “the mixture layer 9 is not formed on each of both surfaces of the current collector 10.” EX1005, ¶[0039]. Sato’s negative lead is coupled to negative electrode 5 by an extension lead 11/5L “connected to one of the surfaces of the exposed portion 12” of current collector 10. EX1005, ¶¶[0039], [0093]; EX1003, ¶¶127-129, 178.

85. Pet. at 29-30.

86. But Sato discloses separate embodiments. Sato describes 11 different embodiments, referring to each as Battery 1, Battery 2, and Battery 3 through Battery

11. Ex. 1005 ¶¶ [0104], [0111], [0136]-[0137], [0148]. These embodiments fall into one of two categories of battery configurations. In the first, describing Batteries 1 through 7 (*id.* ¶ [0101]),<sup>3</sup> Sato discloses an electrode where the negative lead is at the electrode's end and the *positive* lead is within the middle of the positive electrode. *Id.* ¶¶ [0104], [0111] (describing negative lead on exposed “*outermost portion*”).

87. In Batteries 8 through 11, the *negative* lead is in the middle of the negative electrode (*id.* ¶¶ [107], [0136]-[0137]), while positive lead is at the end of the positive electrode. *Id.* ¶ [0137] (describing the exposed portion where the positive lead was located as the “*at the innermost portion.*”). This lead location applies to Battery 9, Battery 10 and Battery 11. *Id.* ¶¶ [0139], [0141], [0143]. However, Petitioner relies on Sato's Battery 1 to teach the location of a “first recess” (positive recess in the middle) and Battery 8 to teach the location of the “second recess” (negative recess in the middle). Pet., 26-27 (citing disclosures for Battery 1 for the first recess), 29 (citing disclosures for Battery 8 for the second recess).

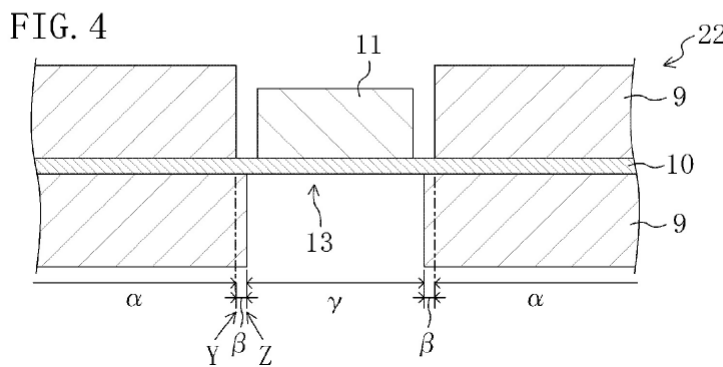
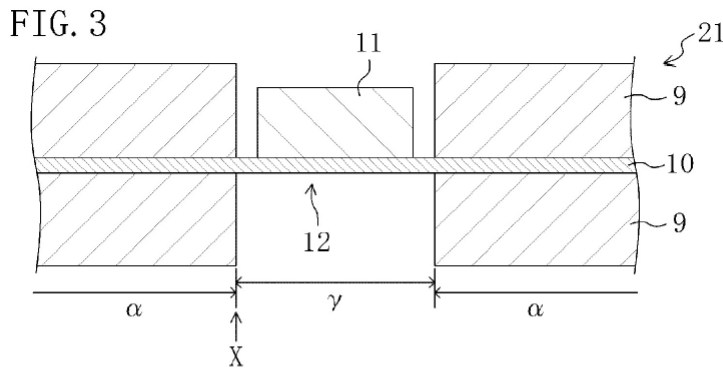
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<sup>3</sup> Batteries 2 through 7 have the same location of the exposed portion as Battery 1, which is described in paragraphs [0104] and [0111]. *Id.* ¶ [0115] (Battery 2), ¶ [0117] (Battery 3), ¶ [0119] (Battery 4); ¶ [0121] (Battery 5); ¶ [0123] (Battery 6); ¶ [0125] (Battery 7).

88. Petitioner’s expert, Dr. von Sacken, acknowledges that the proposed combination relies on the different embodiments of Sato. Ex. 1003 ¶ [0136] (Dr. von Sacken stating “the following annotated figures show Sato’s positive electrode plate *according to Battery 1* and negative electrode plate *according to Battery 8*”); *see also id.* ¶ [0136], n. 5 (Dr. von Sacken stating “Sato’s Battery 8 includes a positive electrode and negative electrode made in the same manner as described in Battery 1 except for the placement of the tabs”). Accordingly, Sato fails to describe an embodiment with a positive electrode active material layer provided with a “first recess” and a negative electrode active material layer provided with a “second recess” as claimed.

89. Additionally, Dr. von Sacken states that a “POSA combining Battery 1 and Battery 8 would understand that this arrangement [of a lead in a recess] is suitable for both positive and negative electrodes and that combining them would reduce the ‘current collection resistance.’” I disagree with this conclusion. In my opinion, a POSITA would not be motivated by “current collection resistance” because (1) it would frustrate Sato’s primary purpose of passing a crush test (2) Sato nowhere seeks to improve current collection resistance and (3) current collection resistance is generally a battery trait that is secondary to ionic resistance and energy density.

90. First, it is my opinion that a POSITA would not have modified Sato at least because it would frustrate Sato’s primary purpose, to survive a crush test. Sato improves the likelihood of passing a crush test by increasing the durability of an electrode at one of its weakest points—the middle. Specifically, Sato teaches the specific “problem” of this prior art is that “the presence of the lead in the middle portion [of the electrode] tends to cause a stress.” Ex. 1003 ¶ [0024]. The stress identified by Sato becomes especially problematic if a recess is formed on both sides (i.e., top and bottom) of the active material. *See, id.* Unlike the ’498 Patent, Sato’s solution is to improve the structural integrity around the recesses by sizing a recess on top of the electrode with different dimensions than the recess on the bottom of the electrode, such that the edges of the top recess does not align with the edges of the bottom recess. *Id.* ¶ [0015]. As can be seen below, in the comparative example (Figure 3), the edges of the top and bottom recess of an electrode align. *Id.*, FIG. 3, ¶ [0038]-[0039]. In Sato’s solution—as shown in Figure 4—the edges do not align, due to the relatively larger width of the top recess compared to the width “ $\gamma$ ” of the bottom recess. *Id.*, FIG. 4, ¶ [0040].



*Id.*, FIGS. 3, 4.

91. Modifying Sato to include a recess on each electrode would reduce the likelihood to pass a crush-test. Sato teaches the specific “problem” of prior art is that “the presence of the lead *in the middle portion* [of the electrode] *tends to cause a stress*.” Ex. 1003 ¶ [0024]. Sato’s goal is to *reduce this stress* such that the battery will survive a crush test. *Id.*; Ex. 1003 ¶¶ [0008], [0009], [0022]-[0025]; [0042]. Sato’s solutions, which all have only one lead in the middle portion, overcome the stated problem by minimizing stress. *Id.* If Sato added an additional lead in the middle, as Petitioner contends, the additional recess would “tend[ ] to cause [additional] stress.” Ex. 1003 ¶ [0024]. Therefore, it is my opinion that adding an

additional recess to accommodate the presence of the lead in the middle portion would be nonobvious to a POSITA, counter to Sato's acknowledgement that leads in the middle of an electrode increase stress, counter to Sato's goal of reducing stress, and counter to Sato's embodiments which all use one recess.

92. Second, Sato nowhere seeks to reduce "current collection resistance." Sato teaches that the *prior art* has improved current collection by using a recess, but doing so comes with the problem of increased stress and failure of a crush test. Ex. 1005 ¶ [0024] (describing that, in Patent Document 2, "when an external force is applied, the presence of the lead in the middle portion tends to cause a stress . . ." but "[t]his problem, however, is not pointed out in Patent Document 2"). This is the very problem Sato intends to solve, but its proposed solution and advantages would be wholly defeated by Petitioner's proposed modification. Ex. 1003 ¶¶ [0008], [0009], [0022]-[0025], [0042]. Therefore, even assuming a POSITA wanted to improve current collection resistance beyond the prior art—in my opinion a POSITA would still be dissuaded from improving the current collection resistance *at the expense* of sacrificing structural integrity in complete disregard for Sato's primary purpose.

93. Third, current collection resistance is not a critical problem in most Li-ion cells because "ionic resistance" far dominates over current collection resistance in cells. Therefore, a POSITA would generally not be motivated to improve current

collection resistance, because such improvements would be minimal compared to the more difficult problem of ionic resistance.

94. In sum, Sato does not disclose a battery with “a positive active material layer being provided with a first recess” and a “negative electrode active material layer being provided with a second recess.” In my opinion, Petitioner does not provide a reasonable explanation for combining one recess from one embodiment with another recess from another embodiment. Furthermore, it is my opinion that a POSITA would not be motivated to combine portions of the different embodiments in Sato in the way Petitioner contends due to Sato’s goal of passing a crush test and limiting stress caused near the leads. Including two recesses in both the middle of the positive electrode and the middle of the negative electrode would thus defeat the stated purpose and frustrate the alleged improvement of Sato.

## **2. Claim 17 is Not Unpatentable**

95. For Claim 17, Petitioner relies on the same arguments discussed above for Claim 1. Pet. § IX. B.1 (addressing Claims 1 and 17 together, starting on page 23). Therefore, at least for the same reasons discussed above for Claim 1 (Section VII.A.1), it is my opinion that the Petition fails to show Sato and Takemura render obvious Claim 17.

**3. Claims 2, 3, 6, 8, and 19 Are Not Unpatentable**

96. Claims 2, 3, 6, and 8 are not unpatentable at least for the same reasons as discussed above with respect to claim 1 and at least because they depend from claim 1. Claim 19 is not unpatentable at least for the same reasons as discussed above with respect to claim 17 and at least because it depends from claim 17. I reserve the right to address claims 2, 3, 6, 8, and 19 individually if this proceeding is instituted.

**B. Ground 2: Sato, Takemura, and Nakamura Do Not Render Obvious Claims 4, 5, 7, and 18**

97. In my opinion, Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 2 is unpatentable. Claims 4, 5, and 7 depend from Claim 1 and Claim 18 depends from Claim 17. I understand Petitioner relies on its Ground 1 arguments for the elements recited by independent Claims 1 and 17. Therefore, in my opinion, Claims 4, 5, 7 and 18 are not unpatentable for at least the same reasons as discussed above with respect to Ground 1.

**C. Ground 3: Sato, Takemura, Oh-539, and Oh-144 Do Not Render Obvious Claims 20 and 22**

98. In my opinion, Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 3 is unpatentable. Claim 20 depends from claim 1 and claim 22 depends from Claim 17. Petitioner relies on its Ground 1 arguments for the elements recited by independent Claims 1 and 17.

Therefore, in my opinion, claims 20 and 22 are not unpatentable for at least the same reasons as discussed above with respect to Ground 1.

**D. Ground 4: Sato, Takemura, and Kobayashi Do Not Render Obvious Claims 9-11, 14, and 16**

99. In my opinion, Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 4 is unpatentable. For claim 9, Petitioner relies wholly on its Claim 1/Ground 1 analysis for all the similar elements appearing in Claim 9, which make up a majority of the claim language. Pet., 68-69; *see also* Pet., 114-116. Therefore, it is my opinion that Ground 4 fails for all the same reasons identified for Ground 1 with respect to claim 1. *Supra*, Section VII.A.1.

100. Claims 10, 11, 14, and 16 depend from claim 9. Petitioner relies on its Ground 4 arguments for the elements recited by independent claim 9. Pet., 68-69; *see also* Pet., 114-116. Therefore, in my opinion, claims 10, 11, 14, and 16 are not unpatentable for at least the same reasons as discussed above with respect to Ground 1.

**E. Ground 5: Sato, Takemura, Kobayashi, and Nakamura Do Not Render Obvious Claims 12, 13, and 15**

101. Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 5 is unpatentable. Claims 12, 13, and 15 depend from claim 9. Petitioner relies on its Ground 4 arguments for the elements

recited by independent claim 9. Therefore, claims 12, 13, and 15 are not unpatentable for at least the same reasons as discussed above with respect to Ground 4.

**F. Ground 6: Sato, Takemura, Kobayashi, Oh-539, and Oh-144 Do Not Render Obvious Claim 21**

102. Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 6 is unpatentable. Claim 21 depends from claim 9. Petitioner relies on its Ground 4 arguments for the elements recited by independent claim 9. Therefore, claim 21 is not unpatentable for at least the same reasons as discussed above with respect to Ground 4.

**G. Ground 7: Takemura, Oh-539, and Kobayashi Do Not Render Obvious Claims 1-3, 9-11, and 17**

103. Petitioner contends that Takemura, Oh-539, and Kobayashi render obvious claims 1-3, 9-11, and 17 of the '498 Patent. Independent claims 1, 9, and 17 recite:

1. A lithium-ion battery, comprising:

a positive electrode comprising a positive current collector and a positive electrode active material layer containing  $\text{LiCoO}_2$ , wherein the positive electrode active material layer is formed on the positive current collector, the positive electrode active material layer being provided with a first recess

accommodating a positive lead being coupled with the positive current collector;

a negative electrode comprising a negative current collector and a negative electrode active material layer containing graphite or silicon, wherein the negative electrode active material layer is formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

a separator disposed between the positive electrode and the negative electrode; and

an electrolyte,

wherein, a top surface of the positive lead is provided with a first insulating glue layer, a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer, the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

9. A lithium-ion battery, comprising:

a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector, the positive

electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

a negative electrode, comprising a negative current collector and a negative electrode active material layer being formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

a separator disposed between the positive electrode and the negative electrode; and

an electrolyte,

wherein, a first location of a top surface of the positive lead is provided with a first insulating glue layer; a second location of a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the

negative plate is pasted with a second insulating glue layer; a third location of a surface of the positive current collector opposite to the surface of the positive current collector where the positive lead is covered with another first insulating glue layer; the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

17. A lithium-ion battery, comprising:

a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector, the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

a negative electrode, comprising a negative current collector and a negative electrode active material layer being formed on the negative current collector, the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

a separator disposed between the positive electrode and the negative electrode; and

an electrolyte,

wherein, a first location of a top surface of the positive lead is provided with a first insulating glue layer; a

second location of a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer; the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess..

104. In my opinion, Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 7 is unpatentable, for the reasons below.

**1. The Petition Fails to Show That Takemura, Oh-539, and Kobayashi Render Obvious Claim 1**

**a. Takemura Teaches Away from the Arrangement of Tape in FIGS. 8 and 9**

105. As discussed above with respect to Ground 1, in my opinion, Takemura instructs a POSITA *not* to expand the tape of FIGS. 8 and 9 – the very opposite of what Petitioner claims a POSITA would be motivated to do. *Supra* § VII.A.1.a.

106. I understand that Petitioner relies on Takemura as a primary reference teaching claim elements such as a “battery,” a “positive electrode,” a “negative electrode,” and a “separator.” Pet. 88 -89, 91-92, 95-96. I understand that Petitioner relies on Oh-549 to disclose a first recess (Pet. at 90-91) and a second recess (Pet. 93-95). I further understand that—like Grounds 1 and 4—Petitioner relies wholly on Takemura’s Figures 8 and 9 tape to disclose tape with a width and length greater than a width and length of the second recess. Pet. 102-103. For the same reasons as discussed above in Grounds 1 and 4, its combination with Oh-549 fails.

107. I understand Petitioner argues a POSITA would be motivated to use “the width of Takemura’s insulating tape” which it argues is “greater than the width of the recess formed in the negative active material of Takemura’s negative electrode to cover all exposed metal.” Pet. 103, Ex. 1003 ¶¶ 397-398, 432-434, 460-462. Petitioner further asserts that “a POSA would have made the length of Takemura’s tape (measured along the electrode’s width) larger than the length of the current

collector's exposed surface in the Takemura-Oh-539 battery to avoid exposing negative electrode metal to lithium plating (or, at least, found this obvious)." Ex. 1003 ¶ 398. But this alleged motivation is undercut by Takemura itself for the same reasons discussed above with regard to Grounds 1 and 4. Takemura disparages the use of tape in Figures 8 and 9, seeking to solve the problems that tape causes by *eliminating or minimizing* the tape. A POSITA would therefore not have made the length of Takemura's tape *larger* as is asserted by Petitioner.

108. Unlike the claims of the '498 Patent, Oh-539 has nothing to do with preventing lithium deposition or using tape—it never mentions either. Oh-539 identifies a problem with the prior art, namely, that a "conventional lithium secondary battery is problematic in that its high-rate discharging characteristics are not good because the distance the electric current moves is long." Ex. 1007 ¶ [0006]. To solve this high discharging rate problem, Oh-539 discloses "decreasing the distance the electric current moves" in a battery. *Id.* ¶ [0007]. Oh-539 achieves this decreased distance by forming non-coated portions such that "tab 32 is connected of the cathode center non-coated portion." [0047]- [0048]; *see also id.* ¶¶ [0058]-[0060] (discussing center non-coated portions for the anode). Therefore, the current no longer has to travel from one end of the electrode to the other. *Id.*

109. I disagree that a POSITA would be motivated to combine Takemura's tape size from Figs. 8 and 9 with Oh-539. The motivation cannot be found in Oh-

539 because Oh-539 never mentions lithium deposition/plating or tape. *See, generally*, Ex. 1007. And the motivation cannot be found in Takemura because, as explained above, Takemura disparages the use of tape in Figures 8 and 9, seeking to solve the problems it causes. Section VII.A.1.a. Therefore, a POSITA would not be motivated to combine Takemura's Figure 8 and 9 tape with Oh-539.

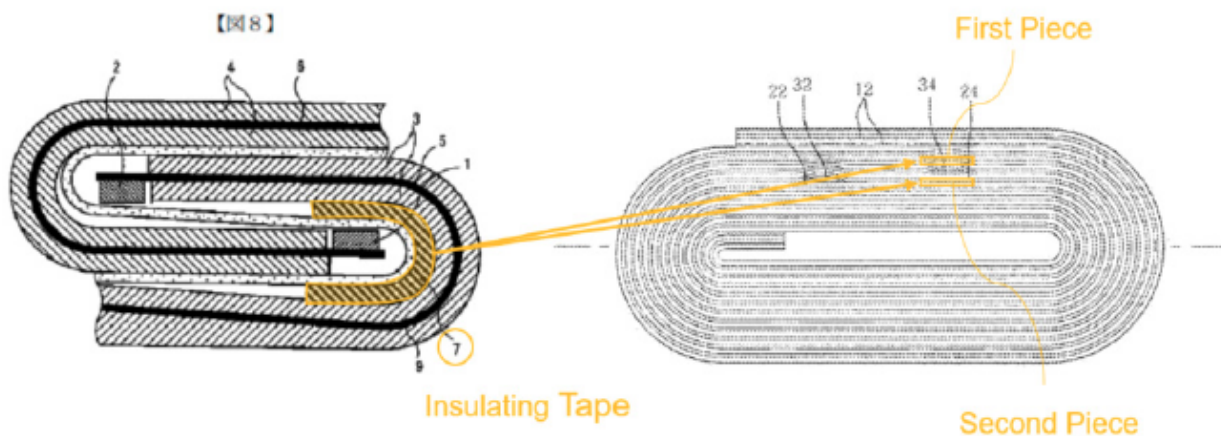
**b. Takemura does not render obvious a “second insulating glue layer” that “has a length larger than a length of the second recess”**

110. In my opinion, Takemura does not render obvious “a second insulating glue layer” that “has a length larger than a length of the second recess.” I understand that Petitioner relies entirely on Takemura to disclose this claim element. Pet., 102-103. But as explained in Section VII.A.1.b (and as Petitioner agrees), Takemura fails to disclose a second insulating glue layer having “a length larger than a length of the second recess.” Therefore, in my opinion, Ground 7 fails for the same reasons as identified for Grounds 1 and 4.

**c. Even if combined, the resulting combination of Takemura with Oh-539 would not result in placing the “second insulating glue layer” at the claimed location**

111. As explained below, it is my opinion that combining Takemura and Oh-539 would not result in a “second insulating glue layer” placed “opposite to the second recess.”

112. I understand Petitioner argues a POSITA would be motivated to combine Takemura and Oh-539 and “shift[ ] Takemura’s [Figure 8 and 9] tape on the surface of positive active material layer to remain opposite the negative lead connection to shield the exposed metal surfaces of the negative lead connection from lithium plating.” Pet. 99-100, Ex. 1003 ¶ 394. Petitioner and Dr. von Sacken argue “[s]pecifically, a POSA would have placed Takemura’s tape on the positive material layer surface opposite the second recess of Takemura-Oh-539 battery.” Pet. 100; Ex. 1003 ¶ 394. When combining Takemura’s tape with Oh-539’s central lead placement, Petitioner asserts a POSITA would place the tape in the central portions of the electrodes (as shown on the right-hand side in Petitioner’s annotated figures below). Pet., 99-100; Ex. 1003 ¶ 395.



113. Petitioner and Dr. von Sacken assert that “In combining Oh-539’s central placement of the negative lead connection with Takemura, a POSA would have likewise shifted Takemura’s tape on the surface of positive active material layer

to remain opposite the negative lead connection *to shield the exposed metal surfaces of the negative lead connection from lithium plating.*” Pet., 99-100; Ex. 1003

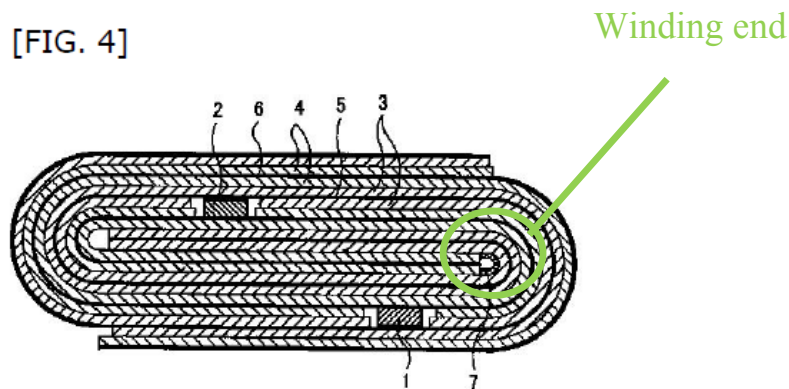
¶ 394-95. Dr. von Sacken further asserts that:

*To prevent lithium plating* at the exposed metal located on the top and bottom side of the second recess in the Takemura-Oh-539 battery, a POSITA would have been motivated to divide Takemura’s insulating tape 7, which is bent around top and bottom sides at an end of the electrode, into two pieces as shown above. The two pieces would be located at the second location as recited in element [1.H] of the ’498 patent—namely on a surface of the positive electrode active material layer across the separator from the second recess, with the first piece above and the second piece below the second recess.

Ex. 1003 ¶ 395.

114. It is my opinion that a POSITA would not have combined Takemura’s lithium plating prevention with Oh-539’s lead placement. But even assuming that a POSITA would have combined Takemura’s lithium plating prevention with Oh-539’s lead placement, which would be incorrect in my opinion, it is my opinion the combination would not be accomplished in the way proposed by Petitioner. If using Takemura’s teachings for how to avoid lithium plating, a POSITA would instead shave off the active material as taught by Takemura such that no tape is needed around Oh-539’s leads—which would not meet the claim limitations. Ex. 1006 ¶ [0019]. Takemura teaches removing active material to form “an active material uncoated portion . . . which prevents lithium metal deposition.” *Id.*

115. In fact, Dr. von Sacken’s hypothetical combination of Takemura’s tape with the central recesses of Sato is contradicted by Takemura’s actual teaching for how tape should be placed in a battery with a centrally located recess. In Figure 4—the only Takemura disclosure that has a lead in a recess (and not a figure Petitioner relied upon)—Takemura teaches placing a minimal amount of tape only at *the winding end* to prevent lithium deposition. *Id.* ¶ [0022] (“The positive electrode active material layer 3 opposite the beginning of the winding end of the negative electrode is covered with insulating tape 7 to prevent lithium metal deposition”). Minimal insulating tape 7 can be seen at the winding end of the electrode in Figure 4 below.



Ex. 1007, FIG. 4. Therefore, adding tape where Petitioner alleges—in the middle of Sato— would cause additional “extra space” at the locations of Oh-539, something which Takemura teaches a POSITA to avoid. Ex. 1006 ¶ [0035].

116. In other words, had Takemura actually contemplated disclosing the use of tape across recesses (and beyond), it had ample opportunity to do so. *Id.* Instead, it disclosed an *alternative* to placing tape “opposite” a recess. *Id.* And given Oh-539 is silent on the use of tape, neither Takemura nor Oh-539 can be relied upon to come up with the proposed “modified” version of Takemura.

**2. Claims 9 and 17 are Not Unpatentable**

117. For Claim 9 and 17, Petitioner relies on the same arguments discussed above for Claim 1. Pet. § XV.C (addressing Claims 1, 9, and 17 together on pages 88-100). Therefore, for at least the same reasons discussed above for Claim 1 (Section VII.G.1), it is my opinion that the Petition fails to show Takemura, Oh-539, and Kobayashi render obvious Claim 17.

**3. Claims 2, 3, 10, and 11 are Not Unpatentable**

118. Claims 2 and 3 are not unpatentable for at least the same reasons as discussed above with respect to claim 1 and at least because they depend from claim 1. Claims 10 and 11 are not unpatentable for at least the same reasons as discussed above with respect to claim 9 and at least because they depend from claim 9. I reserve the right to address claims 2, 3, 10, and 11 individually if this proceeding is instituted.

**H. Ground 8: Takemura, Oh-539, and Oh-144 Do Not Render Obvious Claims 20-22**

119. In my opinion, Petitioner fails to establish that there is a reasonable likelihood that at least one challenged claim of Ground 8 is unpatentable. Claim 20 depends from claim 1, claim 21 depends from claim 9, and claim 22 depends from claim 17. Petitioner relies on its Ground 1 arguments for the elements recited by independent Claims 1 and 17. Therefore, in my opinion, claims 20 and 22 are not unpatentable for at least the same reasons as discussed above with respect to Ground 1. Petitioner relies on its Ground 4 arguments for the elements recited by independent Claims 9. Therefore, in my opinion, claim 21 is not unpatentable for at least the same reasons as discussed above with respect to Ground 4.

**VIII. CONCLUSION**

120. In sum, it is my opinion that Grounds 1-8 of the Petition do not render any of Claims 1-19 of the '498 Patent unpatentable as obvious for the reasons I discuss above.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on the 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 Section 1001 of Title 18 of the United States Code.

Executed on June 10, 2025, in Livermore, CA.

A handwritten signature in black ink, appearing to read 'James Kaschmitter', is written over a solid horizontal line.

James Kaschmitter