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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

NITRIDE SEMICONDUCTORS CO., LTD., a Japanese corporation, Plaintiff, v. RAYVIO CORPORATION, a Delaware corporation, Defendant.	CASE NO. 3:17-cv-02952 COMPLAINT FOR PATENT INFRINGEMENT DEMAND FOR JURY TRIAL

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Nitride Semiconductors Co., Ltd. ("NS"), for its Complaint against defendant Rayvio Corporation ("Rayvio" or "Defendant"), alleges as follows:

INTRODUCTION

1. Plaintiff NS brings this patent infringement action to protect its valuable patented technology relating to ultraviolet ("UV") light-emitting diode ("LED") technology. An LED is a semiconductor device that converts electrical energy into light. LEDs have many advantages over conventional light sources, including lower energy consumption, longer lifetime, and smaller size.

2. UV LEDs emit invisible UV light at a wavelength less than about 380nm. UV LEDs have a number of industrial, medical, health and hygiene applications. These applications include, for example, water purification, sterilization, and disinfection applications.

3. NS was founded in 2000 out of the Nitride Semiconductor Laboratory at Tokushima University in Japan. NS developed the world's first UV LED in 2000. Prior to NS's introduction of UV LEDs, it was believed that the development of shorter wavelength UV LEDs was impossible as the emission efficiency from semiconductors at the shorter wavelength would rapidly deteriorate. However, in 2000, NS succeeded in the development of the world's first high efficiency UV LED at a 350nm wavelength.

4. NS has continued to be a pioneer in UV LED technology. NS makes and sells epitaxial wafers, UV LED chips, UV LED lamps, and UV LED appliances.

THE PARTIES

5. Plaintiff NS is a company organized and existing under the laws of Japan, with its principal place of business at 115-7, Itayajima, Akinokami, Seto-cho, Naruto-shi, Tokushima 771-0360, Japan.

6. On information and belief, defendant Rayvio is a company organized and existing under the laws of the State of Delaware, with its principal place of business at 3980 Trust Way, Hayward, CA 94545.

JURISDICTION AND VENUE

7. This is an action for patent infringement, under the patent laws of the United States, 35 U.S.C. § 271 et seq. This Court has subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

8. This Court has personal jurisdiction over Rayvio. Rayvio has its principal place of business in this District. Rayvio also transacts and does business in the State of California and this District, and has committed acts of patent infringement in the State of California and this District. On information and belief, Rayvio is engaged in substantial and continuous contacts with the State of California and this District, through its conduct of business, including making, testing, selling, offering for sale, and/or importing infringing products and services to customers. On information and belief, Rayvio also places or causes to have placed infringing products and services into the stream of commerce, with the knowledge that such products and services will be made, imported, sold, offered for sale, and/or used in the State of California and this District. As such, Rayvio has purposefully availed itself of the privilege of conducting business within this District; has established sufficient minimum contacts with this District such that it should reasonably and fairly anticipate being haled into court in this District; and has purposefully directed activities at residents of this State. Furthermore, at least a portion of the patent infringement claims alleged herein arise out of or are related to one or more of the foregoing activities. On information and belief, a substantial part of the events giving rise to NS's claims, including acts of patent infringement, have occurred in the State of California and this District.

9. Venue is proper within this judicial District under 28 U.S.C. §§ 1391(b) and 1400(b). Rayvio has its principal place of business in this District, and as such has a regular and established place of business in this District. Rayvio has committed acts of patent infringement in this District, including through the activities discussed in Paragraph 8 above, a substantial part of the property at issue in this action is situated in this district, and Rayvio is subject to personal jurisdiction in this District.

PATENT-IN-SUIT

10. On March 1, 2005, the United States Patent and Trademark Office duly and

legally issued U.S. Patent No. 6,861,270 ("the '270 Patent"), entitled "Method for Manufacturing Gallium Nitride Compound Semiconductor and Light Emitting Element," to Professor Shiro Sakai. NS is the owner by assignment of the '270 Patent. A true and correct copy of the '270 Patent is attached hereto as Exhibit 1.

COUNT I

(PATENT INFRINGEMENT – '270 PATENT)

11. Plaintiff NS re-alleges and incorporates the allegations set forth in paragraphs 1-10 above as if fully set forth herein.

12. On information and belief, Rayvio has infringed and continues to infringe one or more claims of the '270 Patent pursuant to 35 U.S.C. § 271(a) at least by, without authority, making, using, offering to sell, and/or selling within the United States, or importing into the United States, infringing UV LEDs or products containing such LEDs, including, for example, Rayvio's SMD Ultraviolet Emitter on MCPCB Hex Star (SB4) product ("SB4"). On information and belief, the infringing UV LEDs are manufactured within the United States.

13. On information and belief, Rayvio also has infringed and continues to infringe pursuant to 35 U.S.C. § 271(g) at least by, without authority, importing into the United States or offering to sell, selling, and/or using within the United States infringing UV LEDs or products containing such LEDs, including, for example, Rayvio's SB4, made using a process covered by one or more claims of the '270 Patent. On information and belief, the infringing UV LEDs made by the process claimed in the '270 Patent are not materially changed by subsequent processes and do not become a trivial and nonessential component of another product.

14. Rayvio has infringed at least independent claim 8 of the '270 Patent pursuant to 35 U.S.C. § 271(a).

15. Claim 8 of the '270 Patent recites:

> A light emitting element comprising a gallium nitride based semiconductor, the light emitting element comprising:
>
> a substrate;

a first gallium nitride based semiconductor layer formed on the substrate, the first gallium nitride based semiconductor layer having a first surface;

a composition material of the first gallium nitride based semiconductor formed on less than a total area of the first surface; and

a second gallium nitride based semiconductor layer having a varied compositional ratio and formed on the first gallium nitride based semiconductor layer onto which the composition material is formed, and the second gallium nitride based semiconductor is a light emitting layer.

16. As set forth below, on information and belief, each of the limitations of claim 8 is satisfied, literally or under the doctrine of equivalents, by Rayvio's infringing products including, for example, Rayvio's SB4.

17. As shown in the image below from the SB4 Product Data Sheet, and as the product designation SB4 indicates, Rayvio's SB4 contains four light emitting elements, which are individual UV LEDs. *See* Ex. 2 at p. 1. The SB4 itself also constitutes a light emitting element, namely a "UV LED." *Id.*

18. Each of the four LEDs in the SB4 is comprised of a gallium nitride based semiconductor.

19. Robert Walker is the CEO at Rayvio. In an article published in *Semiconductor Engineering*, he stated, "We are developing demonstration applications that highlight the potential for our high power AlGaN deep UV diodes." Ex. 3 at p. 2. AlGaN refers to aluminum

gallium nitride, which is a gallium nitride based semiconductor.

20. Each of the four LEDs in the SB4 includes a substrate.

21. Rayvio has stated that it is using standard sapphire substrates. *See* Ex. 4 at p. 2.

22. Rayvio markets its "Ellie" sterilizer to its customers on the Internet. *See* Ex. 5. Rayvio identifies this product as containing "[f]our TRUVIOLET digital UV light LED modules." *Id.* Rayvio identifies "[t]he patents behind Ellie's germ-killing power" as including two patents entitled, "Backside transparent substrate roughening for UV light emitting diode." *Id.*

23. On information and belief, the LEDs in the SB4 are the same as the TRUVIOLET LEDs in the Ellie sterilizer in the respects relevant to infringement of the '270 Patent, and thus those TRUVIOLET LEDs constitute additional exemplary infringing LEDs of Rayvio.

24. Each of the four LEDs in the SB4 comprises a first gallium nitride based semiconductor layer formed on the substrate. On information and belief, consistent with Dr. Walker's statement quoted above, this first gallium nitride based semiconductor layer formed on the substrate is AlGaN. This first gallium nitride based semiconductor layer in each LED has a first surface.

25. On information and belief, each of the four LEDs in the SB4 comprises a composition material of the first gallium nitride based semiconductor formed on less than a total area of the first surface.

26. Rayvio issued a press release stating that its "core technology" is based on work by its Chief Technology Officer, Dr. Yitao Liao, and Professor Theodore Moustakas of Boston University, and that this technology is "exclusively licensed to RayVio from Boston University." Ex. 6 at p. 1.

27. A principal technical challenge for Rayvio is that deep UV LEDs composed of AlGaN are highly defect sensitive. *See* Ex. 3 at p. 3.

28. The '270 Patent discloses addressing this challenge: "One object of the present invention is to improve characteristics of a gallium nitride based semiconductor, such as, for example, light emitting efficiency, even when dislocations are present in the semiconductor."

Ex. 1, col. 1, lns. 42-45.

29. Rayvio claims that it uses the technology it exclusively licensed from Boston University to address this challenge. *See* Ex. 3 at p. 3.

30. As noted in the *Semiconductor Engineering* article, "[a] patent search reveals a U.S. patent application owned by Boston University with RayVio CTO as co-inventor" with an Abstract that begins as follows: "A method of growing an AlGaN semiconductor material utilizes an excess of Ga [gallium] above the stoichiometric amount typically used. The excess Ga results in the formation of band structure potential fluctuations that improve the efficiency of radiative recombination and increase light generation of optoelectronic devices …." Ex. 3 at p. 3.

31. The published patent application containing these statements in the Abstract is U.S. Patent App. Pub. No. US 2014/0103289 A1 ("the '289 application"). Ex. 7. This published patent application identifies Yitao Liao and Theodore Moustakas as the named inventors. *Id.* The application is also assigned to Boston University. These facts are consistent with Rayvio's characterization of its "core technology" as having been invented by Drs. Liao and Moustakas. The provisional application leading to the '289 application was filed on April 30, 2010. *Id.*

32. In April 2011, Milan Minsky, identified as part of the Rayvio team, stated that the idea to commercialize the technology for Rayvio arose around October 2010: https://www.youtube.com/watch?v=ia_6ymmqtjQ. This is also consistent with timing of the filing of the provisional application for the '289 application.

33. On information and belief, the '289 application discloses Rayvio's core technology that Rayvio uses in its UV LEDs.

34. On information and belief, the '289 application evidences that each of the four LEDs in the SB4 comprises a composition material of the first gallium nitride based semiconductor formed on less than a total area of the first surface of a first gallium nitride based semiconductor layer.

35. In the '289 application, "[t]he growth of AlGaN films under excess Ga conditions is depicted in FIG. 11. The top portion of the figure shows a growing AlGaN layer in cross

section, while the bottom portion shows the corresponding potential energy levels of the conductance band 100 and valence band 120." Ex. 7, ¶ [230]. "Localized regions of excess Ga cause localized reduction in AlN mole fraction, corresponding to band structure potential fluctuations, which form favored locations for the recombination of electrons 120 and holes 130, resulting in light emission 5." *Id.* Figure 11 is copied below.

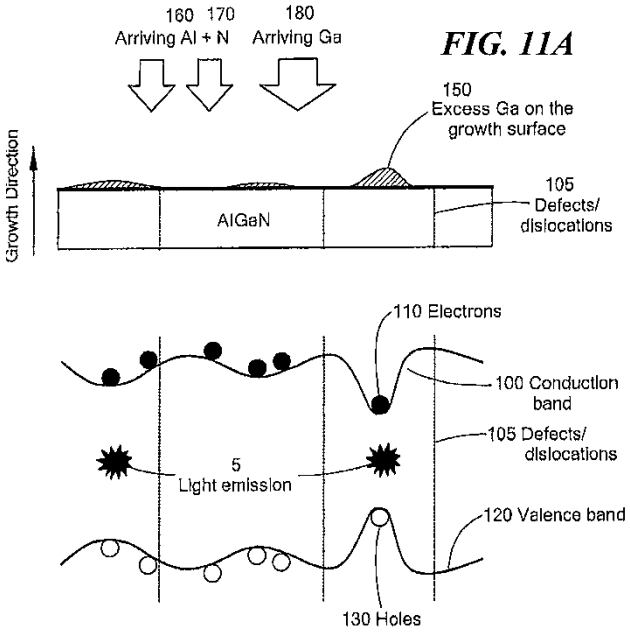

FIG. 11A

FIG. 11B

36. This disclosure in the '289 application is in accordance with the teachings of the '270 Patent. In the '270 Patent, Fig. 1A shows an embodiment of the invention where the localized regions of excess gallium are labeled 14, and the '270 Patent discloses creating "a spatial fluctuation in the band gap" as a result. Ex. 1, col. 3, lns. 44-55. "FIG. 4 is an explanatory diagram illustrating spatial fluctuation in a band gap." *Id.*, col. 3, lns. 21-22. Light emission occurs where the band gap is narrow (gap "a" in Figure 4). *Id.*, col. 1, lns. 27-30. Figures 1A and 4 are copied below.

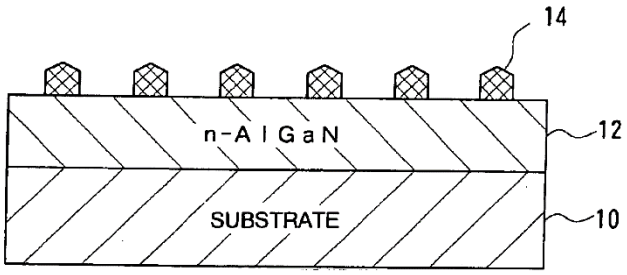

Fig. 1A

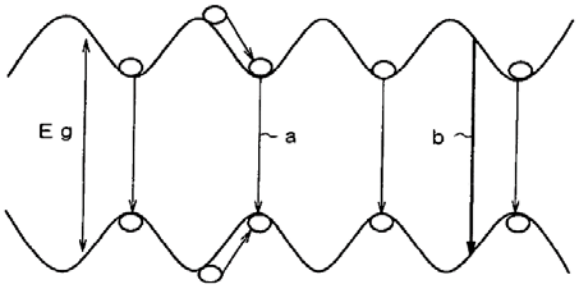

Fig. 4

37. As demonstrated by the correspondence between the figures, shown below, the approach illustrated in Figure 11 of the '289 application closely resembles the teachings of the '270 Patent.

'289 application

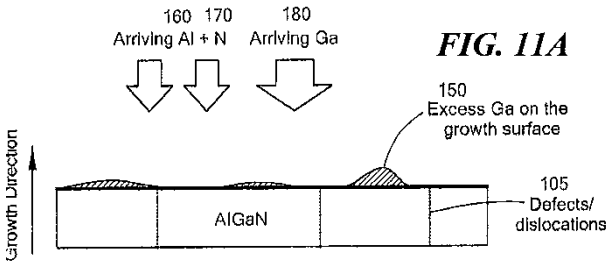

FIG. 11A

'270 Patent

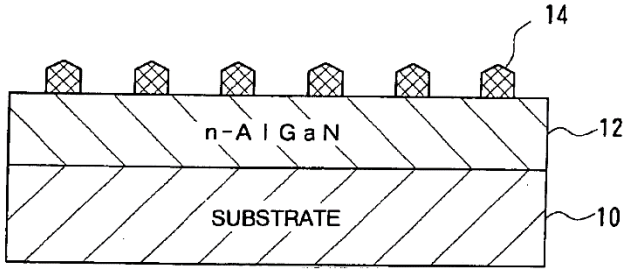

Fig. 1A

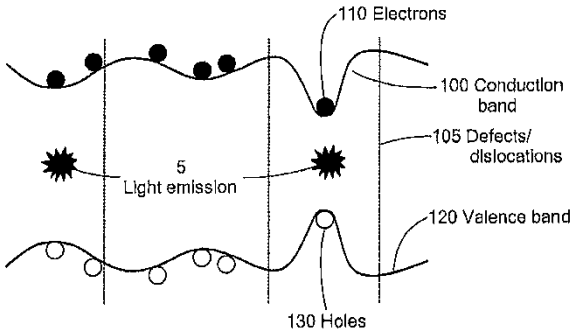

FIG. 11B

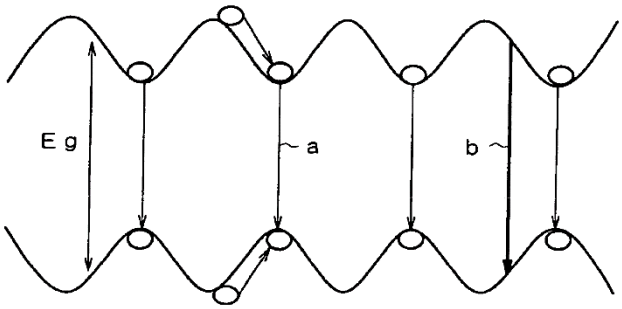

Fig. 4

38. On information and belief, each of the four LEDs in the SB4 also comprises a second gallium nitride based semiconductor layer having a varied compositional ratio and formed on the first gallium nitride based semiconductor layer onto which the composition material is formed, and the second gallium nitride based semiconductor is a light emitting layer. On information and belief, the '289 application evidences that each of the four LEDs in the SB4 comprises this layer.

39. Per above, the '289 application discloses a second AlGaN layer having a varied compositional ratio that is formed on the first AlGaN layer onto which the composition material is formed, and this second AlGaN layer is a light emitting layer. *See, e.g.*, Ex. 7, ¶ [230] ("Localized regions of excess Ga cause localized reduction in AlN mole fraction, corresponding to band structure potential fluctuations, which form favored locations for the recombination of electrons 120 and holes 130, resulting in light emission 5.").

40. The light emitting layer in each LED of the four LEDs in the SB4 emits UV light. In particular, the SB4 emits UV light at a "nominal wavelength" of either "285nm" or "310nm," depending on the part number. Ex. 2 at p. 3.

41. On information and belief, Rayvio has infringed at least independent claim 1 of the '270 Patent pursuant to § 271(g).

42. Claim 1 of the '270 Patent recites:

> 1. A method for manufacturing a gallium nitride based semiconductor, comprising the steps of:
>
> (a) forming a first gallium nitride based semiconductor on a substrate, the first gallium nitride based semiconductor having a first surface;
>
> (b) forming on less than a total area of the first surface a composition material of the first gallium nitride based semiconductor; and
>
> (c) forming a second gallium nitride based semiconductor on the first gallium nitride based semiconductor on which the composition material is formed; wherein a spatial fluctuation is created in the band gap by variation in the compositional ratio in the second gallium nitride based semiconductor created by the composition material, and the second gallium nitride based semiconductor is a light emitting layer.

43. On information and belief, as set forth below, each of the limitations of claim 1 is satisfied, literally or under the doctrine of equivalents, by Rayvio's infringing products including, for example, Rayvio's SB4.

44. As stated above, each of the four LEDs in the SB4 is comprised of a gallium nitride based semiconductor. Rayvio's CEO stated that Rayvio's products are "AlGaN deep UV diodes," which are gallium nitride based semiconductors. Ex. 3 at p. 2.

45. On information and belief, the method of manufacturing each LED in the SB4 involves forming a first gallium nitride based semiconductor on a substrate. As stated above, Rayvio has admitted that it uses standard sapphire substrates. *See* Ex. 4 at p. 2. Rayvio further markets its Ellie sterilizer containing its UV LEDs as reflecting technology in patents directed to roughening substrates. *See* Ex. 5. On information and belief, consistent with Dr. Walker's statement quoted above, the first gallium nitride based semiconductor layer formed on the substrate is AlGaN. This first gallium nitride based semiconductor layer in each LED has a first surface.

46. On information and belief, the method of manufacturing each of the four LEDs in the SB4 also comprises forming on less than a total area of the first surface a composition material of the first gallium nitride based semiconductor. On information and belief, the '289 application evidences that method of manufacturing each of the four LEDs in the SB4 comprises forming on less than a total area of the first surface a composition material of the first gallium

nitride based semiconductor. *See, e.g.*, Ex. 7, ¶ [230], Fig. 11.

47. On information and belief, the method of manufacture further comprises forming a second gallium nitride based semiconductor on the first gallium nitride based semiconductor on which the composition material is formed. On information and belief, spatial fluctuation is created in the band gap by variation in the compositional ratio in the second gallium nitride based semiconductor created by the composition material, and the second gallium nitride based semiconductor is a light emitting layer. On information and belief, per above, the '289 application evidences that each of the four LEDs is manufactured using this step. *See, e.g.*, Ex. 7, ¶ [230]. The light emitting layer in each LED of the four LEDs in the SB4 emits UV light. *See* Ex. 2.

48. Rayvio's infringement has caused and is continuing to cause damage and irreparable injury to NS. NS will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

49. NS is entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

50. At least as of the time Rayvio is served with this Complaint, Rayvio will have actual notice of the '270 Patent and its infringement of that patent. On information and belief, at least after service of this Complaint, Rayvio's infringement will be willful, at a minimum, if Rayvio does not discontinue infringing manufacture, use, offers to sell, sales, and/or importation and remove the infringing products from its product offerings. Such willful infringement would entitle NS to enhanced damages under 35 U.S.C. § 284 and a finding that this case is exceptional, entitling NS to an award of its reasonable attorneys' fees under 35 U.S.C. § 285.

PRAYER FOR RELIEF

WHEREFORE, NS respectfully requests that this Court enter judgment in its favor and against Rayvio as follows:

A. A declaration that Rayvio has infringed the '270 Patent under 35 U.S.C. § 271, and a final judgment incorporating the same;

B. A preliminary and permanent injunction, enjoining Rayvio and its officers, agents, servants, employees, representatives, successors, and assigns, and all others acting in concert or participation with them from continued infringement under 35 U.S.C. § 271 of the '270 Patent;

C. An award of damages adequate to compensate NS for Rayvio's infringement of the '270 Patent, together with prejudgment and post-judgment interest and costs pursuant to 35 U.S.C. § 284;

D. An order finding that Rayvio's infringement is willful and enhancing damages pursuant to 35 U.S.C. § 284;

E. An order finding that this is an exceptional case under 35 U.S.C. § 285 and awarding relief, including reasonable attorneys' fees, costs, and expenses;

F. An accounting of all infringing sales and other infringing acts by Rayvio, and an order compelling an accounting for infringing acts not presented at trial and an award by the Court of additional damages for such acts; and

G. Any other relief to which NS is entitled or that the Court deems just and proper.

JURY DEMAND

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, NS hereby demands trial by jury of all issues so triable.

Dated: May 23, 2017

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