Appeal Decision

Appeal No. 2020-6407

Appellant Lumileds Holding B.V

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2017-38576, entitled "SURFACE TREATMENT OF SEMICONDUCTOR LIGHT EMITTING DEVICE", [the application published on August 10, 2017, Japanese Unexamined Patent Application Publication No. 2017-139472] has resulted in the following appeal decision:

Conclusion

The appeal of the case was groundless.

Reason

No. 1 History of the procedures

March 1, 2017 : Application (this is a divisional application from Japanese Patent Application No. 2014-534016 filed on October 1, 2012 (claim of priority under the Paris Convention was received by the foreign receiving office on October 6, 2011, the United States))

March 2, 2017 : Written statement

As of January 16, 2018 : Notice of reasons for refusal

April 19, 2018 : Written opinion, written amendment

As of July 31, 2018 : Notice of reasons for refusal

February 6, 2019 : Written opinion, written amendment

As of July 19, 2019 : Notice of reasons for refusal

October 21, 2019 : Written opinion, written amendment

As of December 26, 2019 : Decision of refusal

May 12, 2020 : Request for appeal of the case, written

amendment

No. 2 Decision to dismiss amendment on the Amendment as of May 12, 2020

[Conclusion of Decision to Dismiss Amendment]

The Amendment as of May 12, 2020 (hereinafter, referred to as "the Amendment") shall be dismissed.

[Reason]

1 Regarding the Amendment (Detail of Amendment)

(1) Recitation of the scope of claims after the Amendment

By the Amendment, the recitations of Claims 1-9 of the scope of claims were amended as follows (underlined portions are the amended portions).

"[Claim 1]

1. A semiconductor light-emitting device, comprising:

a semiconductor structure comprising a light-emitting region; and

a surface of the semiconductor structure comprising a plurality of peaks having flattened upper ends, wherein,

in the plurality of peaks having flattened upper ends, each of the plurality of peaks comprises a flat part at the upper end, and light that falls on the flat part of the upper end undergoes internal total reflection, and wherein

the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness (Ra) of less than 134 nm as a result of being reduced by at least 10%, has a maximum height of surface features (Rmax) of less than 1050 nm as a result of being reduced by at least 20%, and a layer thickness of the semiconductor material is less than 10 μm.

[Claim 2]

The semiconductor light-emitting device according to claim 1, wherein

each flattened peak has one flat upper end.

[Claim 3]

The semiconductor light-emitting device according to claim 1, wherein

the semiconductor light-emitting device further comprises a wavelength conversion material on the surface.

[Claim 4]

The semiconductor light-emitting device according to claim 1, wherein

the semiconductor light-emitting device further comprises a mount, and

the semiconductor structure is attached to the mount.

[Claim 5]

The semiconductor light-emitting device according to claim 1, wherein

the semiconductor structure comprises:

an n-type region;

a p-type region;

the light-emitting region between the n-type and p-type regions;

an n-contact for the n-type region; and

a p-contact for the p-type region.

[Claim 6]

The semiconductor light-emitting device according to claim 5, wherein

the surface comprises a surface of the n-type region.

[Claim 7]

The semiconductor light-emitting device according to claim 5, wherein

the n-contact is insulated by a gap from an active region, the p-type region, and the p-contact.

[Claim 8]

The semiconductor light-emitting device according to claim 7, wherein

the gap is filled with an insulating material.

[Claim 9]

A light-emitting device, comprising:

a semiconductor structure comprising

an n-type region comprising a surface comprising a plurality of peaks having flattened upper ends, wherein, in the plurality of peaks having flattened upper ends, each of the plurality of peaks comprises a flat part at the upper end, and light that falls on the flat part of the upper end undergoes internal total reflection,

a p-type region,

a light-emitting region between the n-type region and the p-type region,

an n-contact for the n-type region, and

a p-contact for the p-type region;

a wavelength conversion material on the surface of the n-type region; and

a mount to support the semiconductor structure, wherein

the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness (Ra) of less than 134 nm as a result of being reduced by at least 10%, has a maximum height of surface features (Rmax) of less than 1050 nm as a

result of being reduced by at least 20%, and a layer thickness of the semiconductor material is less than 10 μm."

(2) Claims before the Amendment

The recitation of Claims 1-9 of the scope of claims in the written amendment as of October 21, 2019 is as follows.

"[Claim 1]

1. A semiconductor light-emitting device, comprising:

a semiconductor structure comprising a light-emitting region; and

a surface of the semiconductor structure comprising a plurality of peaks having flattened upper ends, wherein,

in the plurality of peaks having flattened upper ends, each of the plurality of peaks comprises a flat part at the upper end, and light that falls on the flat part of the upper end undergoes internal total reflection, and wherein

the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness reduced by at least 10%, and has a maximum height of surface features reduced by at least 20%.

[Claim 2]

The semiconductor light-emitting device according to claim 1, wherein

each flattened peak has one flat upper end.

[Claim 3]

The semiconductor light-emitting device according to claim 1, wherein

the semiconductor light-emitting device further comprises a wavelength conversion material on the surface.

[Claim 4]

The semiconductor light-emitting device according to claim 1, wherein

the semiconductor light-emitting device further comprises a mount, and

the semiconductor structure is attached to the mount.

[Claim 5]

The semiconductor light-emitting device according to claim 1, wherein

the semiconductor structure comprises:

an n-type region;

a p-type region;

the light-emitting region between the n-type and p-type regions;

an n-contact for the n-type region; and

a p-contact for the p-type region.

[Claim 6]

The semiconductor light-emitting device according to claim 5, wherein

the surface comprises a surface of the n-type region.

[Claim 7]

The semiconductor light-emitting device according to claim 5, wherein

the n-contact is insulated by a gap from an active region, the p-type region, and the p-contact.

[Claim 8]

The semiconductor light-emitting device according to claim 7, wherein

the gap is filled with an insulating material.

[Claim 9]

A light-emitting device, comprising:

a semiconductor structure comprising

an n-type region comprising a surface comprising a plurality of peaks having flattened upper ends, wherein, in the plurality of peaks having flattened upper ends, each of the plurality of peaks comprises a flat part at the upper end, and light that falls on the flat part of the upper end undergoes internal total reflection,

a p-type region,

a light-emitting region between the n-type region and the p-type region,

an n-contact for the n-type region, and

a p-contact for the p-type region;

a wavelength conversion material on the surface of the n-type region; and

a mount to support the semiconductor structure, wherein

the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness reduced by at least 10%, and has a maximum height of surface features reduced by at least 20%."

2 Propriety of amendment

(1) Regarding new matters

In the Amendment, regarding Claims 1 and 9, an amendment that "average surface roughness (Ra)" is "less than 134 nm", and "a maximum height of surface features (Rmax)" is "less than 1050 nm" has been made.

Relating to the relevant amendment, in the description or drawings attached to the application of the present application (hereinafter, referred to as "the Description"; the Description has not been amended from the one at the initial application), there are

the following descriptions.

"[0018]

The following table compares a roughened surface with no post-roughening plasma treatment with a roughened surface treated for 60 s with plasma at 600 W. Ra is the mean roughness of the surface and Rmax is the maximum height of surface features. Light output is given in arbitrary units.

[Table 1]

表面	光出力	R_a (nm)	R_{max} (nm)
処理なし	420	185.8	1598
６００Ｗで処理、６０秒	287.28	133.4	1049

表面 Surface

光出力 Light Output

処理なし No Treatment

６００Ｗで処理、６０秒 Treated at 600 W for 60 s

[0019]

As illustrated in the above table, both light output and surface roughness are reduced for a treated surface. For example, as a result of treatment according to embodiments of the invention, the mean surface roughness may be reduced by at least 10% in some embodiments, by at least 20% in some embodiments, and by at least 30% in some embodiments. As a result of treatment according to embodiments of the invention, the maximum height of surface features may be reduced by at least 20% in some embodiments, by at least 30% in some embodiments, and by at least 40% in some embodiments."

In the above description, although it can be read that, as a result of performing treatment of the surface, Ra is 133.4 nm and Rmax is 1049 nm, the numerical values of Ra of 134 nm and Rmax of 1050 nm, as with the Amendment, cannot be read. In addition, even if the other descriptions of the Description and the common general technical knowledge are taken into consideration, it cannot be said that it is obvious for a person skilled in the art to make such numerical values like the values in the Amendment, and therefore it can be said that the above-mentioned amendment is one that introduces new technical matters.

Furthermore, also regarding the amendment to prescribe "less than" in "less

than 134 nm" and "less than 1050 nm" in the Amendment, there is no description that indicates that the values of Ra of 133.4 nm and Rmax of 1049 nm in Table 1 are values indicating the upper limit value or the lower limit value. Furthermore, even from the descriptions of the Description such as "[0004] It is an object of the invention to provide a light emitting device where the maximum amount of flux from the device may be controlled." of "[Problem to be solved by the invention]", the technical matters described in the Description stay for the purpose of controlling or adjusting a light bundle, and are not ones for the purpose of making a light bundle be a certain amount of value or less than a certain amount of value, and, therefore, as long as there is no explicit description such as "less than" in the Description, it also cannot be said to be obvious for a person skilled in the art regarding the above-mentioned amendment of prescribing "less than", and the Amendment can be said to be one that introduces a new technical matter.

Therefore, since the Amendment is not one that has been made within the matters described in the description, the scope of claims, or the drawings originally attached to the application, it does not meet the requirement stipulated in Article 17-2(3) of the Patent Act.

(2) Judgment on independent requirements for patentability

Although the Amendment is one that adds new matters as explained in the above-mentioned (1), examination is further made as indicated below assuming that the Amendment is not one that adds new matters.

The Amendment is one that restricts that "an average surface roughness" and "a maximum height of surface features", which are matters needed for specifying the inventions recited in Claims 1-9 before the Amendment, "is less than 134 nm" and "is less than 1050 nm", respectively. And the field of industrial application and the problem to be solved of the invention recited in Claims 1-9 before amendment and those of the invention recited in Claims 1-9 after amendment are identical with each other. Therefore, the Amendment includes an amendment for the purpose of restriction of the scope of claims of Article 17-2(5)(ii) of the Patent Act.

Therefore, whether or not the inventions recited in Claims 1-9 of the scope of claims after the Amendment (hereinafter, referred to as "Amended Invention 1" and the like) are ones for which the Appellant can be granted a patent independently at the time of filing of the patent application (whether these satisfy the requirements stipulated in Article 126(7) of the Patent Act as applied mutatis mutandis pursuant to the provisions of Article 17-2(6) of the same Act) will now be discussed below.

A Regarding Amended Inventions 1-8

Amended Invention 1 is one that has been described in the above-mentioned 1(1), and there is a recitation that "the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness (Ra) of less than 134 nm as a result of being reduced by at least 10%, has a maximum height of surface features (Rmax) of less than 1050 nm as a result of being reduced by at least 20%, and a layer thickness of the semiconductor material is less than 10 μm".

Relating to the recitation, although it is understood that the recitations of "reduced by at least 10%" and "reduced by at least 20%" (hereinafter, referred to as "Recitation of Reduction") have some sort of target objects, and reduction is being prescribed in comparison with the relevant target, there is no indication of an object to be the relevant target in Amended Invention 1, and thus it is ambiguous what kind of aspect the above-mentioned Recitation of Reduction means.

Here, although it can be thought, from the recitation of "a plurality of peaks having flattened upper ends" of Amended Invention 1, to grasp the to-be-compared target of Recitation of Reduction mentioned above by guessing peaks whose upper ends are not flattened, it is not possible to guess the shape of non-flattened peaks from flattened peaks unless there is guessable limitation regarding the shape of the peaks (for example, cases in which, if the slopes of peaks are of a linear shape or a curved shape in cross-section, it is well-defined that the curved line or the like is expressed by what kind of formula, and the like). Then, descriptions to the effect that peaks of Amended Invention 1 are limited to peaks of such guessable shapes do not exist in the specifying matters and the Description of the Amended Invention 1, but, rather, there is described, in the Description, peaks obtained by photoelectrochemical (PEC) etching, and it is understood that the shapes of these peaks are not guessable, and, therefore, even if a target of comparison is tried to be guessed as mentioned above, it is unclear what kind of aspect the above Recitation of Reduction means.

The same applies to Amended Inventions 2-8 that refer to Claim 1.

Therefore, Amended Inventions 1-8 are not clear.

B Regarding Amended Invention 9

As with the matter instructed in the above-mentioned A, Amended Invention 9 is not clear, either.

C Summary

Therefore, the present application concerning Amended Inventions 1-9 does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act, and is one for which the Appellant should not be granted a patent independently at the time of patent application.

3 Closing on the Amendment

As above, since the Amendment violates the provisions of Article 17-2(3) of the Patent Act, and the provisions of Article 126(7) of the Patent Act as applied mutatis mutandis pursuant to the provisions of Article 17-2(6) of the same Act, it should be dismissed under the provisions of Article 53(1) of the same Act which is applied mutatis mutandis by replacing certain terms pursuant to the provisions of Article 159(1) of the same Act.

Accordingly, in conclusion, the above-mentioned decision to dismiss the amendment has been made.

No. 3 Regarding the Invention

1 The Invention

The amendment made on May 12, 2020 has been dismissed as above, and the inventions before the Amendment are inventions according to Claims 1-9 of the scope of claims in the written amendment as of October 21, 2019, and the invention according to Claim 1 thereof (hereinafter, referred to as "the Invention") is one specified by the matters recited in Claim 1 thereof as described in the above-mentioned No. 2 [Reason] 1(2).

2 Reasons for refusal stated in the examiner's decision

The reasons for refusal stated in the examiner's decision are as follows.

"(Novelty) The inventions according to Claims 1-9 of this application are inventions recited in Cited Document 1 distributed before the priority date thereof, and, therefore, fall under Article 29(1)(iii) of the Patent Act, and the Appellant should not be granted a patent for these.

(Inventive step) The inventions according to Claims 1-9 of this application could have been invented with ease by a person ordinarily skilled in the art in the technical field of the invention before the application was filed, based on the invention recited in Cited Document 1 distributed before the priority date thereof, and, therefore, the Appellant should not be granted a patent for these in accordance with the provisions of Article 29(2) of the Patent Act.

(Clarity) Since this application has deficiency in recitation of the scope of claims, it does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act.

Cited Document 1: Japanese Unexamined Patent Application Publication No. 2006-179511".

3 Regarding novelty and inventive step

(1) Regarding Cited Document 1

A In Japanese Unexamined Patent Application Publication No. 2006-179511 (published on July 6, 2006), which is Cited Document 1 cited in the reasons for refusal stated in the examiner's decision, there are the following descriptions together with drawings.

(A) "[Claim 1]

A light emitting device, comprising:

a nitride semiconductor substrate; an n-type nitride semiconductor layer on a first main surface of the nitride semiconductor substrate; a p-type nitride semiconductor layer positioned further than the n-type nitride semiconductor layer when viewed from the nitride semiconductor substrate; and a light generating layer positioned between the n-type nitride semiconductor layer and the p-type nitride semiconductor layer, wherein

specific resistance of the nitride semiconductor substrate is at most 0.5 Ω.cm,

the side of the p-type nitride semiconductor layer is mounted face-down and light is emitted from a second main surface of the nitride semiconductor substrate that is opposite to the first main surface, and

a trench is formed in the second main surface of the nitride semiconductor substrate.

[Claim 2]

The light emitting device according to claim 1, wherein

the trench has a V-shaped cross section."

(B) "[0014]

There is also the following problem. When the GaN-based light emitting device formed on a sapphire substrate is mounted face-down so that the back surface of the sapphire substrate is used as a light emitting surface, light beams of a prescribed incident angle or larger are totally reflected at an interface between the sapphire substrate and the GaN layer that has generated and propagated the light beams, and do not go out, as refractive index of sapphire is about 1.8 and that of GaN is about 2.4.

Specifically, light beams whose incident angle is in the range of $\theta \geq \sin^{-1}(1.8/2.4) \cong 42°$ are confined in the GaN layer and do not go out. This leads to lower light emission efficiency at the main surface of sapphire substrate. Although light emission efficiency is important, there is a still another problem. The totally reflected light beams propagate through the GaN layer and are emitted from the side portion of GaN layer. The amount of totally reflected light is considerably large and the GaN layer is thin, so that the optical energy of the light beams emitted from the side portion has a quite high energy density. Sealing resin positioned at the side portion and irradiated with the light beams is damaged, shortening the life of the light emitting device."

(C) "[0048]

Next, the method of manufacturing the LED of Example A will be described.

...

(a8) After that, on the N surface of the substrate, trenches 80 having a V-shaped cross section were formed by dicing. As shown in FIG. 3, the depth T3 of the trench was 40 μm, the angle formed by the sidewall of trench 80 and the plane parallel to the second main surface of GaN substrate 1 was 60°, and the pitch P between adjacent trenches 80 was 150 μm.

(a9) Thereafter, as shown in FIGS. 3 and 4, scribing was performed such that a chip boundary 50 appears as a side surface, and the resulting chip is provided as the light emitting device. The light emitting device as a chip had a light emitting surface having the shape of a 300 μm square (a square each side of which had the length of 300 μm) and a light generating layer of a 300 μm square. Specifically, in FIG. 4, L1 = 300 μm, and L2 = 400 μm. The width L3 of the element isolating trench was L3 = 100 μm, and the width D of one side of n-electrode was D = 100 μm.

(a10) Referring to FIG. 1, the chip was mounted such that the side of p-type GaN layer of the chip was in contact with a mounting portion 21a of the lead frame, whereby the light emitting device was formed. By conductive adhesive 14 applied at the mounting portion, the light emitting device and the mount were fixed to each other and conduction was attained.

...

(a12) Then, the n-electrode and the lead portion of lead frame were brought into conduction by wire bonding, and an epoxy-based resin was applied for resin seal, whereby the light emitting device was provided as a lamp."

(D) "[0176]

(Tests and Results): Examples S9 to S12 of the present invention and Comparative Example T9 were put in an integrating sphere, a prescribed current was applied, and optical output values collected and output from a detector were compared. As a result, Example S9 of the invention attained the optical output of 2.2 W, S10 attained 2.3 W, S11 attained 2.3 W and S12 attained 2.4 W. In contrast, the output of Comparative Example T9 was 1.6 W. As can be understood from the foregoing, devices having trenches 80 on the side of light emitting surface (second main surface) of the GaN substrate to provide protrusions and recesses all come to have relatively large interface area between the GaN substrate and epoxy resin 15, and the interface has various angles to the surface of the light generating layer so that total reflection at the interface tends to be suppressed, and for these reasons, higher optical output could be attained by Examples S9 to S12 of the invention than by Comparative Example T9.

[0177]

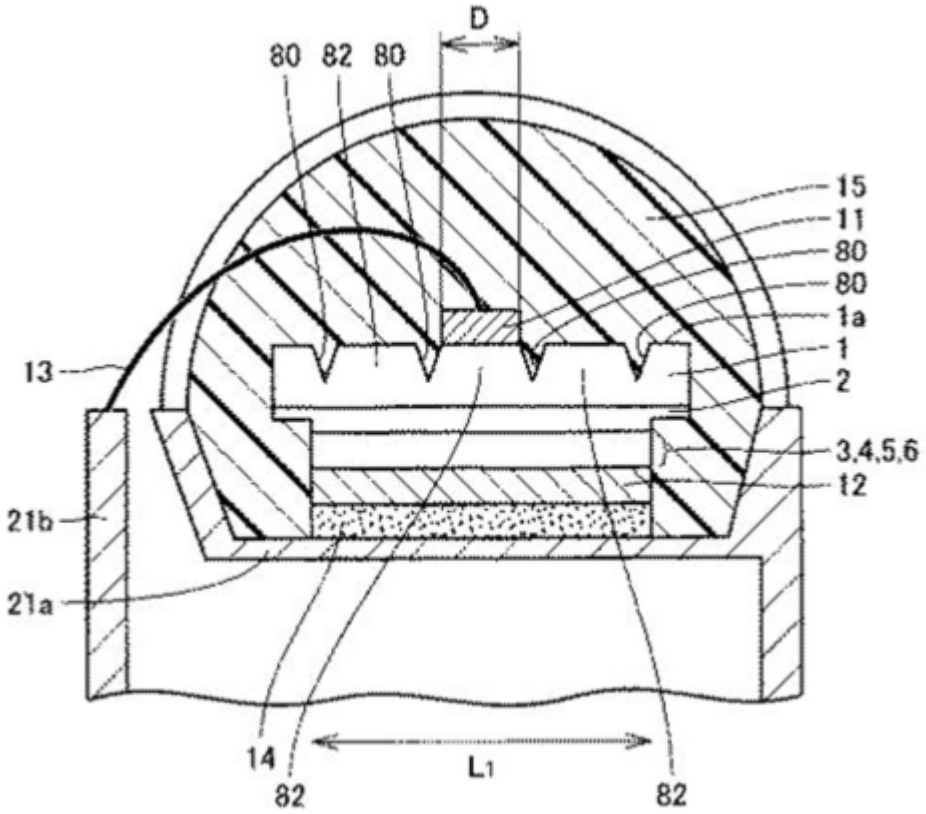
Next, referring to FIGS. 64 to 69, there will be described the influence of trench depth, pitch of adjacent trenches, the angle θ formed by the sidewall of the trench and the plane parallel to the second main surface of GaN substrate (see FIG. 3), and the shape of a convex portion formed between the trenches on the optical output, studied by the inventors. FIG. 64 is a graph representing a relation between trench depth and light extracting magnification. FIG. 65 is a graph representing a relation between the pitch of adjacent trenches and light extracting magnification. FIG. 66 is a graph representing a relation between the light extracting magnification and an angle θ formed by a trench sidewall and a plane parallel to the second main surface of the GaN substrate. FIG. 67 is a graph representing a relation between the light extracting magnification and the shape and arrangement of convex portions formed between the trenches. FIG. 68 is a schematic plan view illustrating a quadrangular arrangement of circular cones at the convex portions shown in FIG. 67. FIG. 69 is a schematic plan view illustrating a hexagonal arrangement of circular cones shown in FIG. 67. The data shown in FIGS. 64 to 67 are obtained by preparing sample LEDs basically having the same structure as Example S9 of the invention with characteristics on the abscissa of the graphs varied, and by making measurements of the samples.

[0178]

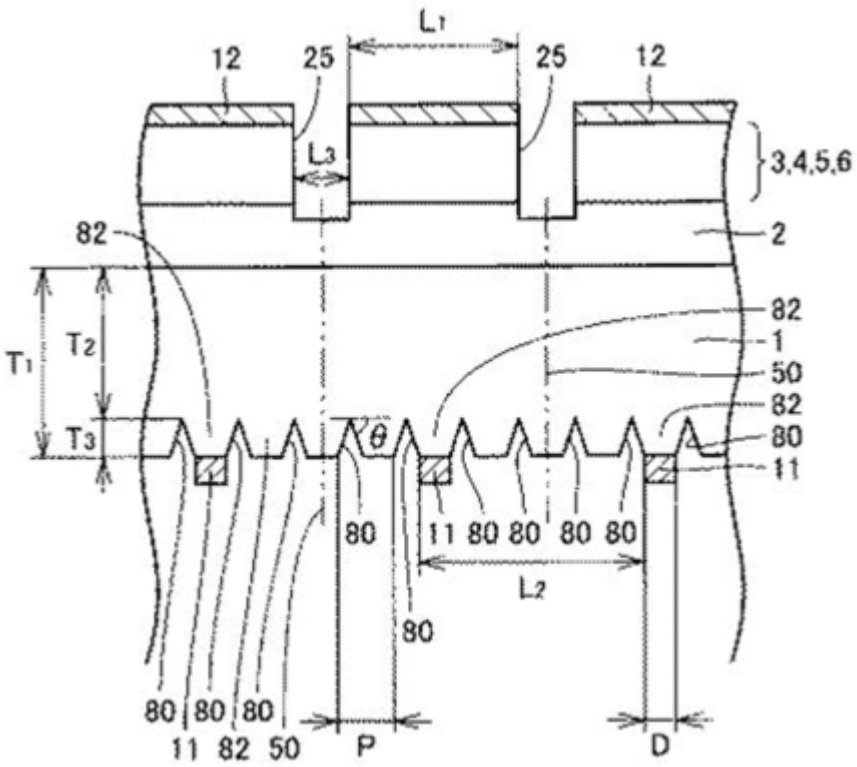
The abscissa of the graph shown in FIG. 64 represents trench depth (μm), and the ordinate represents light extracting magnification. The light extracting magnification on the ordinate is a relative value using as a reference a case not having the trench. As can be seen from FIG. 64, the light extracting magnification was more than 1.2 times as high when the trench depth was 100 μm, 200 μm, and 300 μm than

when the trench was not formed. It can be seen that a larger amount of light can be extracted (a larger amount of light is emitted from the substrate) when trenches are formed than when they are not formed. Further, FIG. 64 shows that the deeper the trench, the larger the light extracting magnification."

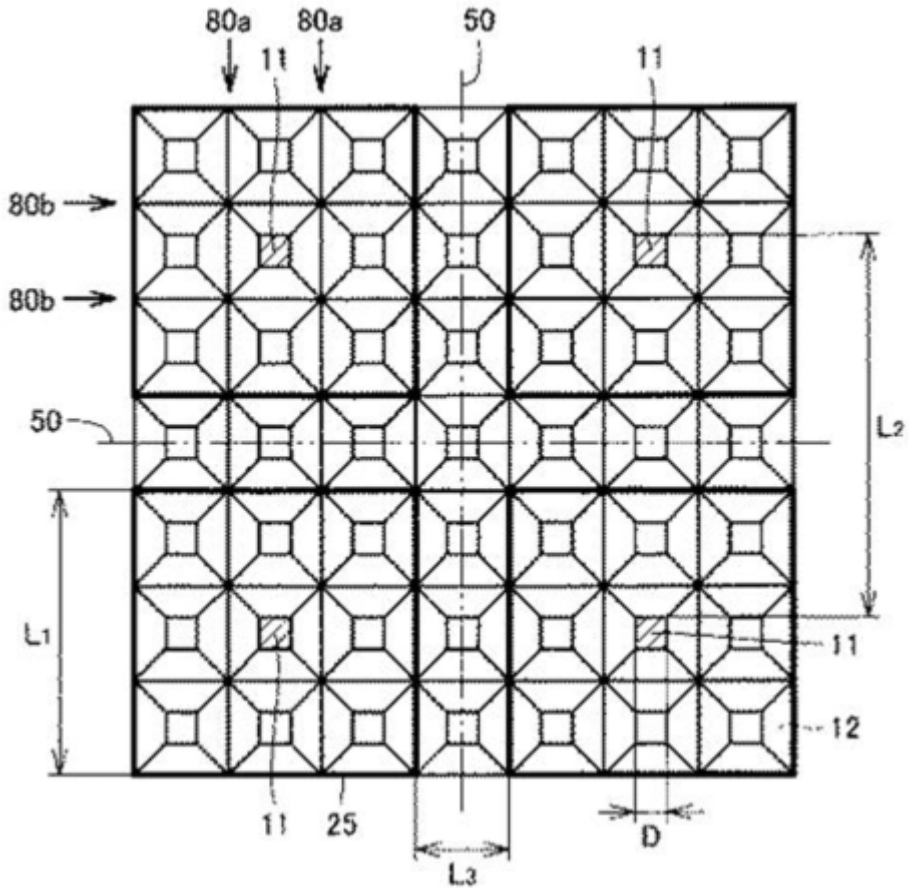
(E) FIG. 1 is shown as follows.



(F) FIG. 3 is shown as follows.



(G) FIG. 4 is shown as follows.



(H) It can be perceived from FIGS. 1 and 3, while taking the descriptions of the above-mentioned (A)-(D) into consideration, that, in the GaN substrate 1 (nitride semiconductor substrate), there are formed a plurality of trenches, and, in a surface of the GaN substrate 1 (nitride semiconductor substrate) on which trenches are formed, portions without a trench are flat.

B From the above-mentioned descriptions and the drawings, it is recognized that there is described in Cited Document 1 the following invention (hereinafter, referred to as "Cited Invention").

Cited Invention

"A light emitting device, comprising:

a nitride semiconductor substrate; an n-type nitride semiconductor layer on a first main surface of the nitride semiconductor substrate; a p-type nitride semiconductor layer positioned further than the n-type nitride semiconductor layer when viewed from the nitride semiconductor substrate; and a light generating layer positioned between the n-type nitride semiconductor layer and the p-type nitride semiconductor layer, wherein

the side of the p-type nitride semiconductor layer is mounted face-down and light is emitted from a second main surface of the nitride semiconductor substrate that is opposite to the first main surface;

a plurality of trenches are formed in the second main surface of the nitride semiconductor substrates,

the trenches have a V-shaped cross section, respectively,

in a surface of the nitride semiconductor substrate on which trenches are formed, portions without a trench are flat,

as one embodiment, the depth T3 of the trench is 40 μm, the angle θ formed by the sidewall of trench 80 and a plane parallel to the second main surface of GaN substrate 1 is 60°, and the pitch P between adjacent trenches 80 is 150 μm, and wherein,

as another embodiment, devices having trenches 80 on the side of a light emitting surface (second main surface) of the GaN substrate to provide protrusions and recesses all have an interface area between the GaN substrate and epoxy resin 15 having various angles to the surface of the light generating layer so that total reflection at the interface tends to be suppressed, and for these reasons, higher optical output can be attained."

(2) Comparison

The Invention and Cited Invention will be compared.

A Since it is obvious that "A light emitting device, comprising: a nitride semiconductor substrate; an n-type nitride semiconductor layer on a first main surface of the nitride semiconductor substrate; a p-type nitride semiconductor layer positioned further than the n-type nitride semiconductor layer when viewed from the nitride semiconductor substrate; and a light generating layer positioned between the n-type nitride semiconductor layer and the p-type nitride semiconductor layer" of Cited Invention is a semiconductor light-emitting device, and is of a semiconductor structure including a light-emitting region, it corresponds to "a semiconductor light-emitting device" and "a semiconductor structure comprising a light-emitting region" of the Invention.

B From the above-mentioned A, the Invention and Cited Invention are identical in the following corresponding feature, and different in the following different feature although not quite satisfactorily.

<Corresponding Feature>

"A semiconductor light-emitting device, comprising

a semiconductor structure comprising a light-emitting region."

<Different Feature>

The Invention is one comprising "a surface of the semiconductor structure comprising a plurality of peaks having flattened upper ends, wherein, in the plurality of peaks having flattened upper ends, each of the plurality of peaks comprises a flat part at the upper end, and light that falls on the flat part of the upper end undergoes internal total reflection, and wherein the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness reduced by at least 10%, and has a maximum height of surface features reduced by at least 20%", whereas Cited Invention is one in which "a plurality of trenches are formed in the second main surface of the nitride semiconductor substrates, the trenches have a V-shaped cross section, respectively, in a surface of the nitride semiconductor substrate on which trenches are formed, portions without a trench are flat, as one embodiment, the depth T3 of the trench is 40 μm, the angle θ formed by the sidewall of trench 80 and a plane parallel to the second main surface of GaN substrate 1 is 60°, and the pitch P between adjacent trenches 80 is 150 μm, and wherein, as another embodiment, devices having trenches 80 on the side of light emitting surface (second main surface) of the GaN substrate to provide protrusions and recesses all have an interface area between the GaN substrate and epoxy resin 15 having various angles to the surface of the light generating layer so that total reflection at the interface tends to be suppressed, and for these reasons, higher optical output can be attained".

(3) Judgment

A Regarding "a surface of the semiconductor structure comprising a plurality of peaks having flattened upper ends, wherein, in the plurality of peaks having flattened upper ends, each of the plurality of peaks comprises a flat part at the upper end" of the Invention concerning the different feature

Since Cited Invention is one in which "a plurality of trenches are formed in the second main surface of the nitride semiconductor substrates, the trenches have a V-shaped cross section, respectively, in a surface of the nitride semiconductor substrate on which trenches are formed, portions without a trench are flat", it can be said that such shape is a shape made by flattening the upper ends of the peaks when it is expressed from another perspective.

Therefore, regarding the above-mentioned constitution of the Invention, it cannot be said that it is a substantive different feature.

B Regarding "light that falls on the flat part of the upper end undergoes internal total reflection" of the Invention concerning the different feature

Seen from the descriptions such as "[0014] ... light beams of a prescribed incident angle or larger are totally reflected at an interface between the sapphire substrate and the GaN layer that has generated and propagated the light beams, and do not go out ...." in Cited Document 1, it is obvious that Cited Invention is focusing attention on total reflection of light at an interface of the semiconductor structure, and, further, in Cited Invention, since "devices having trenches 80 on the side of light emitting surface (second main surface) of the GaN substrate to provide protrusions and recesses all have an interface area between the GaN substrate and epoxy resin 15 having various angles to the surface of the light generating layer so that total reflection at the interface tends to be suppressed", it can be said that Cited Invention prevents total reflection by providing protrusions and recesses rather than just flattening a contact interface, and, therefore, it is obvious that Cited Invention assumes reduction of total reflection as much as possible on the premise that light beams are totally reflected at the flat portion.

Therefore, it can be said that Cited Invention also has the above-mentioned constitution of the Invention, and, therefore, it cannot be said that the above-mentioned constitution of the Invention is a substantive different feature.

C Regarding "the surface comprising the plurality of peaks having flattened upper ends has an average surface roughness reduced by at least 10%, and has a maximum height of surface features reduced by at least 20%" of the Invention concerning the different feature

(A) As will be also explained in the below-mentioned 4, regarding the recitations of "reduced by at least 10%" and "reduced by at least 20%", it is not clear that reduction of 10% or 20% is made with respect to what, and it cannot be said that a substantive limitation is applied, and, therefore, it cannot be said that the above-mentioned constitution of the Invention is a substantive different feature.

(B) Hereinafter, interpreting the above-mentioned recitation of "reduced by at

least 10%" and "reduced by at least 20%" as "an average surface roughness is reduced by at least 10%" and "a maximum height of surface features is reduced by at least 20%" from those of an aspect of peaks having non-flattened upper ends, examination will be made. Interpreting in that manner, it is still unclear what kind of aspect it means as will be explained in the below-mentioned 4. However, provided a shape of peaks having a linear slope in cross-section, guessing of an aspect of peaks having non-flattened upper ends is possible.Therefore, the body promotes examination interpreting that the Invention at least includes such aspect.

As an average surface roughness of the Invention, Ra is used according to Table 1 of the description of the present application, and, since Ra generally means an arithmetic mean roughness, the average surface roughness of the Invention is understood as being the arithmetic mean roughness Ra.

Since Cited Invention is one in which "as one embodiment, the depth T3 of the trench is 40 μm, the angle θ formed by the sidewall of trench 80 and a plane parallel to the second main surface of GaN substrate 1 is 60°, and the pitch P between adjacent trenches 80 is 150 μm", it can be thought that the shape of peaks is a linear slope in cross-section, and, therefore, the aspect of Cited Invention is one that can be translated into the cross-section of FIG. 3, with the length of the base of a peak is 150 μm, the basic angle of the peak is 60°, and the distance between the flat surface of the flattened upper end of the peak and the base is 40 μm. When this shape is grasped in the above cross-section mathematically, it can be said that it is a shape made by flattening upper ends (upper parts) of equilateral triangles each having a side of 150 μm, at a height of 40 μm from the base. Here, since the height of the above-mentioned equilateral triangle is $75 \times \sqrt{3} \cong 130$ μm, due to flattening of the upper end of the equilateral triangle, its height is reduced from 130 μm to 40 μm, resulting in the height of the peaks in Cited Invention being reduced by nearly 70% roughly from the original equilateral triangle as is speculated to have a non-flattened upper end, and, therefore, it is presumed that this aspect satisfies the numerical value range according to the Invention that "an average surface roughness is reduced by at least 10%" and "a maximum height of surface features is reduced by at least 20%" from the aspect of the peaks having non-flattened upper ends.

In addition, even if it is not so, numerical value limitations prescribed in the Invention could be set by a person skilled in the art by appropriately designing the shape of the trenches in Cited Invention.

D Regarding effects

Even if there are different features between the Invention and Cited Invention, effects of the Invention concerning the different features are nothing but ones which could be predicted by a person skilled in the art from Cited Invention.

(4) Summary

Therefore, the Invention is Cited Invention, it falls under Article 29(1)(iii) of the Patent Act, and the Appellant should not be granted a patent for that.

In addition, since the Invention is one that could have been invented by a person skilled in the art with ease based on Cited Invention, the Appellant should not be granted a patent for that under the provisions of Article 29(2) of the Patent Act.

4 Regarding clarity

As with the above-mentioned No. 2 2(2)A, the Invention also includes Recitation of Reduction; that is, "reduced by at least 10%" and "reduced by at least 20%", and it is unclear that Recitation of Reduction mentioned above means what kind of aspect.

Therefore, the Invention is not clear, and the present application has deficiency in recitation of the scope of claims, and, therefore, does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act.

No. 4 Closing

As above, since the Invention is Cited Invention, it falls under Article 29(1)(iii) of the Patent Act, and the Appellant should not be granted a patent for that.

In addition, the Invention is one that could have been invented by a person skilled in the art with ease based on Cited Invention, and, therefore, the Appellant should not be granted a patent for that under the provisions of Article 29(2) of the Patent Act.

Further, since the present application has deficiency in recitation of the scope of claims, it does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act, and thus the Appellant should not be granted a patent for that.

Consequently, without examining the inventions according to the other claims, the present application should be rejected.

Therefore, the appeal decision shall be made as described in the conclusion.

January 22, 2021

Chief administrative judge:	YAMAMURA, Hiroshi
Administrative judge:	INOUE, Hiroyuki
Administrative judge:	KONDO, Yukihiro