

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BOE TECHNOLOGY GROUP CO., LTD.,
Petitioner

v.

OPTRONIC SCIENCES LLC,
Patent Owner

IPR2024-01132
Patent 7,586,121

DECLARATION OF ERIC BRETSCHNEIDER, PH.D.

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1. I, Eric Bretschneider, declare as follows:

I. INTRODUCTION

2. I have been retained by counsel for Patent Owner Optronic Sciences LLC in this proceeding. My credentials are described in my curriculum vitae, which is Exhibit 2006. I offer this report in response to the Petition for *Inter Partes* Review, Case No. 2024-01131 regarding U.S. Patent No. 7,586,121 (the "'121 Patent"), filed by Petitioner Boe Technology Group Co., Ltd.

3. I have been asked by Patent Owner's counsel to offer technical opinions relating to the '121 Patent, the alleged prior art, and the arguments and opinions presented by Petitioner and its expert, Dr. Dean Neikirk.

4. I am being compensated at my standard consulting rate of \$500 an hour, plus out-of-pocket expenses. My compensation does not depend on the testimony that I express in this Declaration, or on the outcome of these cases.

5. I have reviewed the papers and exhibits filed in this proceeding as of the date my declaration is signed. I understand that Petition challenged the patentability of claims 1-7 of the '121 Patent (the "Challenged Claims"). Specifically, the Petition sets forth the following challenges:

Ground	Claims	Stat. Basis	Prior Art
1	1-3 and 5	35 U.S.C. §102	Anzai
2	4	35 U.S.C. §103	Anzai in view of Yamazaki
3	1-7	35 U.S.C. §103	Yamazaki in view of Anzai

6. After performing the analysis described herein and applying the standard outlined below, in my opinion, none of the grounds provide a basis for concluding that claims 3,4, or 7 of the '121 Patent should be found invalid. I have no opinions about the other claims. My opinions are based on the record evidence, my knowledge and experience in the field, and my opinion as to the level of ordinary skill in the art.

II. BACKGROUND AND QUALIFICATIONS

7. My complete qualifications and professional experience are described in my Curriculum Vitae, a copy of which is attached as Exhibit 2021.

8. I have over 30 years of experience with LEDs, displays, lighting fixtures, and lighting including a comprehensive background in a full range of LED technologies, including solid state lighting (SSL) fixture/lamp design, integration, and reliability, LED chip and package testing and reliability, fabrication, optical design, thermal management, and color conversion.

9. Throughout the course of my career, I have designed and transferred into manufacturing over 150 different LED-based lighting products, including LED lighting products designed to be installed in fixtures and in different lighting

environments and applications. I have also designed and transferred into manufacturing dozens of different LED chips and packages for a variety of different applications with a particular focus on display applications and general lighting.

10. I am recognized as a leading expert in matters related to reliability for all types of LED technology and have consulted with numerous companies to help develop internal testing methods and reliability standards for evaluating their products.

11. I am currently the Chief Technology Officer at EB Designs & Technology. In that capacity, I am, among other things, responsible for the design of solid-state lighting technologies for clients ranging from startups to Fortune 100 companies.

12. I also served as a member of the University of Florida's Department of Chemical Engineering Advisory Board for 25 years, from 1998 until 2022. During my tenure on this Advisory Board, I served as Chair for a total of 8 years. I also served on the Dean's Advisory board for the College of Engineering at the University of Florida from 2007-2009 and 2017-2022. I have been a Conference Chair for LED Measurement and Standards. I am also a member of numerous professional societies, including the International Society for Optics and Photonics (SPIE), Optica, the Society for Information Display (SID), the Materials Research Society (MRS), and the Illuminating Engineering Society (IES).

13. Inside the IES, I am a founding member of the Science Advisory Panel, which has oversight over all testing and technical committees and work groups inside the IES. I am also a full member of the Test Procedures Committee which develops test, measurement and reliability standards for LEDs and lighting fixtures. Inside the Test Procedures Committee, I serve as chair of the projections and reliability subcommittee which develops reliability standards for LED based lighting products including utilizing all forms of lighting technologies. I recently led the work group that revised TM-21 which is the internationally accepted standard for predicting reliability of LED packages. I also developed a new mathematical model that, for the first time, allows prediction of the color shift of an LED package over its time. This model is the basis for a new IES standard known as TM-35, which predicts the rate of color shift for LED products over time.

14. I joined the IES in 2006 and have been a member of the Test Procedures Committee since that time. As a result, I have been an active participant in the development of testing standards related and have helped to formalize the terminology for solid state lighting since the beginnings of the industry. Additionally, I serve on the IES Color Committee and the IES Photobiology Committee.

15. I previously served as Chief Technology Officer at QuarkStar, LLC., from 2016 until 2023. QuarkStar is primarily a technology development company

that is focused on new approaches to improving performance and efficiency of products that rely on LED light sources. In this role, I helped negotiate the company's first technology license to a European manufacturer of lighting fixtures. This technology has since be incorporated into one of their premium product lines. I also lead the efforts to transition products into manufacturing to produce fixtures for the Museum of Fine Arts, Houston (MFAH). These fixtures provide over 60% of the artificial lighting in a \$500 million expansion.

16. Prior to my position at EB Designs & Technology, I served as the Director of Engineering at HeathCo, LLC. In that capacity, I was responsible for advanced technology/product development related to solid-state lighting, sensors, notifications, and control products.

17. Prior to my position as Director of Engineering at HeathCo, I was at the Elec-Tech International Co., Ltd., where I held the positions of Chief Engineer, ETi Lighting Research Institute and VP of Research and Development, ETi Solid State Lighting. In my Elec-Tech capacities, my responsibilities included developing all technology and product roadmaps for markets in North America, China, Europe, and Japan. I designed and developed LEDs, LED packages and LED based lighting products for all of these markets.

18. Between 2008 and 2011, I was at Lighting Science Group Corporation (LSG), first as a product development manager, and my responsibilities included

developing solid state lighting products, then as VP of Research, and my responsibilities included developing advanced LED models for product development and production control. In these roles, I was involved in the design and manufacture of numerous LED-based lighting fixtures and products. The products I helped launch included LSG's C2D (Curb to Door) products. These products were designed to be installed in outdoor locations including wall packs, parking lots, and streetlights. These fixtures, particularly the wall pack fixtures, were also suitable for installation in public transportation areas.

19. Between 2004 and 2008, I was at Toyoda Gosei North America, where I was a sales manager, and my responsibilities included managing and developing LED die and package sales accounts from the eastern region of North America. I was also tasked with providing technical support for the entire western hemisphere. The support I provided included design of LED packages and design of lighting fixtures and products that incorporated LED packages. Notable successes at Toyoda Gosei included expanding market niches and applications for LED based backlights for LCD displays. I provided significant technical and design support to large customers, including 3M, Global Lighting Technologies, Apple, Dell, and Hewlett Packard.

20. Between 2003 and 2004, I was at Beeman Lighting, where I was Director of Solid State Lighting Engineering, and my responsibilities included leading development of solid state lighting systems and materials.

21. Between 1998 and 2003, I was at Uniroyal Optoelectronics. Uniroyal Optoelectronics was a joint venture between Uniroyal Technology Corporation and Emcore Corporation which was initially focused on development and production of GaN-based and AlInGaP-based LED chips. Later, Uniroyal Optoelectronics expanded their scope to include LED packages. At Uniroyal Optoelectronics, I held a number of positions including Team Leader for the Epitaxial Growth and Materials Characterization areas, Sr. Epi Scientist, Director of Intellectual Property, University Relations and Government Contracts. My responsibilities included MOCVD hardware modification, epitaxial process development as well as design, development and testing of new LED chip structures for both AlInGaP and GaN-based material systems. I was also responsible for providing technical support and assistance to customers on topics related to use of LED chips, design of LED packages and design of LED based lighting products and systems. This support included both optical and thermal design of LED packages and LED lighting products. My work at Uniroyal included providing technical support and package design for Kopin which resulted in the development of full color micro displays that were used as electronic viewfinders for Kodak digital cameras.

22. I have also authored and presented more than a total of 30 publications, presentations, and seminars, and I am a named inventor on over 65 issued patents and more than 25 pending patents.

23. I earned a bachelor's degree in Chemical Engineering from Tulane University in 1989.

24. I earned a Ph.D. in Chemical Engineering from the University of Florida in 1997, where my graduate work focused on development of optoelectronic devices, including novel silicon based visible LEDs and sulfide based TFELD structures and zinc selenide blue LEDs. As a graduate student, I was also an active participant in the Phosphor Technology Center of Excellence (PTCOE). The PTCOE was a large research consortium that was focused on technology development of display technology for electroluminescent (both alternating current and direct current) displays, field emission displays, and plasma displays.

25. In 1989 I worked for Shell Oil Corporation in Norco, LA. I was tasked with modeling heat exchanger performance for the crude oil distillation column in order to identify cost saving opportunities. I developed an improved model for determining the operating efficiency of heat exchange units that incorporated determined the economic impact on different operating conditions. The model was designed to be compatible with all major operating units on site and resulted in costs savings of over \$20 million/year at the Norco Facility alone. My work was quickly

adopted throughout the entire corporation and has resulted in sustained annual cost savings of approximately \$500 million/year.

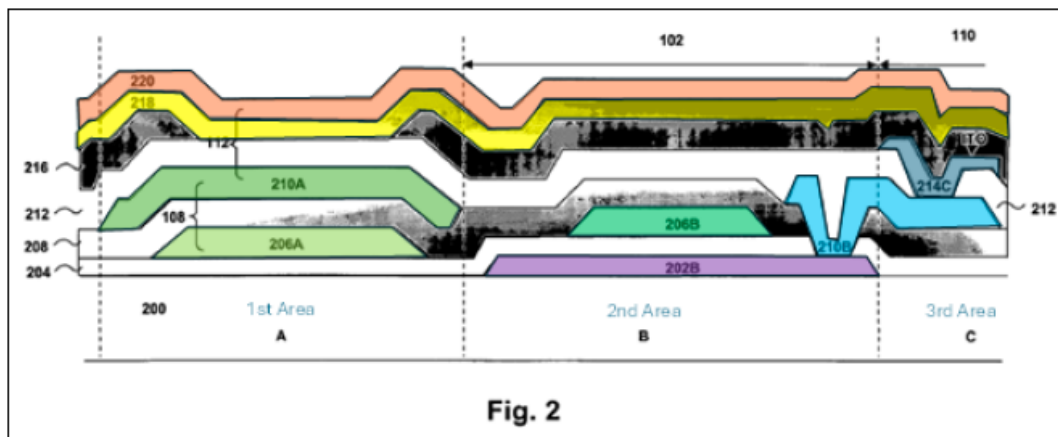
26. Based on the above education and experience, I believe that I have a detailed understanding of the state of the art during the relevant period, as well as a sound basis for opining how persons of ordinary skill in the art at that time would understand the claim terms and technical issues in this case. I believe that I would have this understanding regardless of which definition of a “person of ordinary skill in the art” is adopted by the Board. I meet Petitioner’s proposed definition, which is “a Bachelors’ degree in electrical or mechanical engineering or a comparable field of study, plus approximately two to three years of professional experience with electronic and optoelectronic system design,” because I have a B.S. and a Ph.D. in Chemical Engineering as well as over 30 years of experience in LED design, a subfield of optoelectronics.

27. The opinions stated in this declaration are based on my own personal knowledge and professional judgment; if called as a witness during any proceeding in this matter I am prepared to testify competently about them.

28. In forming my opinions, I have considered the materials discussed and cited herein, including the asserted patents, the prosecution histories of the patents, and the prior art references discussed herein, and any other references referred to or cited in this declaration.

III. THE '121 PATENT

29. The '121 Patent relates to an “electroluminescence device and, more particularly, to a storage capacitor of an electroluminescence device and a method for forming the storage capacitor.” Ex. 1001, 1:6–9. “Capacitors 108 and 112 are shown to be formed over an area A of substrate 200, transistor 102 is shown to be formed over an area B of substrate 200, and part of OLED 110 is shown to be formed in an area C of substrate 200.” Ex. 5:18–21. A particular goal of the '121 Patent is increasing the capacitance of the storage capacitor without significantly increase the area. Ex. 1001, 1:27-37. Dr. Neikirk provided the following annotated Figure 2 of the '121 Patent:



Ex. 1002, ¶25.

30. The '801 Patent states, (with coloring and emphasis added): “[D]oped polysilicon 202B and intrinsic polysilicon 202 [are formed] over area B of substrate 200. A layer of gate oxide 204 is formed over all of areas A, B, and C. A layer of

first metal is deposited over gate oxide 204 and patterned to form first metal patterns 206A and 206B over areas A and B, respectively. A layer of interlayer dielectric (ILD) 208 is formed over first metal patterns 206A and 206B. A layer of second metal is deposited over ILD 208 and patterned to form second metal patterns 210A over area A and 210B over both areas B and C, wherein second metal pattern 210B contacts polysilicon pattern 202B through a via hole (not numbered) in ILD 208 and gate oxide 204. A layer of *passivation silicon nitride (SiN) 212* is formed over ILD 208 and second metal patterns 210A and 210B. A layer of indium tin oxide (ITO) is formed over passivation SiN 212 and patterned to form an ITO pattern 214C over area C of substrate 200, wherein ITO pattern 214C contacts second metal pattern 210B through a via hole (not numbered) in passivation SiN 212. A layer of *capping SiN 216* is deposited to cover passivation SiN 212 and ITO pattern 214C. A layer of organics 218 [yellow] is deposited over all of areas A, B, and C. Over area A, capping SiN 216 is also patterned to expose a portion of passivation SiN 212.” Ex. 1001, 5:22–44.

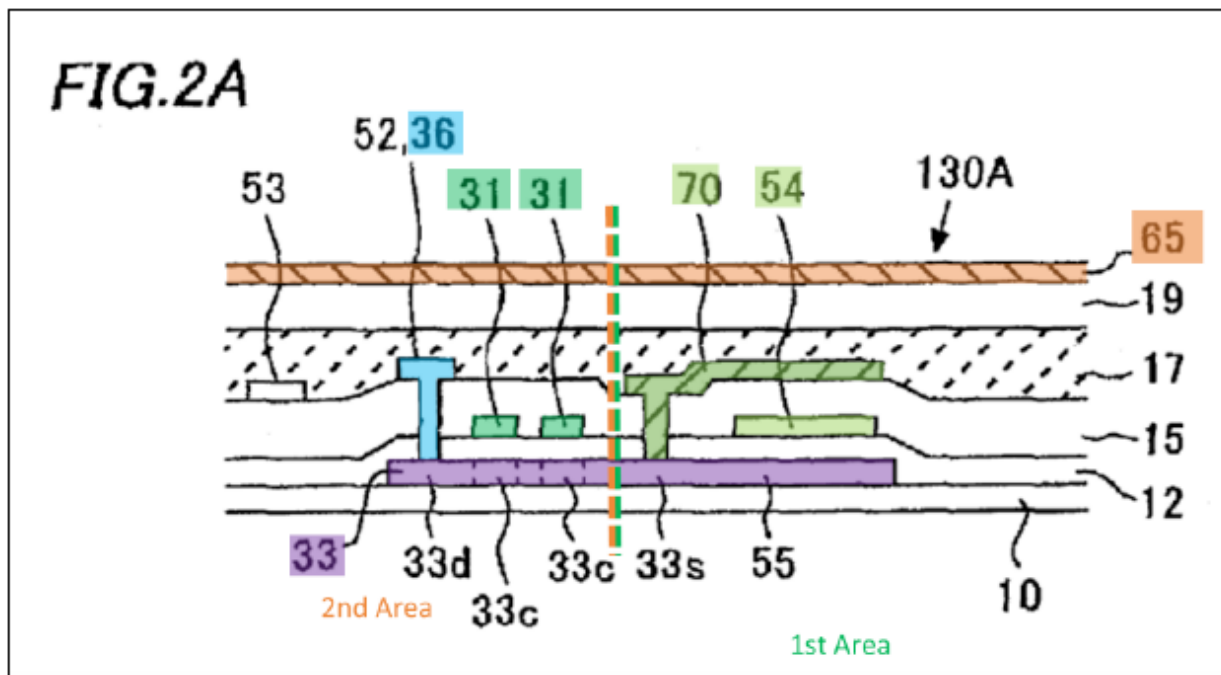
31. The '801 Patent teaches that capacitor 108 and capacitor 112 share second conductive layer 210A. Ex. 1001, 6:17–23. “[C]apacitor 112 comprises second metal pattern 210A, passivation silicon nitride 212, and third metal 220, while capacitor 108 comprises first metal pattern 206A, ILD 208, and second metal pattern 210A.” Ex. 1001, 6:29–32.

IV. SUMMARY OF THE ALLEGED PRIOR ART

A. Overview of Anzai

32. Anzai teaches “an electroluminescent display device with a storage capacitance element for holding a video signal supplied to a gate of a driving transistor.” Ex. 1003, 1:7–10. Anzai discloses that the device is fabricated using sequentially deposited layers, including a “first planarization film 17” that *is made of an organic resin* and a “second planarization film 19.” *Id.* at 5:3–12. Anzai teaches that “first planarization film 17 [is] made of an organic resin for flattening the surface.” *Id.* at 4:22–25.

33. Dr. Neikirk provides the following annotated Fig. 2A of Anzai:

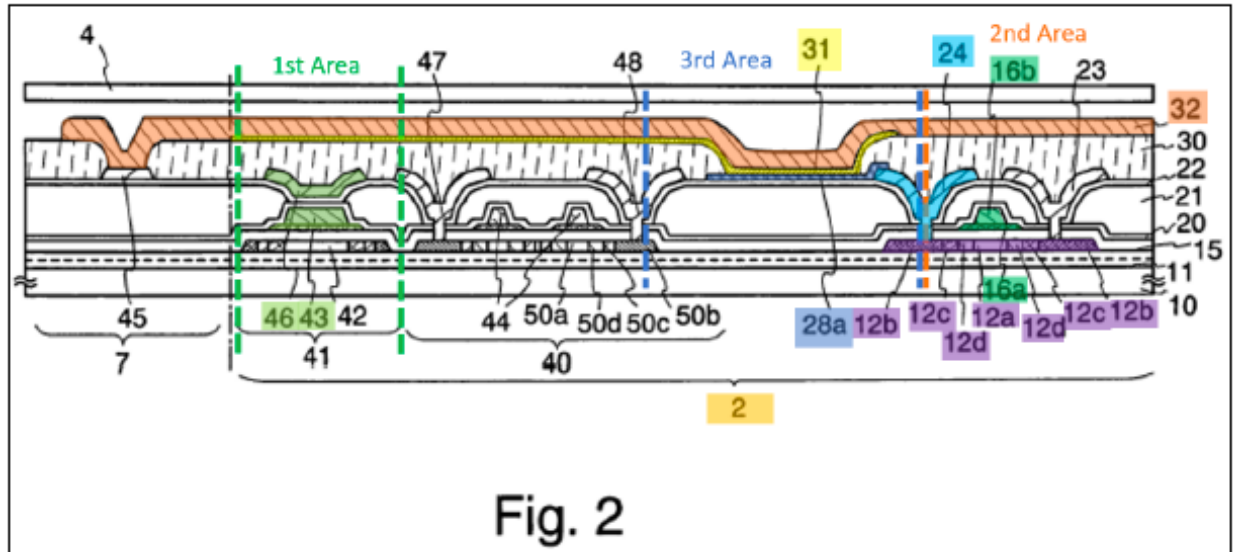


Ex. 1002, ¶23.

B. Overview of Yamazaki

34. Yamazaki “relates to a light emitting device using a light emitting element having a layer that contains an organic compound between a pair of electrodes.” Ex. 1004, 1:7–9. Yamazaki teaches that an “insulating material 30 may be a photosensitive or non-photosensitive organic material (such as polyimide, acrylate, polyamide, polyimide amide, resist, or benzocyclobutene), an inorganic material (such as silicon oxide, silicon nitride, or silicon oxynitride) with a CVD method, a sputtering method, or coating method, or a laminate thereof.” Ex. 1004, 11:45-50. Yamazaki also teaches that the flat top surface of insulation layer 30 can be achieved by CMP (chemical mechanical polish), which can be performed after the formation of insulating material 30. *Id.*, 20:17-24.

35. I note that the embodiment of Yamazaki relied on by Dr. Neikirk discloses a single insulation layer 30 is disposed between **cathode electrode layer 32** and the electrodes 46, 47, 48, 24, 23, as may be seen in Figure 2 of Yamazaki as annotated by Dr. Neikirk:



Ex. 1002, ¶85.

V. THE LEVEL OF ORDINARY SKILL IN THE ART

36. I have been informed that my analysis of the Challenged Claims should be viewed from the perspective of a person of ordinary skill in the art (POSITA) as the earliest claimed priority date, which I have been informed is December 7, 2004.

37. I understand that a POSITA is a hypothetical person presumed to have known the relevant art at the time of the invention. I have been informed that in determining the level of ordinary skill in the art the following factors may be considered none of which is predominant: (1) type of problems encountered in the art; (2) prior art solutions to those problems; (3) rapidity with which innovations are made; (4) sophistication of the technology; and (5) educational level of active workers in the field.

38. I understand that Dr. Neikirk has opined that a POSITA “would have had a Bachelors’ degree in electrical or mechanical engineering or a comparable field of study, plus approximately two to three years of professional experience with electronic and optoelectronic device design or other relevant industry experience. Additional graduate education could substitute for professional experience, and significant experience in the field could substitute for formal education.” Ex. 1003, ¶36.

39. In my opinion, the field of “electronic and optoelectronic device design” is too broad. A POSITA of the '121, had at least a Bachelors’ degree in a field of engineering or physics and at least two to three years of professional experience related to the design and manufacture of the relevant aspects of flat panel displays. Additional relevant graduate education related could reduce but not eliminate the time requirement for professional experience. While Dr. Neikirk proposes a different definition of a POSITA, the differences do not have material effect on my opinions rendered below. Regardless of which definition of a POSITA were used, my conclusions would remain the same.

40. Through my education and work experience during the relevant timeframe, I believe myself to have at least ordinary skill in the art. I am also familiar with the knowledge and capabilities of one of skill in the art as of 2004.

VI. APPLICABLE LEGAL STANDARDS

41. I am not a lawyer and offer no legal opinions. My analysis and opinions are based on my expertise in this technical field and on the instruction that counsel has given me for the legal standards outlined in the rest of this section. These principles are summarized below.

A. Burden of Proof

42. I understand that the petitioner must prove invalidity of a patent claim by a preponderance of the evidence, that is, the evidence must be sufficient to show that a fact or legal conclusion is more likely than not.

B. Date of Invention

43. I have been asked to use the date of the filing of the earliest application to which priority is claimed as the date of invention for purposes of my analysis.

C. Anticipation

44. I understand that a claim may be anticipated if a prior art disclosure teaches each and every element required by the claim, either expressly or inherently. The identical invention must be shown in as complete detail as is contained in the claim. When a claim covers several structures or compositions, either generically or as alternatives, the claim is deemed anticipated if any of the structures or compositions within the scope of the claim is known in the prior art.

45. I understand that, once the claims of a patent have been properly construed, the next step in determining anticipation of a patent claim requires a

comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

D. Obviousness

46. I understand that even if a patent claim is not anticipated, it may still be invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person of ordinary skill in the pertinent art.

47. I also understand that a patent may be rendered obvious based on an alleged prior art reference or a combination of such references plus what a person of ordinary skill in the art would understand based on his or her knowledge and the references. It is also my understanding that in assessing the obviousness of claimed subject matter one should evaluate obviousness over the prior art from the perspective of one of ordinary skill in the art at the time the invention was made (and not from the perspective of either a layman or a genius in that art).

48. I understand that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was known in the prior art. There must be a reason for combining the elements in the manner claimed. That is, there must be a showing that a person of ordinary skill in the art at the time of the invention would have thought of either combining two or more references or modifying a reference to achieve the claimed invention.

49. I understand that an obviousness determination includes the consideration of the following factors: (1) the scope and content of the prior art, (2) the differences between the prior art and the claims at issue, (3) the level of ordinary skill in the art, and (4) any secondary indicia of non-obviousness (*e.g.*, “secondary considerations” such as commercial success in the marketplace of the claimed invention), to the extent that they exist. I understand that the following are examples of approaches and rationales that may be considered:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of a known technique to improve similar devices (methods, or products) in the same way;
- Applying a known technique to a known device (method or product) ready for improvement to yield predictable results;
- Applying a technique or approach that would have been obvious to try (choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success);
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or

other market forces if the variations would have been predictable to a person having ordinary skill in the art; and

- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

50. I understand that the burden is on the petitioner to explain how an invention is obvious if one of ordinary skill in the art, facing a wide range of needs created by developments in the field, would have seen an obvious benefit to the solutions tried by the applicant. I further understand when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, it may be obvious to a person of ordinary skill to try the known options. If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique would have been obvious.

51. I understand that the burden is on the petitioner to explain how specific references could be combined, which combinations of elements in specific references would yield a predictable result, and how any specific combination would operate or read on the claims. I further understand that the petitioner cannot rely on conclusory statements but must instead provide a reasoned explanation supported by evidence. I also understand that obviousness does not exist where the prior art

discourages or teaches away from the claimed invention. I also understand that even if a reference does not teach away, its statements regarding preferences are relevant to a finding whether a person skilled in the art would be motivated to combine that reference with another reference.

52. I also understand that one of ordinary skill in the art must have a reasonable expectation of success in combining or modifying prior art references.

53. I also understand that all elements of a claim must be considered in an obviousness analysis.

54. I understand that it is impermissible to use hindsight to arrive at the claimed invention. My understanding is that the inventor's own path never leads to a conclusion of obviousness. I also understand that, when assessing whether there was a motivation to combine references to teach a claim element, defining the problem in terms of its solution reveals improper hindsight.

E. Claim Construction

55. I understand that claims are construed from the perspective of a person of ordinary skill as of the effective filing date of the patent application. A "person of ordinary skill in the art" is a hypothetical person who is presumed to have known the relevant art at the time of the invention.

56. I understand that persons of ordinary skill in the art are deemed to read the claims in the context of the entire patent, including the specification and prosecution history.

57. I understand that the claims define the invention and the terms used in the claims are generally given their plain and ordinary meanings they would have to a person of ordinary skill in the art at the time of the effective filing date of the application. The context of a claim can be particularly helpful, and other claims may inform the meaning of a term in a particular claim.

58. I understand that claim terms are normally used consistently throughout a patent. Thus, the meaning of a term may help inform the meaning of the same term in other claims. Differences between claims may also help define the terms, although this may not be the case where the specification or prosecution history indicate that such differences do not impact the scope of the claims.

59. I understand that a patentee can act as its own lexicographer by defining a term, in the patent specification, to have a specific meaning. It is my understanding that statements made to the patent office by the patentee or its legal representative during prosecution can serve to illuminate, or possibly narrow the proper scope of claim terms, and that such statements must be considered when construing the claim terms. This is sometimes referred to as a disclaimer. I have taken into account these principles in my analysis.

60. I understand that reference materials that were publicly available at the time that the patent application was filed, such as dictionaries, treatises or other technical references, may provide context and background for deciphering how one of ordinary skill in the art would have considered the terms used in the claims.

61. However, I understand that such references, as well as testimony (including this report) are generally known as “extrinsic evidence,” and are accorded less weight than evidence found within the patent and prosecution history. In addition, I understand that extrinsic evidence that is inconsistent with the claims, specification, or prosecution history should not be considered in the claim construction process.

F. Section 112 Definiteness

62. I understand that, under 35 U.S.C. § 112 ¶ 2, “[t]he specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.”

63. I understand that that claims must be definite. This means that the claims must particularly point out and distinctly claim the subject matter that the applicant regards as her invention. I understand that indefiniteness is evaluated from the perspective of a person of ordinary skill in the art at the time of a patent’s filing. I understand that a patent claim is indefinite if the claim, when read in light of the specification and the prosecution history, fails to inform, with reasonable certainty,

a person of ordinary skill in the art of the scope of the invention. Absolute or mathematical precision in claim language is not required and even if more than one interpretation is presented for a claim term, the term may still be definite if an informed and confident choice is available among the contending alternative definitions.

G. Teaching Away

64. I understand that a prima facie case of obviousness may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. I understand that a known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.

VII. CLAIM CONSTRUCTION

65. I understand that in *Inter Partes* review, claims “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 2282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F. R. § 42.100(b). This is also referred to as the *Phillips* standard as explained in the Case *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). I have applied this standard in rendering my opinions herein.

66. In my opinion, the term “passivation layer” has a plain and ordinary meaning—it is a layer of a material that renders the surface layer below chemically passive or unreactive, especially by tying up dangling bonds. *See* Ex. 2010 at 556 (“passivation[:] The protection of . . . layers, or surfaces of semiconductors by depositing a material which renders them chemically passive or unreactive. . .”); *see also* Ex. 2011 at 256–57 (describing passivation and planarization). For further context, a dangling bond is an electron on the surface of a semiconductor crystal that lacks a neighboring atom to bond with, which creates an electrically active surface state that negatively impacts the performance of the semiconductor. Dangling bonds are passivated with an inorganic dielectric layer (such as silicon nitride or silicon dioxide) that is designed to chemically and electrically stabilize the semiconductor surface by neutralizing dangling bonds. In other words, a passivation layer forms chemical bonds with the surface. In my opinion, this definition is consistent with the '121 Patent's disclosure of a “passivation silicon nitride” layer. *See* Ex. 1001, 5:34–36.

67. In my opinion, the plain and ordinary meaning of the term “capping layer” as it is used in the '121 Patent is a layer of hard material to protect a layer underneath—it may be thought of as similar to a hard “cap” that can be worn to protect the head. This definition is consistent with the '121 Patent's disclosure of silicon nitride as the capping layer, as SiN is a hard, durable material, which a

POSITA would have known. *See* Ex. 1001, 5:40–42 (“A layer of capping SiN 216 is disposed to cover passivation SiN 212 and ITO pattern 214C.”).

VIII. CHALLENGE 1: THE PETITION’S ANTICIPATION THEORY BASED ON ANZAI (CLAIMS 1-3 AND 5)

68. The Petition and Dr. Neikirk’s challenge 1 asserts that Anzai anticipates claims 1-3 and 5. In my opinion, these references fail to disclose the limitations regarding a planarization layer and a capping layer, *which are relevant to claim 3*.

A. No Passivation Layer

69. Dr. Neikirk identifies Anzai’s first planarization layer 17 as the “passivation layer.” Ex. 1002, ¶64. However, Dr. Neikirk must rely on an inaccurate definition of “passivation” in order to do so. Anzai teaches that the first planarization film 17 is “made of an organic resin for flattening the surface,” which is acknowledged by Dr. Neikirk. Ex. 1002, ¶62 (citing Ex. 1003, ¶62). Dr. Neikirk also admits that “Anzai does not disclose the material for planarization layer 19,” noting that “it must be made of an insulation material.” Ex. 1001, ¶62.

70. Dr. Neikirk asserts “[t]he first planarization film 17 is formed over the entire surface for flattening, which will protect the semiconductor surface from the surrounding environment (for passivation)” and that “[a]s such, a POSITA would understand that Anzai’s planarization film 17 is a passivation layer.” Ex. 1002, ¶63. This assertion is simply incorrect.

71. A planarizing film made of organic resin is not a passivation layer. A POSITA would be aware of this, as the chemical compounds that form organic resin are organic molecules and do not have any free or unbonded electrons capable of reacting with and passivating a surface. As I discuss above in Section VII, a passivation layer is a layer of a material that renders the surface layer below chemically passive or unreactive, especially by tying up dangling bonds. A dangling bond is an electron on the surface of a semiconductor crystal that does not have a neighboring atom to bond with, which creates an electrically active surface state and harms the performance of the semiconductor. Dangling bonds are passivated with an inorganic dielectric layer (such as silicon nitride or silicon dioxide) that is designed to chemically and electrically stabilize the semiconductor surface by neutralizing dangling bonds, *not an organic resin*. Importantly, inorganic layers are either formed in-situ or deposited by a sputtering or evaporation process which essentially bombards a surface with free atoms or clusters of atoms that react to form the passivation layer on the surface. As the formation process essentially occurs at the atomic level, the forming inorganic layer is readily able to form atomic bonds with the surface being coated and thus passivate the surface. The '121 Patent's disclosure of using silicon nitride for the passivation layer is consistent with this understanding.

72. I also note that a planarization layer is not the same thing as a passivation layer, and that not all insulators are passivating materials, which is contrary to the apparent assertions of Dr. Neikirk. Ex. 1002, ¶¶61–65. For example, Anzai, the very reference Dr. Neikirk identifies, is an *organic resin* material that only planarizes—it does not passivate. Further, while organic resin is an insulator, it does not passivate because lacks the chemical reactivity and atomic bonding characteristics needed to neutralize the electrically active surface states and tie up dangling bonds. An organic resin may form physical bonds with a surface, but does not form chemical bonds with a surface. As discussed above, organic resins are molecular mixes and do not possess free or unbonded electrons which would enable it to act as a passivation material. A POSITA would know this.

73. In my opinion, Dr. Neikirk’s assertions are based on nothing more than in incorrect and inaccurate understanding of what planarization is, and that Anzai does not disclose a planarization layer.

B. No Capping Layer

74. Dr. Neikirk simply states that a POSITA “would understand that Anzai’s . . . planarization film 19 is a capping layer.” Ex. 1002, ¶64. I disagree. A POSITA would have understood a “capping layer” to be a layer of hard material to protect a layer underneath, as I explained in Section VII above. Dr. Neikirk admits that Anzai identifies no material for planarization film 19 and seems to support his

argument solely on the fact that planarization film 19 is “disposed on the first planarization film 17.” Ex. 1002, ¶¶62–63. In my opinion, Dr. Neikirk can identify nothing in Anzai that supports why a POSITA would have understood planarization film 19 to be strong or hard enough to protect the layers underneath—nothing in Anzai identifies such a role or material. Rather, Anzai just supports that planarization film 19 is for planarizing. Thus, in my opinion, Anzai does not disclose a “capping layer.”

75. Accordingly, in my opinion, Anzai does not disclose a “passivation layer” or a “capping layer” and does not anticipate claim 3 of the '121 Patent.

IX. CHALLENGE 2: THE PETITION’S OBVIOUSNESS THEORY BASED ON ANZAI AND YAMAZAKI (CLAIM 4)

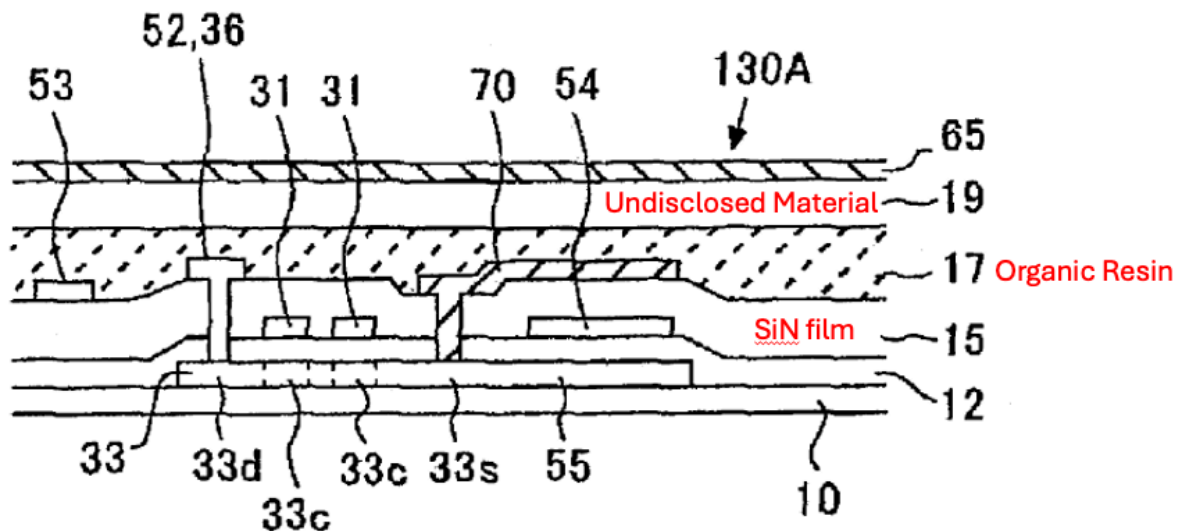
A. Claim 4 Depends from Claim 3, which is allowable

76. Claim 4 depends from claim 3, which is allowable for the reasons discussed above. Therefore, as a threshold matter, it is my opinion that claim 4 is allowable at least because of its dependence on claim 3.

B. No Motivation to Combine

77. In my opinion, Dr. Neikirk fails to identify a reason that a POSITA would have modified Anzai as he is proposing, and that he relies on hindsight to justify the combination.

78. Dr. Neikirk simply says that a “POSITA would have understood the issue involved, namely what material(s) can be used to form the first and second



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organic resins flow more easily to fill out dips in the surface below. Indeed, Yamazaki teaches use of spin coating or ink-jet printing for depositing organic films. Ex. 1004, 2:24-29, 31:14-17. These are simple processes that take advantage of the liquid state of resin materials prior to hardening or developing. In contrast, silicon nitride is usually deposited via chemical vapor deposition or sputtering and requires additional steps (like chemical mechanical polishing) to make flat. Chemical vapor deposition and sputtering require high vacuum or high temperature conditions and specialized chambers to deposit films. Organic resins are also softer than silicon nitride and are less likely to crack or delaminate. Organic resins can be spin coated and cured at lower temperatures in a normal atmosphere (i.e., air)—a much simpler and less expensive process than chemical vapor deposition or sputtering of silicon nitride. In other words, organic resins are cheaper and easier to planarize than silicon nitride.

80. This understanding is supported by the teachings of Anzai itself. I note that Dr. Neikirk acknowledges that “Anzai teaches using silicon nitride for interlayer insulating film 15 between the second and third capacitance electrode layers 54 and 70, and in gate insulating film 12.” Ex. 1002, ¶78. Anzai, however, explicitly discloses that planarization film 17 [is] made of an organic resin for flattening the surface.” Ex. 1003 at 4:22–24. In other words, silicon nitride is used for layers that

are not planarized, while Anzai explicitly calls for organic resin in its planarization layer 17.

81. Further, I note that Yamazaki teaches a wide range of possible materials:

The insulating material **30** may be a photosensitive or non-photosensitive organic material (such as polyimide, acrylate, polyamide, polyimide amide, resist, or benzocyclobutene), an inorganic material (such as silicon oxide, silicon nitride, or silicon oxynitride) with a CVD method, a sputtering method, or coating method, or a laminate thereof. In the case of using the photosensitive organic material as the insulating material **30**, useful photosensitive organic materials may be roughly grouped into two types. That is, the one is a negative type which becomes insoluble to an etchant by photosensitive light irradiation and the other is a positive type which becomes soluble to the etchant by light irradiation. According to the present invention, both types can be appropriately used.

Ex. 1004 at 45–58.

82. Dr. Neikirk offers no reasoning for selecting silicon nitride from Yamazaki's list of materials for use in planarization layers 17 and 19 of Anzai. Indeed, a POSITA would have recognized that it is actually a more difficult material to use for planarization than organic resin, as I explain above. In my opinion, Dr. Neikirk's selection of silicon nitride from the list of Yamazaki's materials is based on nothing but hindsight and a desire to invalidate the '121 Patent.

83. In my opinion, claim 4 is not obvious for the reasons above.

**X. CHALLENGE 3: THE PETITION'S OBVIOUSNESS THEORY
BASED ON YAMAZAKI AND ANZAI (CLAIMS 1-7)**

A. No Motivation to Add a Layer (Claims 3, 4, 7)

84. In my opinion, Dr. Neikirk fails to identify any reason Yamazaki would be modified to include a “passivation layer” and a “capping layer.” Specifically, Dr. Neikirk purports to identify “a passivation layer (Yamazaki insulating material 30) and a capping layer (Anzai’s planarization layer 19).” Ex. 1002, ¶110.

85. Specifically, Dr. Neikirk states that the “modification to Yamazaki would simply involve deposition another [sic] planarization layer on top of an already existing planarization layer (e.g., insulating material 30), which would further improve the flattening purpose of the insulating material 30.” Ex. 1002, ¶121. This reasoning does not make sense. A POSITA would not have added an additional planarizing layer to Yamazaki’s existing planarization layer simply to “improve the flattening purpose of the insulating material 30,” as insulating material 30 is already planarized. Adding an additional planarization layer to a layer that is already planarized would not only add manufacturing steps, complications, and cost, but would also reduce capacitive coupling by increasing the thickness. Further, adding an additional planarization layer to an existing planarization layer is contrary to the understanding and motivations of a POSITA. If a second planarization layer is required, it is implied that the first planarization layer failed to provide a planarized surface. As such, a POSITA would understand that this was the result of an error in the process would simply adjust the conditions so that it resulted in a single

planarized layer—they would not add a second layer. Alternatively, if a second planarization layer is required, it is because the first layer was not, in fact, a planarization layer, in the first place. Thus, Dr. Neikirk's explanation is contrary to the what a POSITA would have done and demonstrates his reliance on hindsight.

86. In my opinion, Dr. Niekirk's reasoning strongly indicates hindsight.

87. I note that this proposed combination fails, even if it were made, because Anzai's planarization layer 19 is not a capping layer, as discussed above.

88. Accordingly, in my opinion, claims 3, 4, and 7 are not rendered obvious for at least the reasons above with respect to ground 3.

XI. CONCLUSION

89. In signing this Declaration, I understand that the Declaration will be filed as evidence in contested cases before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

90. I 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 Section 1001 of Title 18 of the United States Code.

Executed on May 7, 2025 at Flower Mound, TX.

A handwritten signature in black ink, appearing to read "Eric Bretschneider", written over a horizontal line.

Eric Bretschneider, Ph.D.