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**Datasheet for the decision
of 4 June 2008**

Case Number: T 0698/06 - 3.4.03

Application Number: 01306793.9

Publication Number: 1179858

IPC: H01L 33/00

Language of the proceedings: EN

Title of invention:
Light emitting devices

Applicant:
Avago Technologies General IP (Singapore) Pte. Ltd.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 54, 56

Relevant legal provisions (EPC 1973):
-

Keyword:
-

Decisions cited:
-

Catchword:
-



Case Number: T 0698/06 - 3.4.03

DECISION
of the Technical Board of Appeal 3.4.03
of 4 June 2008

Appellant: Avago Technologies General IP (Singapore)
Pte. Ltd
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Singapore 768923 (SG)

Representative: Jehan, Robert
Williams Powell
Staple Court
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London WC1V 7QH (GB)

Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 20 December 2005
refusing European application No. 01306793.9
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. G. O'Connell
Members: V. L. P. Frank
J. Van Moer

Summary of Facts and Submissions

I. This is an appeal from the refusal of application 01 306 793 for the reason that claim 1 had been amended in such a way that it contained subject-matter which extended beyond the content of the application as filed (Article 123(2) EPC 1973).

II. Claim 1 has been amended in the appeal proceedings and now reads as follows (differences with respect to the independent method claim as originally filed have been marked by the board):

"1. A method of providing a light emitting device, including the steps of:
~~providing a base substrate with a projecting platform;~~
providing a reflector cup (22) having a base substrate (23);
providing a projecting platform (29; 29a);
providing a light emitter (21) with a top surface and side surfaces;
positioning the light emitter (21) on said projecting platform (29; 29a), **within the reflector cup (22)**, such that the light emitter is supported at a prescribed distance from the surrounding base substrate (23) **and within an edge perimeter of said platform (29; 29a) on all sides;**
providing an annular trough around the projecting platform (29; 29a);
applying over the light emitter (21) a settable coating material (25) containing a dye compound in such a manner that, when the coating material has set, dye compound covering the light emitter (21)

is able to settle on the light emitter (21), on the projecting platform (29; 29a) and in the trough, so as to provide a layer of dye compound which is of a comparable thickness over the side surfaces as over the top surface of the light emitter (21), excess dye compound being deposited over said surrounding base substrate in said annular trough."

Claims 2 to 13 are dependent on claim 1.

III. The following prior art document is cited in this decision:

D1: EP 1 020 935 A

IV. The examining division argued as follows:

(a) The feature that the light emitter was positioned "within an edge perimeter of said platform" was disclosed only in figures 3 and 4 which related to the first, respectively, second embodiment. The arrangement shown in these drawings however implied that the surface of the projecting platform on which the light emitting diode die was supported, was larger than said light emitting diode die on all sides.

(b) The feature that an annular trough was provided "around the projecting platform" was only disclosed in combination with:

- a base substrate comprising a planar base portion and a sloping wall portion of frusto-

conical form, the planar base portion having a projecting platform, and

- an annular trough around the projecting platform provided by the planar base portion, the sloping wall portion, and the sides of the projecting platform.

- (c) The feature that a coating material was applied over the light emitter in such a manner that "the dye compound is able to settle on the light emitter, on the projecting platform and in the trough, so as to provide a layer of coating material which is of a comparable thickness" was not as such disclosed in the original application. The only part of the original application relating to this feature disclosed that "a coating material (consisting of epoxy) containing a dye compound (consisting of phosphor particles) is applied over the light emitter in such a manner that the compound within the coating material settles in the annular trough so as to provide a layer of dye compound which is of a comparable thickness ... excess dye compound being deposited in said annular trough". The wording "the dye compound covering the light emitter is able to settle on the light emitter, on the projecting platform and in the trough, so as to provide a layer of coating material which is of a comparable thickness ... excess dye compound being deposited over said surrounding base substrate" therefore introduced subject matter which extended beyond the content of the application as filed.

- V. The appellant applicant argued essentially as follows:
- The amendments overcame the objections raised by the examining division. The method of claim 1 specified now that the light emitter was supported at a prescribed distance from the surrounding base substrate and within an edge perimeter of the platform on all sides, that the light emitter was positioned on the projecting platform within the reflector cup and that a layer of dye compound was provided which was of comparable thickness over the sides surfaces as over the top surface of the light emitter, with excess dye compound being deposited in the annular trough.
- VI. The appellant applicant requests that the decision under appeal be set aside and that a patent be granted on the basis of the amended claims and description sent May 2008.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments*
 - 2.1 The examining division refused the application for the reason that claim 1 had been amended in such a way that it contained subject-matter which extended beyond the content of the application as filed. It objected in particular to the following features which had been incorporated into claim 1 (appealed decision, reasons 2.1):

- (a) "the light emitter is supported ... and within an edge perimeter of said platform (29, 29a)"
- (b) "providing an annular trough (23) around the projecting platform (29, 29a)"
- (c) "the dye compound covering the light emitter is able to settle on the light emitter (21), on the projecting platform (29, 29a) and in the trough (23), so as to provide a layer of coating material which is of comparable thickness ... excess dye compound being deposited over said surrounding base substrate"

2.2 The method of claim 1 now specifies that the light emitter is positioned within an edge perimeter of the projecting platform on all sides. This feature implies that the projecting platform is larger than the light emitter as disclosed eg on page 6, lines 15 to 20 and Figures 3 and 4. The objection raised under point (a) is therefore overcome.

2.3 The light emitter is now positioned on a projecting platform within a reflector cup. The reflector cup and the projecting platform therefore define the shape of the annular trough into which the epoxy material settles (page 5, line 24 to page 6, line 7; Figures 3 and 4). The objection raised under point (b) is therefore overcome.

2.4 The feature that the dye compound covering the light emitter is able to settle on the light emitter, on the projecting platform and in the trough, so as to provide

a layer of dye compound which is of comparable thickness over the side surfaces as over the top surface of the light emitter, excess dye compound being deposited in said annular trough, has been disclosed on page 6, lines 2 to 13 and Figures 3 and 4.

2.5 The board is therefore satisfied that the requirements of Article 123(2) EPC are fulfilled.

3. *Novelty and inventive step (Articles 54 and 56 EPC 1973)*

3.1 The application addresses the chromaticity problem found in conventional white LED lamps. In conventional devices a phosphor layer overlies a blue LED die and shifts the emitted light to longer wavelengths. In this manner a yellow-green light as well as some unabsorbed original blue light is emitted and the combined radiation is perceived as white light. However, a yellow ring can be seen around the perimeter of the radiation pattern. The reason for this artefact is that the quantity of luminescent fluorescent material surrounding the LED die tends to be non-uniform. The doped epoxy material is conventionally applied over the LED die in a quantity such that it fills the reflector cup in which the die is mounted. Due to the contours of the device excessive material tends to collect at the sides of the LED, causing the different light coloration at the perimeter (page 2, lines 10 to 25; page 3, line 20 to page 3a, line 1; Figure 1).

3.2 This problem is solved according to the application by a projecting platform 29 provided on the base 23 of the reflector cup 22 so that an annular trough is formed around the platform, the LED die 21 being mounted on

the platform. In this manner, when the luminescent material 25 flows over the die and the platform to fill the reflector cup it can settle at a lower position towards the periphery of the reflector cup than would otherwise be the case. The thickness of the luminescent material is thus approximately constant over the entire surface of the LED die (page 5, line 24 to page 6, line 13; Figure 3).

3.3 Document D1 is the closest prior art on file. It discloses that in the LED devices of the prior art it was difficult to control precisely the amount of the resin medium or the variation in concentration of the photofluorescent compound 103 when filling the reflective cup with the wavelength-shifting resin. This affected significantly the chromaticity of the device ([0011]). D1 therefore provides a device which is always covered with a wavelength-shifting resin medium irrespective of the shapes of leadframes or casings and for which the chromaticity of the emission is finely adjustable, while at the same time suppressing the variation in chromaticity ([0013], [0015]). To this effect D1 discloses a white LED lamp in which a GaN LED 1 is mounted on a submount member 2. The entire exposed surface of the LED 1 and part of the principal surface of the submount member 2 are then coated with a wavelength-shifting resin medium 3 by a screen printing process or, alternatively, by a potting process with a dispenser. This is, however, done **before** mounting them in the reflector cup. Moreover, the resin medium 3 does not cover the sides of the submount member and special care has to be taken that the sides of the LED 1 are covered with a substantially uniform thickness of the

resin medium 3 ([0048], [0053], [0085], [0098], Figures 1(a) and 5).

- 3.4 The submount member 2 of D1 may be equated with the projecting platform 29 of the present application, since the LED is in both cases mounted thereon. However, according to the method of claim 1 the coating material 25 containing the dye compound is applied over the LED so that an excess of dye compound can settle in the annular trough surrounding the projecting platform, ie the coating material is applied **after** the LED has been mounted in the reflector cup 22. In contrast, in D1 the wavelength-shifting resin member 3 does not cover the sides of the submount member (ie the projecting platform) and covers only the LED die. As can be seen in Figure 8 of D1, the annular trough surrounding the submount member 2 is free from any material other than the resin encapsulant 63A. Consequently, the annular trough of D1 has a different function from that in the method of claim 1.
- 3.5 The method of claim 1 differs from the method disclosed in document D1 in that according to the application the light emitter is positioned on the projecting platform within the reflector cup, the coating material is then applied so that excess dye compound is deposited in the annular trough and a layer of dye compound of comparable thickness is formed over the side surfaces as over the top surfaces of the light emitter. The method of claim 1 is therefore new.
- 3.6 There is, moreover, no motivation in D1 for allowing any excess dye compound to deposit in the annular trough, as D1 discloses that the resin member 3 is

applied on the LED die and the submount member **before** mounting them within the reflector cup, ie prior to the forming of the annular trough. While in the method disclosed in D1 the wavelength-shifting resin has to be shaped by eg screen printing, the presently claimed method discloses a simpler way for applying this resin. Moreover, document D1 points away from applying the resin after mounting the LED in the reflector cup, since it discloses that chromaticity problems arise in the conventional devices in which the reflector cup is completely filled with the resin ([0004] and Figure 14).

3.7 The board considers therefore that the method of claim 1 involves an inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent in the following version:

Claims:

1 to 13 sent with letter of 15 May 2008.

Description pages:

1 to 7 sent with letter of 15 May 2008.

Drawings: sheets 1 to 2 as originally filed.

Registrar

Chair

S. Sánchez Chiquero

R. G. O'Connell