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Datasheet for the decision of 25 November 2020

Case Number: T 0265/17 - 3.4.03

Application Number: 10190784.8

Publication Number: 2293352

IPC: H01L33/00, H01L33/20, H01L33/22, H01L33/26

Language of the proceedings: EN

Title of invention:
Semiconductor light emitting device comprising uneven substrate

Patent Proprietor:
Nichia Corporation

Opponent:
Engel, Christoph K.

Headword:

Relevant legal provisions:
EPC 1973 Art. 52(1), 54, 56, 114(1)
EPC 1973 R. 71(2)
RPBA Art. 12(2), 12(4)
RPBA 2020 Art. 12(3), 15, 25(2)

Keyword:
Novelty - main request (yes)
Inventive step - main request (yes)

Decisions cited:

Catchword:

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Beschwerdekammern

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Case Number: T 0265/17 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 25 November 2020

Appellant: (Patent Proprietor)	Nichia Corporation 491-100, Oka Kaminaka-cho Anan-shi Tokushima 774-8601 (JP)
Representative:	Eisenführ Speiser Patentanwälte Rechtsanwälte PartGmbB Johannes-Brahms-Platz 1 20355 Hamburg (DE)
Respondent: (Opponent)	Engel, Christoph K. engel patentanwaltskanzlei Marktplatz 6 98527 Suhl (DE)
Representative:	Rittermann, Marco PATENTSCHUTZengel Marktplatz 6 98527 Suhl (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 2 January 2017 revoking European patent No. 2293352 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	G. Eliasson
Members:	S. Ward
	T. Bokor

Summary of Facts and Submissions

I. This is an appeal by the patent proprietor against the decision of the Opposition Division to revoke European patent EP 2 293 352 on the grounds that the subject-matter of claim 1 of the main request was not new and that the first and second auxiliary requests did not meet the requirements of Articles 76(1) and 123(2) EPC. The third auxiliary request was not admitted into the proceedings.

II. The opposition had been filed against the patent in its entirety on the grounds of lack of novelty, lack of inventive step, and unallowable extension of subject-matter beyond the content of the earlier application as filed (Articles 100(a) and (c), 52(1), 54 and 56 EPC).

III. The following documents are referred to in this decision:

E1: WO 02/23604 A1
E1a: EP 1 328 014 A1
E2: JP 2001 160539 A
E2a: English translation of E2.

In the following, E2 as interpreted in the light of E2a will be simply referred to as E2.

IV. At the end of the oral proceedings held before the Board the appellant/proprietor (hereinafter referred to as the proprietor) confirmed that its main request was the setting aside of the decision under appeal and the

maintenance of the patent in an amended form on the basis of the following documents:

Description: pages 2,4 to 16 of the patent specification, pages 3 and 3a as filed during the oral proceedings before the Board;

Claims: 1-12 of the Main Request filed with the statement of the grounds of appeal dated 10 May 2017;

Drawings: Figures 1 to 17 of the patent specification.

Failing that, the proprietor requested that the decision under appeal be set aside and that the patent be maintained in an amended form on the basis of one of auxiliary requests I, II, IIa, III and IIIa, all filed with the grounds of appeal dated 10 May 2017.

The respondent/opponent (hereinafter referred to as the opponent) requested in writing that the appeal be dismissed.

V. Claim 1 of the main request (the sole independent claim) reads as follows:

"A semiconductor light emitting diode comprising: a substrate (10), a plurality of semiconductor layers (11, 12, 13) formed on said substrate (10) and made of different materials from that of said substrate (10) and an ohmic electrode (34) formed on the surface of the top layer of said semiconductor layers (11, 12, 13) so that light generated in said semiconductor layers (11, 12, 13) is emitted from said ohmic electrode (34) or from said substrate (10), wherein protruding portions (20) for scattering or diffracting light generated in said semiconductor layers (11, 12, 13) are

created in a repeated pattern in the surface of said substrate (10) so that said protruding portion (20) is in contact with at least one of said semiconductor layers (11, 12, 13) and the side face of said protruding portion (20) is inclined relative to the direction in which said semiconductor layers (11, 12, 13) are layered, wherein said protruding portion (20) is formed, when observed from the upper side, in polygon form, wherein the edge of the polygon may be rounded, and wherein said protruding portion (20) does not have a component side that is parallel to an A axis of said semiconductor layers (11, 12, 13)."

VI. The findings of the Opposition Division, insofar as they are relevant to the present decision, are summarised as follows:

Claim 1 of the main request was not new. Figure 11 of E2 disclosed a semiconductor laser diode. Below the threshold current, a laser diode operated like a light emitting diode (LED), and hence, the laser diode in figure 11 was also a light emitting diode. Since the other claimed features could also be identified in E2 in combination with the light emitting diode of Fig. 11, the subject-matter of claim 1 of the main request was not new within the meaning of Articles 52(1), 54(1) and 54(2) EPC.

VII. The arguments of the proprietor, insofar as they are relevant to the present decision, are summarised as follows:

The subject-matter of claim 1 of the main request was novel over E2. In contrast to the present invention, E2 was neither concerned with a light emitting diode nor with an improvement of the light extraction efficiency.

Rather, E2 related to a laser diode and proposed a method for reducing a dislocation density. Contrary to the opinion of the Opposition Division, a skilled person in this field knew very well that laser diodes and LEDs were fundamentally different semiconductor elements. The reference to a "light emitting diode" in paragraph [0235] of E2 was general and lacked any precise teaching.

VIII. The arguments of the opponent, insofar as they are relevant to the present decision, are summarised as follows:

(i) The subject-matter of claim 1 of the main request lacked novelty over E2, which related to a method for producing nitride system semiconductor elements (paragraph [0001]) including LEDs, which were clearly disclosed in paragraphs [0002] and [0235].

The Opposition Division was correct to state that a portion of the light would leave the waveguide formed by the active layer and the cladding layer and would be emitted from the substrate. Moreover, E2 disclosed a light-emitting part in the region on a concave part of the substrate (paragraph [0223], last sentence), which referred to light being emitted from the substrate. Light reaching the repeated projection parts would be naturally scattered or diffracted.

E2 explicitly taught the compatibility of the hexagonal pattern shown in Fig. 6(b) and the embodiment of Fig. 11.

Paragraph [0119] of E2 disclosed that the angle of the concave part side surface was not limited, and paragraph [0150] disclosed that it was preferable to

avoid a component side of the protrusions being parallel to an A axis.

(ii) The subject-matter of claim 1 of the main request also lacked inventive step over E2.

E2 taught that the angle of the concave part side surface was not limited (paragraph [0119]), which was a clear instruction to the ordinary skilled person to choose an angle that did not have to be vertical to the C surface of the substrate.

Further, E2 clearly taught an example in which each side corresponded to a direction equivalent to the (11-20) direction, and hence the uneven shape did not have a component side that was parallel to an A axis.

Additionally, "the semiconductor light diode according to claim 1 is not inventive over E1 and E2 as shown in section D.3 of the substantiation of the grounds for opposition".

The auxiliary requests also did not meet the requirements of the EPC, and some were late filed.

IX. The Board sent the parties a communication under Article 15(1) RPBA 2020 setting out the provisional view that the subject-matter of claim 1 of the main request appeared to be novel and inventive over E2. The Board noted that in relation to several other objections raised against the main request, the Opposition Division had found in favour of the proprietor, and that these matters had not been pursued by the opponent in the appeal proceedings. The Board provisionally presumed that these objections were not

maintained. The auxiliary requests were also briefly discussed.

X. Oral proceedings were appointed for 25 November 2020. The opponent indicated in a letter dated 20 August 2020 that "nobody will be present for the opponent at the oral proceedings". Following a request from the proprietor in a letter dated 27 October 2020, the oral proceedings were held by videoconference on the duly appointed date with the participation of the proprietor. As indicated above, the opponent did not participate in the oral proceedings, nor were any further substantive submissions received from the opponent after the reply to the statement of grounds of appeal.

Reasons for the Decision

1. The appeal is admissible.

2. As announced in advance, the duly summoned appellant did not participate in the oral proceedings held by videoconference. According to Rule 71(2) EPC 1973, if a party duly summoned to oral proceedings does not appear as summoned, the proceedings may nevertheless continue, the party then being treated as relying only on its written case. As the present case was ready for decision at the conclusion of the oral proceedings (Article 15(5) and (6) RPBA 2020), the voluntary absence of the appellant was not a reason for delaying the decision (Article 15(3) RPBA 2020).

3. *Main Request: The Issues to be Decided*

3.1 Apart from very minor editorial changes, claims 1-12 of the main request are identical to claims 1-12 of the main request on which the contested decision was based (i.e. the claims of "ANNEX B" attached to the minutes of the oral proceedings before the Opposition Division).

Under point 4.1 of its communication, the Board pointed out that in the contested decision, in relation to the main request, the Opposition Division discussed the objections of lack of clarity (Reasons, point 2), extension of subject-matter beyond the content of the application and earlier application as filed (Reasons, point 3) and lack of novelty over E1a (points 4.1 and 4.2), and in each case found in favour of the proprietor.

3.2 Under point 4.2 of its communication the Board cited the following from Article 12(3) RPBA 2020:

"The statement of grounds of appeal and the reply shall contain a party's complete appeal case. Accordingly, they shall set out clearly and concisely the reasons why it is requested that the decision under appeal be reversed, amended or upheld, and should specify expressly all the requests, facts, objections, arguments and evidence relied on ...".

3.3 Under the same point, the Board commented as follows:

"In the light of this provision, and since the objections referred to above under point 4.1 do not appear to be mentioned in the opponent's reply, the Board provisionally presumes that the opponent does not maintain these objections."

3.4 No further substantive communication was received from the opponent, nor was the opponent represented at oral proceedings. The Board therefore considers that these objections do not form part of the opponent's case in appeal. Since the Board also sees no compelling reasons why it should re-examine these issues of its own motion pursuant to Article 114(1) EPC, these issues do not form part of the present appeal, and will not be further examined in this decision.

3.5 Consequently, in relation to the main request, the questions to be decided concern novelty over E2 and inventive step.

4. *Main Request: Novelty over E2*

4.1 The feature labels used in the statement of grounds of appeal (point 1, pages 3 and 4) will be used in the present decision.

Claim 1 of the main request seeks protection for a semiconductor light emitting diode (feature 1) comprising *inter alia* a substrate having protruding portions (feature 1.2.3) which are "formed, when observed from the upper side, in polygon form" (feature 1.2.3.3a).

4.2 The Opposition Division found that claim 1 of the main request was anticipated by document E2. The gist of the reasoning was that E2 disclosed in Fig 6b a substrate having polygonal (i.e. hexagonal) protrusions when observed from the upper side, and that this substrate was disclosed in combination with the semiconductor device depicted in Fig. 11.

While it was acknowledged that the device of Fig. 11 was a laser diode, the Opposition Division decided as follows:
"Below the threshold current a laser diode operates like a light emitting diode (LED). Hence, the laser diode in figure 11 is also a light emitting diode" (Reasons, page 11 final paragraph).

Thus E2 disclosed an LED having a substrate with polygonal protrusions, and since the remaining claimed features could also be identified in E2, the subject-matter of claim 1 lacked novelty.

4.3 The device of Fig. 11 of E2 is described in the section beginning at paragraph [0193] as a "semiconductor laser element", and even without looking at the text, it would be immediately apparent to a skilled person that the depicted device is a semiconductor laser.

Whether a semiconductor laser falls within the ambit of claim 1 is to be judged not by what might result from operating the device in a manner which does not correspond to its normal functioning (below threshold), but by what a skilled person, having regard to the commonly used terminology in the technical field, would understand by the wording of the claim.

4.4 A "semiconductor laser" or "laser diode" is a well known device which is engineered to generate light by stimulated emission; a "semiconductor light emitting diode" (LED), as defined in claim 1, is a device which is engineered to generate light by spontaneous emission. The skilled person would understand that there is a clear technical distinction between these two types of device, which is reflected in the

different terminology used consistently in the technical field to describe them.

4.5 The Opposition Division argued that paragraph [0235] "has to be read, contrary to the argumentation of the patent proprietor ... as semiconductor laser elements and light emitting diodes not being separate classes of devices" (Reasons, page 12, second paragraph).

4.6 Paragraph [0235] states the following:

"Although described about the semiconductor laser element manufactured in the above ... [the present] invention can also be applied to manufacture of electronic devices, such as photo detectors, such as elements from a semiconductor, such as semiconductor devices other than a semiconductor laser element, for example, a light emitting diode etc., and a photo-diode, and a transistor."

The Board cannot concur with the Opposition Division's interpretation of this passage. In fact, "a light emitting diode" is listed among "devices other than a semiconductor laser element", so that even in the terminology of E2 these are considered to be two distinct types of device.

4.7 The Board therefore judges that the term "semiconductor light emitting diode" used in claim 1 does not include semiconductor lasers, such as that depicted in Fig. 11 of E2. Hence, even if E2 could be considered to disclose the combination of the arrangements of Figs. 11 and 6b (a combination which does not appear to be explicitly mentioned), the result would be a semiconductor laser having a substrate with polygonal

protrusions, which does not correspond to the claimed subject-matter.

4.8 The only disclosures of a light emitting diode in E2 are the brief mentions in paragraphs [0002] and [0235], and the only substrates disclosed in E2 having polygonal protrusions are those with hexagonal protrusions shown in Fig. 6b, or those with triangular protrusions mentioned, for example, in paragraphs [0148]-[0150]. However, E2 does not directly and unambiguously disclose the combination of light emitting diodes with substrates having hexagonal or triangular protrusions.

The Board therefore judges that the subject-matter of claim 1 of the main request is new within the meaning of Articles 52(1) and 54 EPC 1973.

5. *Main Request: Inventive Step in relation to E2*

5.1 The question of inventive step did not arise in the contested decision, as the subject-matter of claim 1 was found not to be novel, and the auxiliary requests were rejected for other reasons (see above, point I).

In its communication under Article 15(1) RPBA 2020 (point 3.2) the Board stated its provisional opinion that both parties appeared to see E2 as the closest prior art. This observation was not subsequently challenged by either party, and the Board therefore concludes that both parties base their arguments primarily on this document.

5.2 Since claim 1 is directed to a semiconductor light emitting diode, the Board's view is that starting the inventive step analysis from E2 means starting from the

LEDs of paragraph [0002] or paragraph [0235], as these are the only LEDs disclosed in E2. These passages mention LEDs very briefly as one potential area for further exploitation of the invention; no particular structure for an LED is disclosed, nor is any specific combination disclosed of an LED with any of the other features described and depicted in E2. In relation to LEDs, E2 discloses no more than a completely general light emitting diode.

5.3 The difference over the LED disclosed in E2 would then be all the remaining features of claim 1.

5.4 The next step would be to determine the technical problem solved by the distinguishing features. It is long established that the:

"definition of the problem to be solved by the invention should normally start from the problem described in the contested patent. Only if examination shows that the problem disclosed was not solved or if inappropriate prior art was used to define the problem, is it necessary to investigate which other problem objectively exists" (see *Case Law of the Boards of Appeal*, 9th edition, 2019, I.D.4.3.2).

5.5 The problem is defined as follows in paragraph [0011] of the contested patent:

"an object of the present invention is to provide a semiconductor light emitting device wherein an improved external quantum efficiency can be stably secured."

The Board does not find any argument in the submissions of the opponent that this problem needs to be

reformulated, nor can the Board see any reason for not accepting this as the objective technical problem.

5.6 The solution to improving the external quantum efficiency is explained in paragraph [0015] of the contested patent:

"according to the present invention, light propagated in the lateral direction in the case of a conventional flat substrate is scattered or diffracted by recesses and/or protruding portions and finally efficiency [sic] emitted from the upper semiconductor layer or the lower substrate. As a result, the external quantum efficiency can be greatly increased."

The constraint in the technical problem that the improvement in external quantum efficiency should be "stably secured" is explained as follows in paragraph [0016]:

"In addition, crystal defects do not increase in the semiconductor layer even in the case that recesses and/or protruding portions are created in the surface portion of the substrate. Therefore, the above-described high external quantum efficiency can be stably secured."

This is further explained in the succeeding paragraphs of the description.

5.7 Document E2 mentions neither the problem of improving the external quantum efficiency of an LED nor the solution as set out in the contested patent of providing protruding portions in a repeated pattern in the surface of said substrate for scattering or

diffracting light generated in the semiconductor layers.

5.8 E2 discloses forming protrusions on substrate surfaces (e.g. in Figs. 4, 5 and 6B) in order to provide good crystallinity and reduced dislocation density (see e.g. paragraphs [0123] to [0126]).

Thus E2 discloses, at most, a problem and solution similar to the constraint mentioned in the contested patent that crystal defects should not be increased, but it provides no guidance to the skilled person aiming to solve the primary problem (improving the external quantum efficiency of the LED) which is subject to that constraint.

5.9 The arguments of the opponent (point A.2. on page 4 of the opponent's reply to the statement of grounds of appeal) that E2 discloses the claimed features of providing protrusions with inclined side surfaces and avoiding a component side that is parallel to an A axis are not seen as pertinent, as they refer to the detailed form of the claimed protrusions, without addressing the primary question why, starting from a completely general LED as disclosed in E2, a skilled person would find it obvious from the remaining teaching of E2 to solve the problem of improving the external quantum efficiency of an LED by providing protruding portions in a repeated polygonal pattern in the surface of the substrate.

5.10 The Board therefore concludes that the subject-matter of claim 1 of the main request would not be obvious to the skilled person based on document E2.

6. *Main Request: Inventive Step in relation to the combination of E1 and E2*

6.1 In the final paragraph of point A.2. on page 4 of the reply to the statement of grounds of appeal the opponent states the following:

"Additionally, the semiconductor light diode according to claim 1 is not inventive over E1 and E2 as shown in section D.3 of the substantiation of the grounds for opposition."

This is the only reference in the opponent's submissions on appeal to inventive step in relation to this combination of documents.

6.2 Article 12(3) RPBA 2020 (cited above under point 3.2) requires that the reply to the statement of grounds of appeal "shall contain a party's complete appeal case" and should "specify expressly all the requests, facts, objections, arguments and evidence relied on." Essentially corresponding requirements were set out in Article 12(2) RPBA 2007.

In the present case, Article 12(4) RPBA 2007 is applicable for the response to the statement of the grounds of appeal (Article 25(2) RPBA 2020). Article 12(4) RPBA 2007 stipulates that "... everything presented by the parties under (1) shall be taken into account by the Board if and to the extent it relates to the case under appeal and meets the requirements [of Article 12(2) RPBA 2007]".

In support of the assertion that claim 1 of the main request "is not inventive over E1 and E2", the opponent does not "specify expressly" the arguments relied upon,

but merely makes reference to submissions made before the Opposition Division, contrary to the requirements of Article 12(2) RPBA 2007 and Article 12(3) RPBA 2020.

6.3 In the jurisprudence of the Boards, it has also been frequently stressed that a mere reference to a party's earlier submissions before the Opposition Division was not enough to substantiate a ground of appeal (see *Case Law of the Boards of Appeal*, 9th Edition, 2019, V.A. 2.6.4a)).

6.4 This conclusion is all the more appropriate in the present case, as any inventive step argument involving E1 would have to be preceded by an argument explaining why E1 (which was published after two of the three claimed priority dates of the contested patent) should be considered to form part of the state of the art according to Article 54(2) EPC 1973. No argument to this effect, even by reference, has been made in the opponent's submissions on appeal.

6.5 The argument that the subject-matter of claim 1 of the main request is not inventive over the combination of E1 and E2 is therefore considered to be not substantiated, and is not taken into account under Article 12(4) RPBA 2007 in conjunction with Article 25(2) RPBA 2020.

6.6 Hence, and in the light of the conclusion reached above under point 5.10, the Board judges that the subject-matter of claim 1 of the main request involves an inventive step within the meaning of Articles 52(1) and 56 EPC 1973. Claims 2-12 of the main request involve an inventive step at least by reason of their dependence on claim 1. The Board is satisfied that the description

has been suitably adapted to the claims of the main request.

6.7 In the light of this conclusion it is unnecessary for the Board to examine the auxiliary requests.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Opposition Division with the order to maintain the patent as amended in the following version:

   Description: pages 2, 4 to 16 of the patent specification, pages 3 and 3a as filed during the oral proceedings before the Board,

   Claims: 1-12 of the Main Request filed with the statement of the grounds of appeal dated 10 May 2017,

   Drawings: Figures 1 to 17 of the patent specification.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated