

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LITE-ON TECHNOLOGY CORPORATION

Petitioner

v.

SENSOR ELECTRONIC TECHNOLOGY, INC.,

Patent Owner.

Inter Partes Review No. 2022-00780

U.S. Patent No. 9,923,117

**DECLARATION OF DR. DANIEL FEEZELL IN SUPPORT OF PATENT
OWNER'S CONTINGENT MOTION TO AMEND**

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EXHIBIT LIST

Ex. No.	Description
Ex. 2001	Chambers Dictionary of Science and Tech., definition for “ <i>homogeneous</i> ”, 2007.
Ex. 2002	United States Patent No. 7,812,366.
Ex. 2003	E. Fred Schubert, “ <i>Light-Emitting Diodes</i> ”, pgs. 167-168, 2006.
Ex. 2004	United States Patent and Trademark Office, Director Memorandum, dated June 21, 2022.
Ex. 2005	<i>Sensor Electronic Tech., Inc. v. Lite-On Tech. Corp. et al.</i> , Case No. 6:21-cv-00322-ADA (W.D. Texas), Dkt. No. 1, Complaint with Jury Demand, dated April 2, 2021.
Ex. 2006	<i>Sensor Electronic Tech., Inc. v. Lite-On Tech. Corp. et al.</i> , Case No. 6:21-cv-00322-ADA (W.D. Texas), Dkt. No. 45, Amended Scheduling Order, dated June 22, 2022.
Ex. 2007	<i>Burley Licensing LLC v. Micro-Star International Co. Ltd.</i> , Case No. 6:21-cv-00862-ADA (W.D. Texas), Docket Report.
Ex. 2008	<i>Frac Shack Inc. v. Alaska Fuel Distributors Inc.</i> , Case No. 7:19-cv-00026-ADA-DTG (W.D. Texas), Docket Report.
Ex. 2009	<i>MicroPairing Technologies LLC v. General Motors LLC</i> , Case No. 6:21-cv-00761-ADA (W.D. Texas), Docket Report.
Ex. 2010	<i>ParkerVision, Inc. v. LG Electronics Inc.</i> , Case No. 6:21-cv-00520-ADA (W.D. Texas), Docket Report.
Ex. 2011	<i>TrackThings LLC v. Amazon.com, Inc. et al</i> , Case No. 6:21-cv-00720-ADA (W.D. Texas), Docket Report.
Ex. 2012	Docket Navigator, Motion Stay Success Rates Pending <i>Inter Partes</i> Review in W.D. Texas.
Ex. 2013	Ryan Davis, “ <i>Albright Says He’ll Very Rarely Put Cases On Hold For PTAB</i> ”, Law360, dated May 11, 2021.
Ex. 2014	<i>Sensor Electronic Tech., Inc. v. Lite-On Tech. Corp. et al.</i> , Case No. 6:21-cv-00322-ADA (W.D. Texas), Dkt. No. 36, Agreed Scheduling Order, dated February 24, 2022.
Ex. 2015	Docket Navigator, Time to Trial in W.D. Texas.
Ex. 2016	<i>Sensor Electronic Tech., Inc. v. Lite-On Tech. Corp. et al.</i> , Case No. 6:21-cv-00322-ADA (W.D. Texas), Defendants’ Preliminary Invalidity Contentions, dated March 24, 2022.
Ex. 2017	Declaration of Etai Lahav in Support of Patent Owner’s Motion For <i>Pro Hac Vice</i> Admission

Ex. No.	Description
Ex. 2018	Declaration of Dr. Daniel Feezell in Support of Patent Owner's Contingent Motion to Amend
Ex. 2019	Deposition Transcript of Dr. James R. Shealy, taken on January 26, 2023.
Ex. 2020	U.S. Patent Application No. 14/984,156
Ex. 2021	Declaration of Dr. Daniel Feezell in Support of Patent Owner's Response to Petition

I. INTRODUCTION

1. My name is Dr. Daniel Feezell. I am an associate professor in the Electrical and Computer Engineering (ECE) Department at the University of New Mexico (UNM). I have been retained by Patent Owner Sensor Electronic Technology, Inc. (“Patent Owner” or “SETi”) as an expert witness in the above-captioned proceeding to offer certain opinions related to U.S. Patent No. 9,923,117 (“the ’117 Patent”). I am being compensated for the time I spend on this proceeding on an hourly basis at a rate of \$450. This declaration is based upon my knowledge, skill, experience, training, and education in my field of expertise, and upon information reviewed in connection with my retention as an expert witness in this matter. My compensation does not depend on any outcome or order in this proceeding.

2. I received a B.S. degree in Electrical Engineering from the University of California, Irvine in 2000. In September 2000, I began graduate studies at the University of California, Santa Barbara (UCSB). I was offered a position as a graduate research assistant in Prof. Larry Coldren’s group. In 2001, I received a M.S in Electrical Engineering from UCSB. In 2005, I received a Ph.D. in Electrical Engineering from UCSB, with emphasis in electronics and photonics. My dissertation was titled *Long-Wavelength Vertical-Cavity Surface-Emitting Lasers with Selectively Etched Thin Apertures*. My area of research was generally

in light-emitting photonic devices based on semiconductors with a focus on semiconductor lasers, including a vertical-cavity surface-emitting laser (VCSEL) platform using AlGaAsSb distributed Bragg reflectors (DBRs).

3. Immediately following my doctoral research work, I accepted a Postdoctoral Researcher position at UCSB in the group of Prof. Shuji Nakamura, 2014 Nobel Laureate in Physics. My projects focused on developing a GaN-based VCSEL with SiO₂/Ta₂O₅ dielectric DBRs. At this time, I also worked on other GaN-based semiconductor laser platforms and GaN-based light-emitting diodes (LEDs).

4. In 2007, I began work as the first employee at Soraa, Inc., an GaN-based LED and laser start-up company founded by UCSB professors Shuji Nakamura, Steven DenBaars, and James Speck. At Soraa, Inc., I was responsible for design and fabrication of high-efficiency GaN-based LEDs.

5. In 2010, I joined UCSB as a Project Scientist, working with Prof. Shuji Nakamura in the Solid-State Lighting and Energy Center (SSLEC). In this capacity, I was responsible for managing and advising graduate students working on projects related to GaN-based LEDs and lasers. I also performed my own research on GaN-based VCSELs at the time, including epitaxial growth, fabrication, and characterization.

6. In 2012, I joined the faculty in the Electrical and Computer Engineering (ECE) Department at the University of New Mexico (UNM), first as an Assistant Professor and later promoted to tenured Associate Professor. I also have an affiliation with the Center for High Technology Materials (CHTM) at UNM and I am currently the General Chair of the Optical Science and Engineering (OSE) program. My group's research is focused on epitaxial growth and fabrication of GaN-based optoelectronic devices, including VCSELs and high-efficiency and high-speed LEDs; nanoscale selective-area epitaxy; and wide-band-gap power electronics. I received a Defense Advanced Research Projects Agency (DARPA) Young Faculty Award in 2013 with a Director's Fellowship Extension in 2015 and a National Science Foundation Faculty Early Career Development (CAREER) Award in 2015. In 2020, I was selected for the honorary title of UNM Regents' Lecturer. My UNM research projects have been funded by the National Science Foundation (NSF), the Department of Energy (DOE), DARPA, the Department of Defense (DoD), the Advanced Research Projects Agency – Energy (ARPA-E), the Defense Threats Reduction Agency (DTRA), and private industry. I am a Senior Member of IEEE and have authored or co-authored over 150 journal and conference publications related to semiconductor optoelectronics, electronics, and materials. I am a named inventor on around 25 U.S. patents. I have around 18 years of experience working with GaN-based materials and devices.

7. My CV has been attached as Appendix A.

8. I have reviewed the specification and file history of the '117 Patent and the exhibits and filings in this proceeding, including Lite-On's Petition and the declaration of its expert, Dr. James Shealy.

II. SUMMARY OF OPINIONS

9. I have reviewed certain substitute claims offered by SETi. For the reasons set forth below, it is my opinion that the proposed substitute claims are supported by the originally filed specification of the '117 Patent and patentable over the prior art.

10. This declaration is based on the information currently available to me. To the extent that additional information becomes available, I reserve the right to continue my investigation based on the additional information.

III. LEGAL STANDARDS

11. I have applied the legal standards set forth in my declaration in support of Patent Owner's Response, filed concurrently herewith.

IV. CLAIM CONSTRUCTION

12. My declaration in support of Patent Owner's Response sets forth my opinions on claim construction and identifies the information upon which I relied and the standards that I applied.

V. SETI'S PROPOSED SUBSTITUTE CLAIM IS SUPPORTED BY THE '156 APPLICATION

13. I have reviewed SETi's proposed substitute claim. It is my opinion that this claim is supported by the originally filed application of the '117 Patent and is patentable over the prior art in this proceeding.

14. The substitute claim is provided below, with amended subject matter underlined.

20[pre] A semiconductor heterostructure, comprising:

20[a] an active region;

20[b] a metallic contact;

20[c] a group III nitride semiconductor layer located between the active region and the metallic contact;

20[d] the semiconductor layer including a plurality of inhomogeneous regions arranged within multiple levels of the semiconductor layer along a height direction of the semiconductor layer;

20[e] wherein some of the inhomogeneous regions in a first level of the semiconductor layer are vertically offset from inhomogeneous regions in a second level of the semiconductor layer, and

20[f] wherein the plurality of inhomogeneous regions include one or more of a set of transparent regions, a set of reflective regions and/or a set of conductive regions;

20[g] each of the inhomogeneous regions having a set of attributes differing from a group III nitride material forming the semiconductor layer;

20[h] wherein the set of transparent, reflective and/or conductive regions comprises a group III nitride semiconductor alloy that varies by adjusting a molar fraction of aluminum and/or indium within the regions;

20[i] wherein two or more of the offset inhomogeneous regions of the same type at least partially overlap with one another, wherein the inhomogeneous regions include clusters of overlapping regions disconnected by gaps.

15. For the reasons set forth below, it is my opinion that proposed substitute claim 20 is supported by the originally filed application that issued as the '117 Patent, as shown below. *See* U.S. Patent Application No. 14/984,156 (Ex. 2020) (“the '156 Application”).

20[preamble] A semiconductor heterostructure comprising:

16. The '156 Application discloses a semiconductor heterostructure:

As illustrated, each emitting device 10 includes a heterostructure comprising a substrate 12, a buffer layer 14 adjacent to the substrate 12, an n-type contact layer 16 (e.g., an electron supply layer) adjacent

to the buffer layer 14, and an active region 18 having an n-type side 19A adjacent to the n-type cladding layer 16. Furthermore, the heterostructure of each emitting device 10 includes a p-type contact layer 22 (e.g., a hole supply layer) adjacent to a p-type side 19B of the active region 18. It is understood that the emitting devices 10 are only illustrative of various configurations of heterostructures. To this extent, a heterostructure can include one or more additional layers, which are not shown.

Ex. 2020 ¶ 31.

17. The '156 Application further discloses:

The semiconductor heterostructure 132 can include an active region 140, a p-type contact layer 142 located on a first side of the active region 140, and a n-type contact layer 144 located on a second side of the active region 140 opposite the first side.

Ex. 2020 ¶ 60; *See also id.* at ¶ 8; Figs. 12; 13A.

20[a] an active region;

18. The '156 Application discloses an active region:

Aspects of the invention are further described in conjunction with emitting devices, such as group III nitride-based emitting devices,

including an active region configured to generate radiation during operation of the device.

Ex. 2020 ¶ 29.

19. The '156 Application further discloses:

An illustrative embodiment of a group III nitride based emitting device 10 includes an active region 18 (e.g., a series of alternating quantum wells and barriers).

Ex. 2020 ¶ 33. *See also id.* at ¶ 8, 41; Figs. 2; 12; 13A; claim 1.

20[b] a metallic contact,

20. The '156 Application discloses a metallic contact:

The semiconductor structure 50 includes a vertically conductive region 52 and a background base semiconductor structure 54 and is located adjacent to a metallic contact 60.

Ex. 2020 ¶ 45.

21. The '156 Application further discloses:

In an embodiment of the device 10 shown in FIG. 1 or FIG. 2, a metallic contact 24 and/or a metallic contact 28 can comprise a multilayered structure. For example, the metallic contact 24, 28 can include an ohmic layer adjacent to the corresponding contact layer 22,

16, respectively, followed by a reflective layer located adjacent to the ohmic layer.

Ex. 2020 ¶ 53.

22. The '156 Application further discloses:

The top surface 152 of the optoelectronic device 150 can further include a p-type metallic contact 172 having p-type metallic domains 174 formed on the side 168 of the p-type contact layer 142.

Ex. 2020 ¶ 74; *See also id.* at ¶ 8; Fig. 13A; claim 1.

20[c] a group III nitride semiconductor layer located between the active region and the metallic contact,

23. The '156 Application discloses a group III nitride semiconductor layer located between the active region and the metallic contact:

the various layers of the emitting device 10 are formed of group III nitride based materials.

Ex. 2020 ¶ 32.

24. The '156 Application further discloses:

In a more particular embodiment, the semiconductor structure comprises a group III nitride semiconductor layer.

Ex. 2020 ¶ 29.

25. The '156 Application further discloses:

[A]n emitting device 10 includes one or more layers, such as the n-type contact layer 16 and/or the p-type contact layer 22, formed of a semiconductor structure having one or more inhomogeneous regions located therein.

Ex. 2020 ¶ 35.

26. The '156 Application further discloses:

A semiconductor structure (e.g., the p-type contact layer 22) including transparent, reflective, and/or conductive regions can be fabricated using patterning.

Ex. 2020 ¶ 44.

27. The '156 Application further discloses:

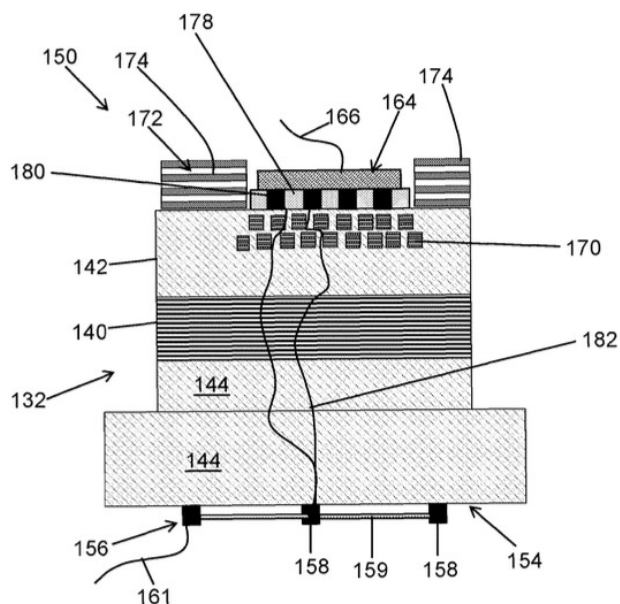
The semiconductor heterostructure 132 can include an active region 140, a p-type contact layer 142 located on a first side of the active region 140, and a n-type contact layer 144 located on a second side of the active region 140 opposite the first side.

Ex. 2020 ¶ 60. *See also id.* at ¶ 8; claim 1. A POSA would understand that n-type and p-type layers discussed in the paragraphs above are group III nitride semiconductor layers.

28. Figure 13A, which is reproduced below, depicts an optoelectronic device 150 formed from the semiconductor heterostructure 132. Ex. 2020 ¶ 67. It

depicts a p-type contact layer 142 (which is a group III-V nitride semiconductor layer located between a p-type metallic contact 172 and the active region 140).

FIG. 13A



20[d] “the semiconductor layer including a plurality of inhomogeneous regions arranged within multiple levels of the semiconductor layer along a height direction of the semiconductor layer”

29. The '156 Application discloses this feature:

In an embodiment, the semiconductor structure includes multiple regions of the same type, which can be located in various portions of the semiconductor structure and can be present at different levels along a height of the semiconductor structure.

Ex. 2020 ¶ 38.

30. The '156 Application further discloses:

As discussed herein, regions of any of the types (e.g., reflective, transparent, or conductive), can be located in various arrangements within a semiconductor structure. To this extent, FIGS. 7A-7C show illustrative arrangements of reflective regions according to embodiments. In FIG. 7A, a semiconductor base layer 70 is located adjacent to a metal contact 72 and includes two levels 74A, 74B of reflective regions. Each level 74A, 74B of reflective regions is immersed in the semiconductor base layer 70.

Ex. 2020 ¶ 49.

31. The '156 Application further discloses:

In one embodiment, the reflective elements 170 can be incorporated in multiple levels of the p-type contact layer 142.

Ex. 2020 ¶ 71. *See also id.* ¶ 8; Figs. 7A-7C; 13A; claim 1.

20[e] wherein some of the inhomogeneous regions in a first level of the semiconductor layer are vertically offset from inhomogeneous regions in a second level of the semiconductor layer

32. The '156 Application discloses that some of the inhomogeneous regions in a first level of the semiconductor layer are vertically offset from inhomogeneous regions in a second level of the semiconductor layer:

Additionally, reflective regions located in level 74B are laterally offset (staggered) from reflective regions located in level 74A. FIG.

7C shows a top view of an embodiment in which the levels 74A, 74B of reflective regions can be staggered in a manner that forms a checkerboard arrangement.

Ex. 2020 ¶ 49. A POSA would understand that Figure 7A depicts the inhomogeneous reflective regions in Figure 7A in level 74B as vertically offset from the reflective regions in level 74A.

33. The '156 Application further discloses:

In one embodiment, the reflective elements 170 can be incorporated in multiple levels of the p-type contact layer 142. As shown in FIG. 13A, the reflective elements 170 in each level can be staggered with reflective elements in an adjacent level such that there is an offset in position between elements in the different levels.

Ex. 2020 ¶ 71. A POSA would understand that Figure 13A depicts the inhomogeneous regions 170 in Figure 13A as vertically offset in two different levels of the p-type contact layer 142. *See also id.* ¶ 8; Figs. 7A-7C; Fig. 13A; claim 1.

20[f] wherein the plurality of inhomogeneous regions include one or more of a set of transparent regions, a set of reflective regions and/or a set of conductive regions

34. The '156 Application discloses that the plurality of inhomogeneous regions include one or more of a set of transparent regions, a set of reflective regions and/or a set of conductive regions:

[T]he inhomogeneous regions can include one or more of: a set of transparent regions, a set of reflective regions, and/or a set of conductive regions.

Ex. 2020 ¶ 35.

35. The '156 Application further discloses:

As discussed herein, regions of any of the types (e.g., reflective, transparent, or conductive), can be located in various arrangements within a semiconductor structure. To this extent, FIGS. 7A-7C show illustrative arrangements of reflective regions according to embodiments. In FIG. 7A, a semiconductor base layer 70 is located adjacent to a metal contact 72 and includes two levels 74A, 74B of reflective regions.

Ex. 2020 ¶ 49.

36. The '156 Application further discloses:

In one embodiment, the reflective elements 170 can be incorporated in multiple levels of the p-type contact layer 142.

Ex. 2020 ¶ 71. *See also id.* ¶ 8; Figs. 7A-7C; 13A; claim 1.

20[g] each of the inhomogeneous regions having a set of attributes differing from a group III nitride material forming the semiconductor layer

37. The '156 Application discloses that each of the inhomogeneous regions has a set of attributes differing from a group III nitride material forming the semiconductor layer:

Each inhomogeneous region has one or more attributes that differ from a material forming the semiconductor layer. The inhomogeneous regions can include one or more regions configured based on radiation having a target wavelength. These regions can include transparent and/or reflective regions.

Ex. 2020 ¶ 28.

38. The '156 Application further discloses:
a region is a reflective region when the region reflects at least ten percent of radiation having a target wavelength, which is radiated at a normal incidence to an interface of the region.

Ex. 2020 ¶ 35. A POSA would understand that this discloses an inhomogeneous region that reflects at least ten percent of radiation having a target wavelength and that the group III nitride material forming the semiconductor layer would not reflect at least ten percent of radiation having a target wavelength; thus, this

reflective region would have a set of attributes differing from the group III nitride material forming the semiconductor layer.

39. The '156 Application further discloses:

In an embodiment, a conductive region has a conductivity at least ten percent higher than a conductivity of a transparent region and a conductivity of a reflective region and a higher conductivity than a base semiconductor material for the layer.

Ex. 2020 ¶ 36. A POSA would understand that this discloses an inhomogeneous region that is conductive that has a higher conductivity (i.e. a set of attributes) than the group III nitride material forming the semiconductor layer.

40. The '156 Application further discloses:

[E]ach inhomogeneous region in either the p-type contact layer 142 and the n-type contact layer 144 can have a set of attributes that differ from the group III nitride material forming the semiconductor layer.

Ex. 2020 ¶ 61. *See also id.* ¶ 8; claim 1.

20[h] wherein the set of transparent, reflective and/or conductive regions comprises a group III nitride semiconductor alloy that varies by adjusting a molar fraction of aluminum and/or indium within the regions

41. The '156 Application discloses that the set of transparent, reflective and/or conductive regions comprises a group III nitride semiconductor alloy that varies by adjusting a molar fraction of aluminum and/or indium within the regions:

In an embodiment shown in FIG. 3B, a reflective region 40 (e.g., a Bragg mirror) can be epitaxially grown, and include a superlattice of group III nitride semiconductor sublayers 42, 44 of $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}/\text{Al}_{x'}\text{In}_{y'}\text{Ga}_{1-x'-y'}\text{N}$, where x , y , x' , and y' are chosen such that a refractive index of one sublayer is different from a refractive index of another sublayer by at least two percent (five percent in another embodiment). In a more particular embodiment, the refractive index of a group III nitride semiconductor alloy varies between values of 2.2 and 2.7 by adjusting a molar fraction of aluminum and/or indium.

Ex. 2020 ¶ 41. A POSA would understand that the above superlattice is a group III nitride semiconductor alloy because it contains a combination of elements from group III of the periodic table (e.g. Al, In, Ga) with nitrogen (N). A POSA would also understand the varied refractive index in the alloy is due to the variation of the molar fraction of aluminum and/or indium within the alloy.

42. The '156 Application further discloses:

In an embodiment, a transparent region, such as one or more of the transparent regions 58, comprises an $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}/\text{Al}_{x'}\text{In}_{y'}\text{Ga}_{1-x'-y'}\text{N}$ superlattice with x , y , x' , and y' are chosen such that the transparency of the superlattice is at least ten percent for a target wavelength of radiation. In another embodiment, the transparent region can be

configured to form a Fabry-Perot interference filter for a target wavelength of radiation. For example, FIG. 5 shows a structure for an illustrative Fabry-Perot interference filter 62 according to an embodiment. In this case, the filter 62 comprises a superlattice including a series of alternating layers of $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$ / $\text{Al}_{x'}\text{In}_{y'}\text{Ga}_{1-x'-y'}\text{N}$, where x and x' molar fractions are larger than 0.35.”);

Ex. 2020 ¶ 47. A POSA would understand that the molar fractions of aluminum and indium vary within the superlattice.

43. The '156 Application further discloses:

Adjacent semiconductor layers can be grown using such a group V/III ratio and growth temperatures, while varying a molar fraction of one or more of the elements (e.g., a molar fraction of aluminum can differ by at least one percent between adjacent layers).

Ex. 2020 ¶ 80. *See also id.* Fig. 7A-7C.

20[i] wherein two or more of the offset inhomogeneous regions of the same type at least partially overlap with one another, wherein the inhomogeneous regions include clusters of overlapping regions disconnected by gaps

44. The '156 Application discloses that two or more of the offset inhomogeneous regions of the same type at least partially overlap with one

another, wherein the inhomogeneous regions include clusters of overlapping conductive regions disconnected by gaps:

In an embodiment, the semiconductor structure includes multiple regions of the same type, which can be located in various portions of the semiconductor structure and can be present at different levels along a height of the semiconductor structure. To this extent, two or more of the regions of the same type can at least partially overlap with one another.

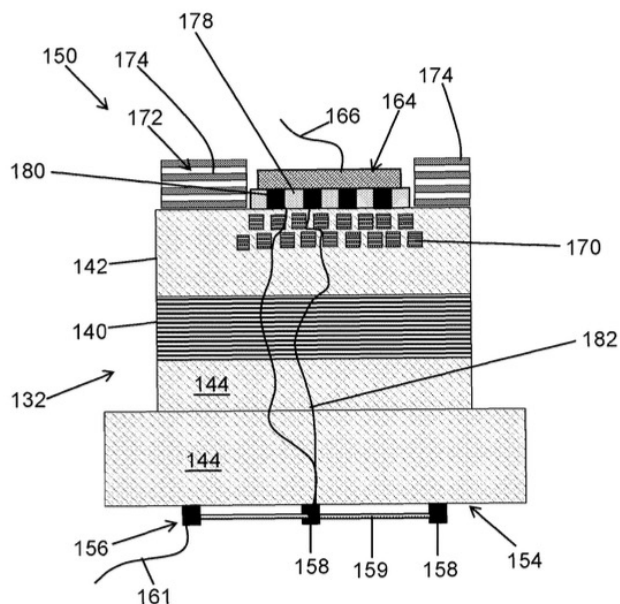
Ex. 2020 ¶ 38.

In an embodiment, the semiconductor structure can include vertically and horizontally conductive regions arranged to form an interconnected network of conductive paths through the semiconductor structure. The term ‘interconnected’ network does not necessarily imply that all the conductive regions form a single network. As used herein, the term is applied loosely and includes clusters of overlapping conductive regions disconnected by gaps.

Ex. 2020 ¶ 51.

45. A POSA would also understand that the inhomogeneous regions 170 depicted in Figure 13A, reproduced below, at least partially overlap and include clusters of overlapping regions disconnected by gaps:

FIG. 13A



VI. THE PROPOSED SUBSTITUTE CLAIM 20 IS PATENTABLE

46. SETi's proposed substitute claim is patentable over the prior art presented by Lite-On in its Petition. For at least the reasons set forth in my declaration in support of Patent Owner's Response, claim 1 is not unpatentable over the art of record, unamended. The additional subject matter of claim 20 further establishes the patentability of the claims.

47. Claim 20 additionally recites "wherein the set of transparent, reflective and/or conductive regions comprises a group III nitride semiconductor alloy that varies by adjusting a molar fraction of aluminum and/or indium within the regions."

48. The prior art of record does not disclose this limitation.

49. For example, in Ohmae, the protruded portions, (the alleged “inhomogeneous regions”) are not group III nitride semiconductor alloys that vary by adjusting a molar fraction of aluminum and/or indium. Ohmae discloses a list of possible materials that could comprise the protruded portions, but none of the materials listed are group III nitride semiconductor alloys that vary by adjusting a molar fraction of aluminum and/or indium. Ex. 1004 ¶ 26. In fact, Ohmae discloses that, in discussing the growth of the semiconductor GaN layer, that “[t]he most important point in this growth resides in that at the initial stage of the growth, GaN does not grow at the protruded portion 12 of the substrate 11 and the growth of GaN starts at the recess portion 12.” Ex. 1004 ¶ 174. This disclosure shows that the protruded portions would not be made of GaN, AlGa_N, AlInGa_N, or InGa_N because if they were, there would be GaN growth on the protruded portions (i.e., there would be no selectivity in growth between the protruded and recessed portions). And, Figure 13 shows no GaN growth on the protruded portions.

50. Similarly, in Ban, the alleged “inhomogeneous regions” are composed of SiO₂, not a group III nitride semiconductor alloy. Ex. 1005 ¶¶ 42-43.

51. Claim 20 also additionally recites “wherein two or more of the offset inhomogeneous regions of the same type at least partially overlap with one another, wherein the inhomogeneous regions include clusters of overlapping regions disconnected by gaps.” The prior art of record does not disclose this

limitation. For example, the alleged “inhomogeneous regions” in Saxler do not overlap at all, let alone partially overlap. Ex. 1007 ¶ 21; Fig. 3. Additionally, the allegedly inhomogeneous regions do not include clusters of overlapping regions disconnected by gaps. Ex. 1006, Fig. 5. Indeed, the “regions” identified actually constitute a single region.

52. I am unaware of any motivation to modify the prior art to include these additional limitations of claim 20. Should Lite-On allege any such motivation(s), I reserve the right to rebut it. Accordingly, it is my opinion that proposed claim 20 is patentable over the prior art.

VII. CONCLUSION

53. For the reasons set forth above, it is my opinion that the proposed substitute claims are supported by the original specification of the ’156 Application and patentable over the prior art.

54. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the 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.

55. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

February 9, 2023

By: 
Daniel Feezell, Ph.D.

Appendix A

DANIEL F. FEEZELL, PH.D.

Department of Electrical and Computer Engineering
University of New Mexico
1313 Goddard St. SE (MSC04 2710), Albuquerque, NM 87106-4343
Phone: 505.272.7823 | Fax: 505.272.7801 | E-mail: dfeezell@unm.edu | Web: www.feezellgroup.com

EDUCATION

Ph.D. Electrical Engineering, University of California Santa Barbara, 2005

Thesis Title: *Long-Wavelength Vertical-Cavity Surface-Emitting Lasers with Selectively Etched Thin Apertures*

Advisor: Professor Larry A. Coldren

M.S. Electrical Engineering, University of California Santa Barbara, 2001

B.S. Electrical Engineering, University of California Irvine, 2000

PROFESSIONAL EXPERIENCE

General Chair, Optical Science and Engineering (OSE) Program, University of New Mexico, Albuquerque, NM, 2022 – present

Associate Professor (with tenure) - Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM, 2017 – present

Assistant Professor - Department of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM, 2012 – 2017

Project Scientist (advisor: Professor Shuji Nakamura) - Materials Department and Solid-State Lighting and Energy Center, University of California Santa Barbara, Santa Barbara, CA, 2010 – 2012

Director of Fabrication and Senior Device Scientist (first employee) - Soraa, Inc., Goleta, CA, 2007 – 2010

Postdoctoral Researcher (advisor: Professor Shuji Nakamura) - Materials Department, University of California Santa Barbara, Santa Barbara, CA, 2005 – 2007

Graduate Student Research Assistant (advisor: Professor Larry A. Coldren) - Electrical and Computer Engineering Department, University of California Santa Barbara, Santa Barbara, CA, 2000 – 2005

Undergraduate Research Assistant (advisor: Professor Henry Lee) - Electrical Engineering and Computer Science Department, University of California Irvine, Irvine, CA, 1999 – 2000

AWARDS AND HONORS

UNM Regents' Lecturer, 2020-2022

Selected for *Physica Status Solidi Showcase 2020* for “A Decade of Nonpolar and Semipolar III-Nitrides: A Review of Successes and Challenges”, 2020

Top 20 Most Cited Papers in *Applied Physics Letters* in 2018 for “Impact of crystal orientation on the modulation bandwidth of InGaN/GaN light-emitting diodes”

Sole Selected UNM Nominee for Blavatnik Award in Physical Sciences & Engineering Category, 2017

Editor's Pick, Optics Express, 2017 (doi.org/10.1364/OE.25.019343)

School of Engineering Junior Faculty Research Award, University of New Mexico, 2016

STC Innovation Award, University of New Mexico, 2016, 2019, 2020, 2021

NSF Faculty Early Career Development (CAREER) Program Award for “CAREER: Short-Wavelength Vertical-Cavity Surface-Emitting Laser Arrays Using Nonpolar and Semipolar GaN,” National Science Foundation, 2015

DARPA Director’s Fellowship for “High-Speed Nonpolar InGaN/GaN Light-Emitting Diodes Using Plasmonic Core-Shell Nanowires,” Defense Advanced Research Projects Agency, 2015

Young Professional Speaker Award at the 2015 Electronic Materials and Applications Conference

DARPA Young Faculty Award for “High-Speed Nonpolar InGaN/GaN Light-Emitting Diodes Using Plasmonic Core-Shell Nanowires,” Defense Advanced Research Projects Agency, 2013

Editor’s Pick, Applied Physics Letters, 2013

30th Annual JSAP Outstanding Paper Award, Japan Society of Applied Physics, 2008

Excellence in Technical Communication Award, Laser Focus World Magazine, 2007

Outstanding Research Achievement, Solid-State Lighting and Display Center, University of California Santa Barbara, 2007

National Research Council (NRC) Postdoctoral Associate Fellowship (declined), NIST, 2007

Three-Year Graduate Student Support Package, University of California Santa Barbara, 2000

ECE Departmental Fellowship, University of California Santa Barbara, 2000

FUNDING HISTORY

Total funding awarded at UNM since joining in 08/2012 is \$9.63M. The listed total funding and individual award values represent only Prof. Feezell’s portion at UNM in the case of multi-institution and/or multi-PI grants (except in the case of equipment grants):

(co-PI) Department of Energy (DOE) National Nuclear Security Agency (NNSA) Minority Serving Institution Partnership Program (MSIPP), Sub-Contract from UT El Paso (UTEP), “Consortium for Education and Research in Electronics for Extreme Environments (E3C),” \$1,125,000, 10/1/22 – 9/30/27, Grant No: 226160676C

(PI) MSI STEM Research and Development Consortium (MSRDC) through DOE, “Scaling Effects in InGaN/GaN Micro-LEDs: Non-Radiative Surface Recombination and Efficiency,” \$99,681.00, 12/6/21 – 12/5/22, Grant No: D01_W911SR-14-2-0001-(OR#57)

(PI) Army Research Laboratory (ARL), “Energy Efficient Electronics and Photonics: III-Nitride VECSELs, UV LEDs, and Integrated Photonics Components for Defense Applications,” \$240,000, 09/15/20 – 12/14/22, Grant No: W911NF2020234

(PI) Applied Materials, “Epitaxial Growth and Characterization of Gallium Nitride Nanostructure-Based Micro-LEDs,” \$245,984, 05/08/20 – 12/31/22, Grant No: 2RQD1

(PI) Applied Materials, “Fabrication of Gallium Nitride Nanostructure-based micro-LEDs,” \$73,800, 05/08/20 – 12/31/22, Grant No: 2RQC9

(co-PI) Sandia National Laboratories, “Designing and fabrication of isolation layer with Porous GaN (for LDRD 218435),” \$54,000, 11/05/2020 – 9/30/2022, Grant No: SPO: 2208054

(co-PI) Sandia National Laboratories, “Student Training and Consumables Procurement for Growth of Low-Dislocation-Density GaN-Based Nanowire Electronics,” \$84,905, 06/23/2021 – 9/30/2022, Grant No: SPO: 2277542

(co-PI) Department of Energy (DOE), “Efficient Green and Yellow LEDs for Solid State Lighting Applications,” \$560,000, 4/1/20 – 3/31/24, Grant No: 20-0374

(PI) Facebook Reality Labs, “Dynamic characterization of μ LEDs,” \$159,264, 10/1/2019 - 3/31/22, Grant No: 2RPM5.

(PI) BluGlass, Ltd, “GaN-Based RPCVD-Grown Laser Diodes,” \$203,000, 12/10/18 – 1/31/22.

(PI) Air Force Research Labs (AFRL), "Advanced Components for Electronics in Space," \$140,000, 2/7/17–01/22/22, Grant No: 2RJN5

(co-PI) Sandia National Laboratories, “Fabrication of Isolation Layer with Porous GaN,” \$25,000, 01/08/2020 – 09/30/2020, Grant No: SPO: 2122883

(PI) Army Research Laboratory (ARL) “High-Efficiency III-Nitride Ultraviolet Light-Emitting Diodes for Defense Applications,” \$231,747, 09/15/18–09/14/20, Grant No: W911NF1820281

(co-PI) National Science Foundation, “MRI: Acquisition of a Magnetic Property Measurement System (MPMS) To Support Research and Education in the State of New Mexico,” \$276,436, 08/01/18–07/31/21, Grant No: 1828744

(co-PI) Defense Threats Reduction Agency (DTRA), “Radiation Effects in N-Face and Nonpolar m-Plane III-Nitrides and Heterostructures,” \$495,000, 08/16/17–08/15/20, Grant No: HDTRA1-17-1-0056 (sub-award: 5704-UNM-DTRA-0056)

(PI) National Science Foundation Electronic, Photonic, and Magnetic Devices Program (**CAREER Award**), “CAREER: Short-Wavelength Vertical-Cavity Surface-Emitting Laser Arrays Using Nonpolar and Semipolar GaN,” \$500,000, 03/01/2015 – 02/29/20, Grant No: 1454691

(co-PI, with Sandia National Labs) Advanced Research Projects Agency Energy (ARPA-E), “High Voltage Re-grown GaN P-N Diodes Enabled by Defect and Doping Control,” \$687,200, 11/15/17–5/14/20, Grant No: DE-AR0000869

(PI) Department of Defense (Army Research Office), “High-Resolution X-Ray Diffractometer for Advanced Epitaxial Thin-Film and Nanoscale Materials Characterization,” \$438,653, 09/5/17–09/4/18, Grant No: W911NF-17-1-0476

(PI) Advanced Research Projects Agency (ARPA-E) via iBeam Materials, Inc., “Epitaxial GaN on Flexible Metal Tapes for Low-Cost LED Devices,” \$130,000, 01/13/17–11/30/18, Grant No: DE-AR0000447 (sub-award: 170846)

(co-PI) National Science Foundation Engineering Research Center in Smart Lighting (sub-contract from Rensselaer Polytechnic Institute), “Patterned m-Plane Nanowall LEDs,” \$999,705 (Fezell portion), \$4,010,723 (total budget), 09/2012 – 08/2018, Grant No: EEC-0812056 (sub-award: A12020)

(PI) Office of Naval Research, “High-Speed Blue and Green Light-Emitting Diodes Using Polarization-Free GaN,” \$593,974, 08/01/2015 – 07/31/2018, Grant No: W911NF-15-1-0428

(PI) Department of Energy (Basic Energy Sciences, Energy Efficiency and Renewable Energy), “Investigation of Superluminescent Diodes for Smart Lighting Systems,” \$400,000, 08/01/2016 – 07/31/2018, Grant No: DE-SC0016618

(co-PI) National Science Foundation, “MRI: Acquisition of Multi-Material Dry Etcher for Nanophotonics,” \$553,348, 09/1/15-08/31/17, Grant No: 1532098.

(PI) Defense Advanced Research Projects Agency (**DARPA**) **Young Faculty Award + Director's Fellowship Extension**, "High-Speed Nonpolar InGaN/GaN Light-Emitting Diodes Using Plasmonic Core-Shell Nanowires," \$936,747, 08/2013 – 07/2017, Grant No: D13AP00055

(PI) Army Research Laboratory (ARL) "Nonpolar Vertical-Cavity Surface-Emitting Lasers for Ytterbium Atomic Clocks," \$259,000 (UNM portion), \$500,000 (total budget including sub-contract to UCSB), 01/2015 – 07/2016, Grant No: W911NF-15-1-0027

(PI) Sandia National Laboratories, "III-Nitride Lasers for Solid-State Lighting," \$121,901, 09/2013 – 10/2015, Grant No: 1391774

TEACHING AND STUDENT SUPERVISION

Courses Taught:

ECE 371, *Materials and Devices*, Required Undergraduate Course, University of New Mexico, Fall Semester 2013, 2014, 2017, and 2019

ECE 471, *Materials and Devices II*, Elective Undergraduate Course, University of New Mexico, Spring Semester 2020

ECE 475, *Introduction to Electro-Optics and Opto-Electronics*, Elective Undergraduate Course, University of New Mexico, Spring Semester 2013, 2015, and 2018, Fall Semester 2022

ECE 495/595, *ST: Light-Emitting Diodes and Solid-State Lighting*, University of New Mexico, Fall Semester 2018

ECE 570, *Optoelectronic Semiconductor Materials and Devices*, Required Graduate Course, University of New Mexico, Fall Semester 2015 and 2016, Spring Semester 2022

ECE 577, *Fundamentals of Semiconductor LEDs and Lasers*, Elective Graduate Course, University of New Mexico, Spring Semester 2012, 2016, and 2019

ECE 595, *ST: Characterization Techniques for Semiconductor Materials and Devices*, University of New Mexico, Fall Semester 2021

MAT 215C, *Semiconductor Device Processing*, Elective Graduate Course, University of California Santa Barbara, Spring Quarter 2011 (with Prof. Nakamura)

ECE 162B, *Fundamentals of Solid-State Physics*, Required Undergraduate Course, University of California Santa Barbara, Winter Quarter 2010 (with Prof. DenBaars)

Graduate Student Advising:

Current Ph.D.:

Mr. Xuefeng Li, Ph. D. Student (post-qualifier, post-proposal), January 2019-present

Mr. Abdelrahman Tarief Mohamed Fawzy Elshafiey Alakrat, Ph. D. Student (post-qualifier, pre-proposal), August 2017-present

Mr. Hatem Babaa, Ph. D. student (post-qualifier, pre-proposal), August 2019-present

Ms. Elizabeth DeJong, Ph.D student (post-qualifier, pre-proposal), August 2019-present

Mr. Caleb Glaser, University of New Mexico, Ph. D Student (pre-qualifier, pre-proposal), August 2018-present

Mr. Zachary Meinelt (on leave), Ph. D. student (pre-qualifier, pre-proposal), August 2019-present

Graduated Ph.D (8 as primary research advisor, 1 as chairperson):

Dr. Farnood Mirkhosravi, University of New Mexico, Ph.D. Graduate, May 2022, “Gamma and Neutron Irradiation Impacts on Ga-polar and N-polar GaN based diodes.” Currently Postdoctoral Fellow at UNM.

Dr. Andrew Aragon, University of New Mexico, Ph.D. Graduate, April 2021, “Etched-and-Regrown Diodes on M-Plane GaN for Next Generation Power Electronic Devices,” **Graduated with Distinction.** Currently at Intel.

Dr. Nick Boynton, University of New Mexico and Sandia National Laboratories, Ph.D. Student (post-qualifier, post-proposal), May 2020. Currently a Senior Member of Technical Staff at Sandia National Laboratories.

Dr. Saadat Mishkat-UI-Masabih, University of New Mexico, Ph.D. Graduate, August 2019, “Nonpolar GaN-Based VCSELs With Lattice-Matched Nanoporous Distributed Bragg Reflector Mirrors,” **Graduated with Distinction.** Currently a Technology Development Module Engineer at Intel.

Dr. Md Mottaleb Hossain, University of New Mexico, Ph.D. Graduate, May 2019, “Algorithmic Multi-Color CMOS Avalanche Photodiodes For Smart-Lighting Applications.” Daniel Feezell (Chairperson), Majeed Hayat (Research Advisor).

Dr. Arman Rashidi, University of New Mexico, Ph.D. Graduate, December 2018, “Carrier Dynamics in High-Speed III-Nitride Light-Emitting Diodes for Visible-Light Communication,” **Won best dissertation award from Optical Sciences and Engineering program at UNM. Graduated with Distinction.** Currently a postdoctoral researcher at UCSB.

Dr. Mohsen Nami, University of New Mexico, Ph.D. Graduate, October 2017, “Nanowire-Based Light-Emitting Diodes: A New Path Towards High-Speed Visible Light Communication.” **Won best dissertation award from Optical Sciences and Engineering program at UNM. Graduated with Distinction.** Currently a postdoctoral researcher at Yale University.

Dr. Nick Martinez, University of New Mexico and Sandia National Laboratories, Ph.D. Graduate, July 2017, “Waveguide-coupled Avalanche Photodiodes for a CMOS Compatible Transceiver Package.” Currently a Senior Member of Technical Staff at Sandia National Laboratories.

Dr. Jeremy Wright, University of New Mexico and Sandia National Laboratories, Ph.D. Graduate, September 2014, “III-Nitride Nanowire Lasers.” Currently a Senior Member of Technical Staff at Sandia National Laboratories.

*Served on the Ph.D. committee for an additional >15 graduated students

Current M.S.:

Julianna Khenaisser, M.S. student, August 2022 – present

Graduated M.S. (22 as primary advisor):

Ms. Elizabeth DeJong, University of New Mexico, OSE M.S. Graduate, May 2022.

Mr. Hatem Babaa, University of New Mexico, OSE M.S. Graduate, May 2022.

Mr. Zachary Meinelt, University of New Mexico, OSE M.S. Graduate, May 2022.

Ms. Windy Slater, University of New Mexico, ECE M.S. Graduate, May 2022.

Mr. Gevoni Briseno, University of New Mexico, ECE M.S. Graduate, May 2022.

Mr. Andrew Miano, University of New Mexico, ECE M.S. Graduate, August 2021.

Mr. Jack Kramer, University of New Mexico, ECE M.S. Graduate, August 2021.
Mr. Xuefeng Li, University of New Mexico, OSE M.S. Graduate, May 2019.
Mr. Alexander Pumerantz, University of New Mexico, ECE M.S. Graduate, May 2019.
Mr. Huck Green, University of New Mexico, ECE M.S. Graduate, May 2019.
Mr. Gabriel Rodriguez, University of New Mexico, ECE M.S. Graduate, May 2018.
Mr. Nick Boynton, University of New Mexico, ECE M.S. Graduate, December 2017.
Mr. Vincent Woods, University of New Mexico, ECE M.S. Graduate, May 2017.
Mr. Kenneth DaVico, University of New Mexico, M.S. Graduate, December 2017.
Mr. Isaac Stricklin, University of New Mexico, ECE M.S. Graduate, December 2017.
Mr. Arman Rashidi, University of New Mexico, OSE M.S. Graduate, December 2017.
Mr. Jimmy Stricklin, University of New Mexico, ECE M.S. Graduate, May 2017.
Mr. Nick Martinez, University of New Mexico, ECE M.S. Graduate, April 2017.
Mr. Bryan Ruane, University of New Mexico, ECE M.S. Graduate, December 2016.
Mr. Saadat Mishkat-Ul-Masabih, University of New Mexico, ECE M.S. Graduate, December 2016.
Mr. Rhett Eller, University of New Mexico, OSE M.S. Graduate, July 2014.
Mr. Mohsen Nami, University of New Mexico, OSE M.S. Graduate, December 2012.

*Served on the M.S. committee for an additional >10 graduated students

Postdoctoral Researcher Advising:

Current:

Dr. Farnood Mirkhosravi, University of New Mexico, University of New Mexico, Postdoctoral Fellow, July 2022-present. Project: “Epitaxial Growth and Characterization of Gallium Nitride Nanostructure-Based Micro-LEDs” with AMAT.

Former:

Dr. Mahmoud Behzadirad, University of New Mexico, Postdoctoral Fellow, January 2019-May 2022. Project: “GaN based RPCVD Grown Laser Diodes” with Blu Glass.

Dr. Arman Rashidi, University of New Mexico, Postdoctoral Fellow, December 2018-June 2020. Project: “RF Characterization of III-nitride optoelectronic Devices.”

Dr. Ashwin Rishinaramangalam, University of New Mexico, Postdoctoral Fellow, August 2012-December 2019. Project: “Coaxial Nanostructure LEDs” with Smart Lighting Engineering Research Center (ERC). Currently at Intel.

Dr. Morteza Monavarian, University of New Mexico, Postdoctoral Fellow, June 2016-June 2019. Project: “High-Speed Blue and Green Light-Emitting Diodes Using Polarization-Free GaN” with DoD. Currently at UCSB.

Dr. Serdal Okur, University of New Mexico, Postdoctoral Fellow, February 2015-June 2016. Project: “Nonpolar Vertical-Cavity Surface-Emitting Lasers for Ytterbium Atomic Clocks” with DARPA. Currently at Structured Materials and Industries, Inc.

Dr. Benjamin Bryant, University of New Mexico and Sandia National Laboratories, September 2013-2015. Project: “High-Speed Nonpolar InGaN/GaN Light-Emitting Diodes Using Plasmonic Core-Shell Nanowires” with DARPA Young Faculty Award. Currently at Avogy.

Undergraduate Student Advising:

Current:

None

Former:

Mr. Neema Naeemi, University of New Mexico, ECE Undergraduate, May 2017-May 2018. Funded by DOD HBCU/MI.

Mrs. Gabriela Rumella, California Polytechnic University San Luis Obispo, June 2018 – August 2018. Funded by Nanoscience and Microsystems Research Experience for Undergraduates (REU) Program.

Mr. William Hale, College of New Mexico Undergraduate, May 2017-August 2017. Funded by Nanoscience and Microsystems Research Experience for Undergraduates (REU) Program.

Ms. Olivia Johnson, University of New Mexico, ECE Undergraduate, August 2015-May 2017. Funded by DOD HBCU/MI. Currently at Palo Verde Nuclear Generating Station.

Mr. Jorge Romero, University of New Mexico, ECE Undergraduate, October 2014-May 2015. Funded by Smart Lighting Engineering Research Center. Currently a graduate student at University of Utah.

Ms. Jacquie Shortridge, University of Arizona Physics Undergraduate, June 2014-August 2014. Funded by Nanoscience and Microsystems Research Experience for Undergraduates (REU) Program.

Ms. Rekha Schnepf, Mellon University Undergraduate, June 2013-August 2013. Funded by Nanophotonics REU Program. Currently at Colorado School of Mines. Received NSF Graduate Fellowship.

Mr. Michael Wabaunsee, Southwestern Indian Polytechnic Institute (SIPI) Undergraduate, October 2012-May 2013. Funded by Nanophotonics REU Program.

High School Student Advising:

Former:

Ms. Sonia Macias, Atrisco Heritage Academy High School Student, June 2017-August 2017. Funded by Smart Lighting Engineering Research Center.

Ms. Aryn Gallegos, Albuquerque Academy High School Student, June 2015-August 2015. Funded by Smart Lighting Engineering Research Center.

Ms. Isabel Gallegos, Albuquerque Academy High School Student, June 2016-August 2016. Funded by Smart Lighting Engineering Research Center.

CONSULTING EXPERIENCE

Independent Technical Consultant (Expert), Radulescu LLP, 12/2022 - present

Independent Technical Consultant, BluGlass Ltd, 03/2020 – present

Independent Technical Consultant (Expert), Perkins Coie, LLP, 04/2020 – 05/2021

SATCO PRODUCTS, INC. Petitioner, v. SEOUL VIOSYS CO., LTD. Patent Owner, Case IPR2020-00655, Patent 9,627,435 B2

SATCO PRODUCTS, INC. Petitioner, v. SEOUL VIOSYS CO., LTD. Patent Owner, Case IPR2020-00608, Patent 9,343,631

Independent Technical Consultant, Exalos, 10/2020 – 06/2021

Independent Technical Consultant, Kairos Ventures, 04/2019 – 07/2019

Independent Technical Consultant (Expert), Latham and Watkins, LLP, 05/2017 – 06/2018

Independent Technical Consultant, CITIC Capital, 12/2016 – 03/2017

Independent Technical Consultant, Masimo Semiconductor, 09/2016 – 9/2017

Independent Technical Consultant (Expert), Williams & Connolly, LLP, 05/2013 – 12/2014

Independent Technical Consultant (Expert), Skadden, Arps, Slate, Meagher, and Flom, LLP, 09/2011 – 09/2012

Independent Technical Consultant for GaN-Based Lasers, Insite Partners: 08/2010 – 11/2010

SERVICE ACTIVITIES

Service to UNM:

UNM: Reviewing of internal proposals for OVPR, 2015 - present

UNM: Large Equipment Advisory Group, 2017 - present

ECE Department: Graduate Curriculum Committee, 2013 – present

CHTM: Nanofabrication Facility Committee, 2018 – present

CHTM: Director's Advisory Committee, 2018 – present

ECE Workload Policy Committee, 2017 and 2021

ECE Department: Optoelectronics Area Chair, 2015 – 2020

UNM: Research Misconduct Committee, 2019 – 2020

CHTM Faculty Search Committee (committee chair), 2018 – 2019 – two faculty hired (ECE and Physics)

ECE Promotion and Tenure Committee, 2018-2019

ECE Department Faculty Search Committee, 2017

CHTM: Director Search Committee, 2017

School of Engineering: Dean Search Committee, 2016

ECE Department: ABET Assessment Committee, 2015

ECE Department: Undergraduate Curriculum Committee, 2013 – 2015

CHTM: Nanofabrication Facility Steering Committee, 2014 – 2015

CHTM: Faculty Search Committee, 2013 – 2014

CHTM: Cleanroom Manager Search Committee, 2014

Leadership:

General Chair, Optical Science and Engineering (OSE), 2022 - present

Chair, CHTM Cleanroom Committee, 2021 - present

Area Chair, Optoelectronics, ECE Department, 2015 – 2020

Chair, CHTM Faculty Search Committee, 2018 – 2019 – two faculty hired (ECE and Physics)

Proceedings Chair and Editor, International Workshop on Nitride Semiconductors (IWN), October 2016

Faculty Advisor, CHTM Nanofabrication Facility, 2015 – 2018

Sources Thrust Leader, NSF Engineering Research Center on Smart Lighting, 2012 – 2019

Professional Service:

DOE Diversity, Equity, Inclusion, and Respect (DEIR) Working Group, 2022 - present

Program Committee, 2022 International Workshop on Nitride Semiconductors (IWN), Optical Devices

Program Committee, 2022 Compound Semiconductor Week (CSW), Semiconductor Lasers and LEDs

Program Committee, 2021 International Conference on Nitride Semiconductors (ICNS)

Session Chair, 2020 SPIE Photonics West

Program Committee, 2020 Lester Eastman Conference

Program Committee, 2020 International Workshop on Nitride Semiconductors (IWN), Optical Devices

Program Committee, 2019 19th International Conference on Crystal Growth and Epitaxy (ICCGE-19) and the 19th US Biennial Workshop on Organometallic Vapor Phase Epitaxy (OMVPE-19)

Program Sub-Committee (Displays and Lighting), 2019 IEEE Photonics Conference

Program Committee, 2019 International Conference on Nitride Semiconductors (ICNS)

Program Committee, 2019 ISPlasma 2019/IC-PLANTS

Technical Committee (Semiconductor Lasers), 2018 Compound Semiconductor Week

Program Committee, 2018 International Workshop on Nitride Semiconductors (IWN)

Program Committee, 2018 SPIE Optics and Photonics Conference (Wide Bandgap Devices)

Program Committee, 2017 International Symposium on Semiconductor Light-Emitting Devices (ISSLED)

Program Committee, 2017 International Conference on Nitride Semiconductors (ICNS)

Session Chair and Organizer for 18th US Workshop on Organometallic Vapor Phase Epitaxy (OMVPE-18)

Invited Organizer for *Group III-Nitrides and Compound Semiconductor Growth on Silicon* topics at 2015, 2016, 2017, 2018 Electronic Materials Conference

Technical Committee Member for Lester Eastman Conference, August 2016

Invited Organizer for *Compound Semiconductor Growth on Silicon* topic at 2014 Electronic Materials Conference

Session Chair for *III-Nitride Novel Device Concepts and Nanowires: Structures and Defects* sessions, 2014 Electronic Materials Conference

Subcommittee Member for *Science and Innovation 15: LEDs, Photovoltaics and Energy-Efficient ("Green") Photonics*, 2014 Conference on Lasers and Electro-Optics

Reviewing and Panels:

DOE Diversity, Equity, Inclusion, and Respect Roundtable, 12/7/21

KAUST PhD Dissertation External Reviewer, 2021

KAUST CRG 2019 proposal reviewer, 7/17/19

DOE Solid State Lighting BTO National Lab Call proposal reviewer, 5/31/19

UNM ADVANCE panel member for “How to talk to your program officer,” 10/19/18

Army Research Office proposal reviewer, 9/26/18

National Science Foundation proposal review panel for Photonics and Lasers in Electronic, Photonic, and Magnetic Devices Program, 1/7/16 – 1/8/16

Department of Energy Solid-State Lighting Roundtable Discussion, 9/9/15

Army Research Labs program reviewer for Sensors and Electron Devices Directorate, 7/22/15

National Science Foundation proposal review panel for LEDs, OLEDs, Lighting, Displays in SBIR/STTR Program, 8/26/14

National Science Foundation proposal review panel for LEDs, OLEDs, and Light Sources in SBIR/STTR Program, 2/26/14

National Science Foundation proposal review panel for Emitters and Detectors in Electronic, Photonic, and Magnetic Devices Program, 1/27/14 – 1/28/14

Technical Journal Reviewer: Applied Physics Letters, Nature, Nano Letters, Optics Express, Journal of Applied Physics, Journal of Crystal Growth, Physica Status Solidi, Photonics Technology Letters, Laser and Photonics Reviews, Electron Device Letters, Photonics Review, Electrochemical and Solid-State Letters, Rapid Research Letters, Applied Physics Express, Japanese Journal of Applied Physics.

Outreach:

Collaborator, Southwestern Indian Polytechnic Institute (SIPI) through NSF CAREER Award, 03/2015-present

Mentor, Research Experience for Undergraduates (REU), University of New Mexico, 09/2012 – 08/2018

Mentor, Research Experience for Teachers (RET), University of New Mexico, 06/2013 – 08/2017

Presenter, “Electricity and Light!,” Pajarito Elementary School (1st – 5th grade gifted class), 05/15/17

Presenter, “Electricity and Light!,” Manzano Day School Elementary (1st grade class), 03/09/17

Presenter, “High Efficiency Solid-State Lighting, Light-Emitting Diodes, and Smart Lighting,” Southwestern Indian Polytechnic Institute (SIPI), 12/05/13 and 04/03/14.

Presenter, “Light-Emitting Diodes and Smart Lighting,” Dolores Gonzales Elementary School (5th grade class), 10/26/12

Instructor for high-school and community college students, National Nanotechnology Infrastructure Network (NNIN), University of California Santa Barbara, 09/2004-06/2005

Professional Standing:

Faculty Associate: Center for High Technology Materials, University of New Mexico

Member: IEEE (Senior Member), IEEE Photonics Society, SPIE, OSA, MRS, Tau Beta Pi

Prior Member: American Physical Society, American Ceramic Society, Eta Kappa Nu

PUBLICATIONS

As of Sept. 2, 2022: **h-index = 46**, **i10-index = 97**, and number of **citations = 7,894** (source: Google Scholar). Since joining UNM in August 2012, I have published 56 peer-reviewed journal articles, 110 peer-reviewed conference presentations/proceedings (including 18 invited presentations), 1 book chapter, 6 popular/technical press publications, 24 workshop/non-refereed presentations, and 10 UNM patents.

ACCEPTED, SUBMITTED, IN-PREPARATION JOURNAL / CONFERENCE PUBLICATIONS

- [1] F. Mirkhosravi, A. Rashidi, J. Gallagher, Z. Abedi, K. Ahn, A. Lintereur, E.K. Mace, M.A. Scarpulla, **D. Feezell**, “Effects of fast and thermal neutron irradiation on Ga-polar and N-polar GaN diodes,” accepted in *Journal of Applied Physics*, July 2022.
- [2] N Pant, X. Li, E. DeJong, **D. Feezell**, R. Armitage, and E. Kioupakis, “Origin of the injection-dependent emission blueshift and linewidth broadening in III-nitride light-emitting diodes,” accepted in *AIP Advances*.
- [3] **D. Feezell**, X. Li, A. Rashidi, M. Nami, M. Monavarian, A. Rishinaramangalam, E. DeJong, and R. Armitage, “Carrier Dynamics of Polar, Semipolar, and Nonpolar InGaN/GaN LEDs Measured by Small-Signal Electroluminescence,” accepted to *SPIE Photonics West*, to be presented Feb. 2023 (Invited).
- [4] N Pant, X. Li, E. DeJong, **D. Feezell**, R. Armitage, and E. Kioupakis, “How numerical simulations can advance wide bandgap materials and devices: a case study on the optical spectrum of visible light-emitting diodes,” submitted to *APS Physics March Meeting*.
- [5] X. Li, E. DeJong, N. Pant, E. Kioupakis, R. Armitage, and **D. Feezell**, “Effect of Emission Wavelength on Carrier Dynamics in InGaN/GaN LEDs,” in preparation for *Applied Physics Letters*.
- [6] M. Behzadizad, R. Someshwar, M. Khoury, and **D. Feezell**, “High-Quality c-Plane GaN Film with Controlled Polarity on PVD AlN Buffer on Si (111),” in preparation.
- [7] A. Rashidi, M. Monavarian, and **D. Feezell**, “Methods for Characterization of Carrier Dynamics in III-Nitride Light-Emitting Diodes,” in preparation for *Laser and Photonics Reviews*.
- [8] M. Monavarian, M. Behzadizad, T. Busani, and **D. Feezell**, “A review of advances and challenges of III-nitride nanostructures: From synthesis/fabrication methods to applications,” in preparation.
- [9] N. A. Sanford, P. T. Blanchard, A. Roshko, A. K. Rishinaramangalam, **D. Feezell**, and A. V. Davydov, “Laser-assisted atom probe tomography study of c-plane and m-plane InGaN test structures: likely contributions from spontaneous polarization effects,” in preparation.

INVITED REFEREED JOURNAL PUBLICATIONS:

- [1] M. Monavarian, A. Rashidi, and **D. Feezell**, “A Decade of Nonpolar and Semipolar III-Nitrides: A Review of Successes and Challenges,” *Phys. Stat. Sol. (a)*, vol. 216, pp. 1800628, Jan. 2019. doi: 10.1002/pssa.201800628 **Selected for Physica Status Solidi Showcase 2020**
- [2] **D. Feezell** and S. Nakamura, “Invention of the Blue Light-Emitting Diode, the Enabler of Solid-State Lighting,” *Comptes Rendus De L’Academie Des Sciences – Serie IV Physique-Astrophysique, The*

Revolution of LED Lighting special issue, vol. 19, pp. 113-133, May 2018. doi: 10.1016/j.crhy.2017.12.001

- [3] **D. Feezell**, J. Speck, S. DenBaars, and S. Nakamura, "Semipolar ($2\bar{0}\bar{2}1$) InGa_N/Ga_N Light-Emitting Diodes for High Efficiency Solid-State Lighting," *J. Display Technol.*, vol. 9, pp. 190-198, Feb. 2013.
- [4] S. DenBaars, **D. Feezell**, K. Kelchner, S. Pimputkar, C. Pan, C. Yen, S. Tanaka, Y. Zhao, N. Pfaff, R. Farrell, M. Iza, S. Keller, U. Mishra, J. Speck, and S. Nakamura, "Development of Gallium-Nitride-Based Light-Emitting Diodes (LEDs) and Laser Diodes for Energy-Efficient Lighting and Displays," *Acta Materialia*, vol. 61, pp. 945-951, Feb. 2013.
- [5] M. Hardy, **D. Feezell**, S. DenBaars, and S. Nakamura, "Group III-Nitride Lasers: A Materials Perspective," *Materials Today*, vol. 14, pp. 408-415, Sep. 2011.
- [6] **D. Feezell**, M. Schmidt, S. DenBaars, and S. Nakamura, "Development of Nonpolar and Semipolar InGa_N/Ga_N Visible Light-Emitting Diodes," *MRS Bulletin: Nonpolar and Semipolar Group III Nitride-Based Materials*, vol. 34, pp. 318-323, May 2009.

REFEREED JOURNAL PUBLICATIONS:

- [1] M. Monavarian, B. Abaie, S. Mishkat-Ul-Masabih, F. Mirkhosravi, A. Mafi, and **D. Feezell**, "Disorder-induced broadband distributed Bragg reflectors in dielectric and nanoporous Ga_N systems," *Physica Status Solidi (PSS) Rapid Research Letters (RRL)*, pp. 2100598(1-5), Feb. 2022. doi:10.1002/pssr.202100598
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WORKSHOPS AND OTHER NON-PEER-REVIEWED PRESENTATIONS:

- [1] **D. Feezell**, “Working with UNMRI on Semiconductor Patents,” Invited Presentation to UNMRI Board of Directors, July 2022.
- [2] **D. Feezell**, “Perspectives from the University of New Mexico (an R1 HIS/MI/MSI),” Department of Energy (DOE) Diversity, Equity, Inclusion, and Respect (DEIR) Roundtable Discussion, Online Zoom Meeting, Dec. 7, 2021.
- [3] **D. Feezell**, “Small-Signal RF Measurements for LED Carrier Dynamics,” DOE Solid-State Lighting R&D Roundtable Discussion, virtual event, Aug. 2021.
- [4] **D. Feezell**, “Nonpolar and Semipolar III-Nitride Optoelectronics at UNM,” Facebook Seminar, virtual event, Mar. 2021.
- [5] **D. Feezell**, “Nonpolar GaN-Based VCSELs with Lattice-Matched Nanoporous Distributed Bragg Reflector Mirrors,” OSE Seminar, UNM, Feb. 2021.
- [6] **D. Feezell**, “Micro-LEDs and Superluminescent Diodes: Optical Properties and Carrier Dynamics,” DOE Solid-State Lighting R&D Workshop, San Diego, CA, Jan. 2020.
- [7] **D. Feezell**, “Nonpolar and Semipolar III-Nitride Optoelectronics,” Center for Integrated Nanotechnologies (CINT) Seminar, June. 2019.
- [8] **D. Feezell**, “High-Speed Micro-Scale Light-Emitting Diodes for Visible-Light Communication,” University of Utah, Salt Lake City, UT, Feb. 2019.
- [9] **D. Feezell**, “Novel measurements and models for understanding the efficacy versus luminance trade-off,” DOE Solid-State Lighting R&D Workshop, Dallas, TX, Jan. 2019. (**Invited Panel Speaker**)
- [10] **D. Feezell**, “Gallium-nitride-based superluminescent diodes for smart lighting systems,” DOE Solid-State Lighting R&D Workshop, Dallas, TX, Jan. 2019.

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- [14] **D. Feezell**, “Nonpolar and Semipolar III-Nitride Optoelectronics,” UNM Optical Science and Engineering (OSE) Seminar, Oct. 2017.
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- [18] **D. Feezell**, “Nonpolar and Semipolar III-Nitride Optoelectronic Materials and Devices,” Ohio State University, April 2016.
- [19] **D. Feezell**, “Nonpolar Vertical-Cavity Surface-Emitting Lasers for Ytterbium Atomic Clocks,” guest speaker at DARPA LUSTER Program Review, Feb. 2016.
- [20] **D. Feezell**, “Superluminescent Diodes: an Alternative to Lasers for Advanced Lighting Systems?,” Department of Energy Solid-State Lighting Roundtable Meeting, Nov. 2015.
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