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**Datasheet for the decision
of 10 June 2021**

Case Number: T 0577/17 - 3.4.03

Application Number: 04741014.7

Publication Number: 1644989

IPC: H01L31/048, H01L31/0216,
H02S20/00

Language of the proceedings: EN

Title of invention:
ENCAPSULATION OF SOLAR CELLS

Patent Proprietor:
Dow Silicones Corporation

Opponent:
Momentive Performance Materials Inc.s

Relevant legal provisions:
EPC Art. 123(2)
EPC R. 103(4) (c)
EPC 1973 Art. 111(1)

Keyword:

Amendments - main request, first to seventeenth auxiliary requests - added subject-matter (yes)

Oral proceedings - withdrawal of proprietor's request for oral proceedings

Reimbursement of proprietor's appeal fee at 25% (yes)



Beschwerdekammern

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Case Number: T 0577/17 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 10 June 2021

Appellant: Dow Silicones Corporation
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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
23 December 2016 concerning maintenance of the
European Patent No. 1644989 in amended form.**

Composition of the Board:

Chairman T. Häusser
Members: M. Ley
D. Prietzel-Funk

Summary of Facts and Submissions

- I. The appeals were filed by the patent proprietor (hereinafter: "the proprietor") and the opponent (hereinafter: "the opponent") against the interlocutory decision of the opposition division finding that, on the basis of the second auxiliary request filed during the oral proceedings on 12 October 2016, the patent EP 1 644 989 in suit (hereinafter: "the patent") met the requirements of the EPC.

- II. In the notice of opposition the patent was opposed on the grounds of lack of novelty and inventive step (Articles 100(a) EPC 1973, 52(1) EPC, 54 EPC 1973 and 56 EPC 1973) and extension of subject-matter beyond the content of the application as originally filed (Article 100(c) EPC 1973, Article 123(2) EPC).

- III. The opposition division decided that claims 1 and 17 of the proprietor's then main request (filed on 12 September 2016) did not meet the requirements of Article 123(2) EPC and that claim 17 of the proprietor's then first auxiliary request (filed during oral proceedings on 12 October 2016) did not meet the requirements of Article 123(2) EPC.

- IV. The proprietor requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the main request or the first to fourth auxiliary requests, all requests filed with its statement setting out the grounds of appeal, or as fifth auxiliary request that the appeal of the opponent be dismissed, or that the patent be maintained in amended form on the basis of the sixth to

seventeenth auxiliary requests filed with its letter dated 15 September 2017.

The set of claims according to the proprietor's main request corresponds to those according to the main request underlying the contested decision except that claim 29 is removed. The proprietor's fourth auxiliary request corresponds to the first auxiliary request underlying the decision. The proprietor's fifth auxiliary request corresponds to the second auxiliary request found allowable by the opposition division (see points 4.1, 4.5, and 4.6 of the proprietor's statement setting out the grounds of appeal).

- V. The opponent requested that the decision of the opposition division be set aside and that the patent be revoked in its entirety. It also requested oral proceedings in case the board did not intend to revoke the patent in its entirety.

In its letter dated 14 September 2017 the opponent requested to reject the second auxiliary request as late filed.

- VI. In a communication pursuant to Article 15(1) RPBA 2020 dated 16 April 2021, the board informed the parties about its provisional opinion that the main request and the first to seventeenth auxiliary requests *inter alia* did not comply with Article 123(2) EPC and that the subject-matter of claim 1 according to the main request and according to the first to eighth auxiliary requests lacked novelty (Article 52(1) EPC and Article 54(1) and (2) EPC 1973).

- VII. Claims 1 and 17 according to the main request have the following wordings (differences compared to the granted

claims are underlined; the labelling **(a)** to **(e)** and **(i)** to **(vi)** is added by the board):

1. A solar cell module comprising:

(a) • a glass superstrate (31),

(b) • a junction box (32),

(c) • interconnected wafer type solar cells (34)

provided in predetermined positions relative to the superstrate (31) in a layer of silicone adhesive (33),

(d) • a top coat of silicone encapsulant (35) provided

to protect the wafers (34) and **(e)** electrical leads

linking adjacent wafers coated such that said leads may be further bonded into a back skin material or the

silicone encapsulant to form an integral seal.

17. A continuous solar cell module encapsulation process comprising the steps of

(i) providing a function [sic] box,

(ii) applying a layer of silicone adhesive onto a glass superstrate,

(iii) depositing interconnected wafer type solar cells onto/in to the uncured adhesive,

(iv) curing the adhesive thermally or by infrared radiation in such a way that the adhesive fixes the interconnected solar cells in a predefined position on the superstrate, and

(v) then uniformly applying by spraying, coating or dispensing a predetermined volume of a liquid silicone encapsulant onto a solar cell module and

(vi) curing said encapsulant thermally or by infrared radiation.

VIII. Independent claims 1 and 17 according to the first to seventeenth auxiliary requests relate to a "solar cell module" and a "continuous solar cell module

encapsulation process", respectively, comprising the features as summarized in the following table:

auxiliary request	device claim 1	method claim 17
1	(a), (b), (c), (d1) , (e)	(i) to (vi)
2	(a) to (e)	(ii), (iii), (iv), (v), (vi), (vii)
3	(a) to (e)	-----
4	(a), (b), (c), (d1) , (e)	(ii), (iii), (iv), (v), (vi), (vii)
5	(a), (b), (c), (d1) , (e)	-----
6	(a), (b), (c), (d2) , (e)	(i) to (vi)
7	(a), (b), (c), (d2) , (e)	(ii), (iii), (iv), (v), (vi), (vii)
8	(a), (b), (c), (d2) , (e)	-----
9	(a) to (e), (f)	(i) to (vi), (f)
10	(a), (b), (c), (d1) , (e), (f)	(i) to (vi), (f)
11	(a) to (e), (f)	(ii), (iii), (iv), (v), (vi), (vii) , (f)
12	(a) to (e), (f)	-----
13	(a), (b), (c), (d1) , (e), (f)	(ii), (iii), (iv), (v), (vi), (vii) , (f)
14	(a), (b), (c), (d1) , (e), (f)	-----
15	(a), (b), (c), (d2) , (e), (f)	(i) to (vi), (f)

16	(a), (b), (c), (d2) , (e), (f)	(ii), (iii), (iv), (v), (vi), (vii) , (f)
17	(a), (b), (c), (d2) , (e), (f)	-----

Feature (d1) reads:

(d1) • a top coat of silicone encapsulant (35) provided as a hard surface to protect the wafers (34) and

Feature (vii) reads:

(vii) and then attaching a junction box.

Feature (d2) reads:

(d2) • a top coat of silicone encapsulant (35) provided as a cured surface to protect the wafers (34) and

Feature (f) reads :

(f) wherein the silicone adhesive and the silicone encapsulant comprise one or more adhesion promoters selected from vinyltriethoxysilane, acrylopropyltrimethoxysilane, alkylacrylopropyltrimethoxysilane, allyltriethoxysilane, glycidopropyltrimethoxysilane, allylglycidylether, hydroxydialkyl silyl terminated methylvinylsiloxanedimethylsiloxane copolymer, reaction product of hydroxydialkyl silyl terminated methylvinylsiloxanedimethylsiloxane copolymer with glycidopropyltrimethoxysilane, and bis-triethoxysilyl ethylene glycol which is the reaction product of triethoxysilane with ethylene glycol.

The board observes that the independent claims of the ninth to seventeenth auxiliary requests correspond to those of the main, first to eighth auxiliary requests, respectively, wherein feature (f) has been added.

IX. The parties' relevant arguments are discussed below.

Reasons for the Decision

1. Procedural issues

1.1 Oral proceedings

In its communication pursuant to Article 15(1) RPBA 2020 dated 16 April 2021, the board informed the parties about their provisional opinion that none of the proprietor's requests met the requirements of the EPC.

As a response, the proprietor withdrew its request for oral proceedings. No further requests were made and no further arguments were provided.

The opponent requested oral proceedings only in case the board did not intend to revoke the patent. The board has no reasons to deviate from its provisional opinion that the opponent's case will be successful as opposed to the proprietor's case.

Since this prerequisite is fulfilled, the case is ready for decision which is taken in written proceedings without holding oral proceedings in accordance with Article 12(8) RPBA 2020.

1.2 Partial reimbursement of the proprietor's appeal fee

According to Rule 103(4)(c) EPC, the appeal fee shall be partially reimbursed at 25% if any request for oral

proceedings is withdrawn within one month of notification of the communication issued by the board of appeal in preparation for the oral proceedings, and no oral proceedings take place.

In the present case, the board issued a communication pursuant to Article 15(1) RPBA 2020 on 16 April 2021, which is deemed to be notified on 26 April 2021 (Rule 126(2) EPC). The proprietor withdrew its request for oral proceedings with a letter dated 11 May 2021 and received on the same date, i.e. within one month of notification of the board's communication. No oral proceedings took place.

Therefore, the conditions of Rule 103(4) (c) EPC are fulfilled with respect to the proprietor's appeal fee, which consequently is to be partially reimbursed at 25%.

1.3 Admission of the second auxiliary request

In its reply dated 14 September 2017, the opponent argued that the proprietor's second auxiliary request corresponded to the first auxiliary request underlying the decision and that the opposition division did not correctly exercise its discretion to admit this late-filed request into the proceedings. The inclusion of feature (vii) in claim 17 was not a "direct response to issues raised during the oral proceedings", but a reaction to an objection raised already under item 4.1.2 a) in the notice of opposition.

The board notes that it is the proprietor's fourth auxiliary request, which corresponds to the first auxiliary request underlying the decision, i.e. the

first auxiliary request submitted at 13:45 hrs during the oral proceedings on 12 October 2016.

Neither in the notice of opposition nor in the annex to the summons to attend oral proceedings, claim 17 is objected to by pointing out that in the application as originally filed it is merely disclosed that the junction box is attached after completion of the continuous encapsulation process. The board understands from the minutes that this point was discussed during oral proceedings in relation to claim 17 of the main request. As a reaction to this discussion, the first auxiliary request underlying the impugned decision was filed and its admission was discussed with the parties. After a break, the opposition division informed the parties that the first auxiliary request was admitted.

In view of the above the board does not share the opponent's view that the opposition division used its discretion in an erroneous way by admitting the first auxiliary request. The board sees no convincing reasons to overturn the opposition division's decision to admit said request into the proceedings (Article 111(1) EPC 1973).

2. Article 100(c) EPC 1973 and Article 123(2) EPC

2.1 Main request

2.1.1 The opposition division held that claims 1 and 17 according to the main request did not meet the requirements of Article 123(2) EPC, because claim 1 did not specify a "hard surface" of the silicone encapsulant, claim 17 was not limited to "spraying, coating and uniformly dispensing" the silicon adhesive and a "junction box" was not disclosed with a

continuous encapsulation process (see the contested decision, points 3.3 and 4.3 of the Reasons).

- 2.1.2 The opponent argued that claim 1 was an unallowable intermediate generalisation of the device shown in figure 4 and described in paragraph [0097] due to the omission of the following features:
- the solar cell module is without a "classical perimeter aluminium frame",
 - the glass superstrate is a "front" glass superstrate,
 - the solar cell module is a "wafer" module,
 - the wafer type solar cells are completely covered by the silicone adhesive (see also paragraph [0064] of the application as originally filed),
 - the positioning of the junction box on the silicone encapsulant,
 - the type of silicone encapsulants, namely those selected from the group of a hydrosilylation cure reaction product, a peroxide cure reaction product and a UV cure reaction product,
 - the top coat of silicone encapsulant is provided as a hard surface,
 - the top coat of silicone is provided to protect the wafers from the environment in order to enhance the lifetime of the solar module as means of generating electricity from sunlight.

The opponent added that no disclosure could be found in figure 4 or paragraph [0097] of the application as filed for electrical leads that were protected by the "top coat of silicone encapsulant". Paragraph [0068] taught that the electrical leads were protected against coating with encapsulant and/or adhesive. It added that figure 4 did not disclose a back skin material.

Regarding claim 17, the opponent argued that a *continuous* solar cell module encapsulation process comprising a step of providing a junction box was not disclosed in the application as originally filed. A junction box appeared in the application in paragraphs [0068], [0092] and [0096], but was attached only after the final framed panel was conveyed into a staged area. Figure 6 showing the continuous encapsulation process was silent about a junction box.

With respect to claim 17, the opponent also objected that original claim 18 and paragraph [0064] did not disclose a silicone adhesive, a general step of "applying a layer of silicon adhesive", a glass "superstrate", a step of "curing the adhesive thermally or by infrared radiation". The example of paragraph [0064] required a "total encapsulation of the whole module".

- 2.1.3 The proprietor indicated figure 4 and paragraph [0097] as basis for claim 1 and figures 3 and 4, paragraphs [0064], [0072], [0092] and [0093] as basis for claim 17.

The proprietor argued that the module included wafer-type solar cells, that it might or might not contain a frame, as stated in paragraph [0068], that the term "glass superstrate" inherently meant "front glass superstrate", that a protection of both the solar cells and the leads by the silicone encapsulant was implicit and that a specific position of the junction box was not required by paragraph [0097] of the application as filed. Regarding the omission of specific types of silicone encapsulants, the proprietor referred to page 17, lines 15 to 17.

For the proprietor, the term "in a layer of silicone adhesive" in claim 1 should be read as "into/onto a layer of adhesive". A complete encapsulation was not required.

It submitted that the feature "as a hard surface" could be omitted from claim 1 because it followed from the silicone encapsulant being claimed as a top coat that it necessarily acted as a hard surface. The proprietor referred to paragraphs [0014] and [0064] as an indication that for the skilled person a "cured and hardened" silicone encapsulant was meant.

Regarding claim 17, the proprietor argued that the omission of spraying, coating or uniformly dispensing the silicone adhesive was not an unallowable intermediate generalisation, as these techniques were only preferable according to paragraphs [0064], [0072] and [0089]. Furthermore, the process of claim 17 was disclosed in claim 18 as originally filed and the junction box was disclosed e.g. in paragraphs [0068], [0092] and [0097]. Paragraph [0093] made it clear that the process described in paragraphs [0056] to [0092] was a continuous process including attaching a junction box. Paragraph [0045] disclosed silicone adhesives to be used for the adhesion of the solar cells onto the support.

2.1.4 The board is of the opinion that neither claim 1 nor claim 17 according to the main request meet the requirements of Article 123(2) EPC for the reasons as follows.

2.1.5 With respect to claim 1, according to figure 4, the junction box 32 is positioned on the silicone encapsulant 35, whereas the claimed wording leaves the

positioning of the junction box entirely open and encompasses a junction box e.g. on the front glass superstrate or within the silicone adhesive. These types of modules are not disclosed in the application as originally filed, contrary to the requirements of Article 123(2) EPC.

The application as originally filed further requires that the silicone encapsulant is selected from the group of a hydrosilylation cure reaction product, a peroxide cure reaction product and a UV cure reaction product, see claim 1 as originally filed or paragraph [0015] of the description as filed. The board does not agree with the proprietor that the passage on page 17, lines 15 to 17 discloses other types of possible silicone materials as it is merely a general statement without technical content. As claim 1 according to the main request does not specify the type of silicone encapsulants, the requirements of Article 123(2) EPC are not met.

Paragraph [0097] makes it clear that the silicone encapsulant is provided as a "hard" surface, which is to be understood that both the silicone adhesive and the silicone encapsulant are cured and hardened layers, see e.g. paragraphs [0015], [0042], [0060], [0062], [0064], [0065], [0099], and [0100]. Only then the encapsulant protects indeed the wafers from the environment in order to enhance the lifetime of the solar module as a means of generating electricity from sunlight. In other words, it is not sufficient to specify that a "top coat of silicone encapsulant" is provided as a "hard" or a "cured" surface in order to meet the requirements of Article 123(2) EPC. The board does not agree with the proprietor that the term "top

coat" implies that a hard surface as understood in the above terms is necessarily present.

2.1.6 The board accepts that the reader of the claim would understand that the term "function box" in claim 17 should read "junction box". With respect to claim 17 directed to a continuous solar cell module encapsulation process, the board is of the view that an encapsulation process comprising a step of providing and attaching a junction box is not disclosed in the application as originally filed, in particular not in original claim 18 in combination with paragraphs [0068], [0092] and [0097]. According to figure 4, the junction box is positioned on the cured and hardened silicone encapsulant so that it must be attached after the encapsulation process, see also paragraph [0092]. Figure 6 is also silent about the attaching of a junction box during the encapsulation process. Paragraph [0093] does not define that a step of providing an junction box is a part of an encapsulation process, either. Thus, claim 17 does not comply with Article 123(2) EPC.

Furthermore, the board agrees with the opposition division and the opponent that in the application as originally filed, whenever a silicone encapsulant is uniformly applied by "spraying, coating and uniformly dispensing", the same technique is used for the silicone adhesive, see e.g. paragraphs [0064], [0072], and [0099]. As claim 17 does not specify the specific way the silicone encapsulant and silicone adhesive is applied, the requirements of Article 123(2) EPC are not fulfilled.

2.1.7 Regarding the remaining objections raised by the opponent under Article 123(2) EPC against claims 1 and

17, the board does not agree with the opponent for the following reasons:

- Figures 3 and 4 make it clear that in the claimed embodiment shown in figure 4 and described in paragraph [0097], a "classical perimeter aluminium frame" can be omitted. The presence of an aluminium frame is, however, not excluded, see also paragraph [0068].
- Claims 1 and 17 define the position of glass superstrate, solar cells and silicone adhesive so that it is unnecessary to further specify the glass superstrate as a front glass superstrate.
- Due to the fact that the solar cell module comprises wafer type solar cells, it is a "wafer" module.
- From figures 4 and 6 and the related description of the application a skilled person cannot derive that the wafer type solar cells are completely encapsulated by the silicone adhesive. The board shares the proprietor's view that the expression "in a layer of silicon adhesive" in claim 1 should be read as "into/onto a layer of adhesive".
- From figure 4 and paragraph [0097] of the description of the application a skilled person would derive that the top coat of silicone encapsulant necessarily protects electrical leads linking adjacent wafers. Paragraph [0097] explicitly states that said leads are coated such that said leads may be further bonded into a back skin material or the silicone encapsulant to form an integral seal. Paragraph [0068] states that preferably the electrical leads are protected against a coating by the silicone encapsulant and/or adhesive, which merely implies that they are not in direct contact with the silicone materials.

2.2 Features (d1) and (d2)

For the board replacing feature (d) by feature (d1) or (d2) does not overcome the objections under Article 123(2) EPC raised against claim 1 of the main request, see section 2.1.5 above. From the application as originally filed, a skilled person understands that both the layer of silicone adhesive and the layer of silicone encapsulant are cured and hardened layers. The indication that the "top coat of silicone encapsulant" is provided "as a hard surface" or "as a cured surface" encompasses the possibility that only the surface of the encapsulant is cured or hard (i.e. hardened), contrary to the disclosure in the application as originally filed.

In other words, claim 1 according to auxiliary requests 1 to 17 do not meet the requirements of Article 123(2) EPC for the reasons given for claim 1 of the main request.

2.3 Respective method claim 17 according to auxiliary requests 1, 6, 9, 10 and 15 comprises the same method steps as claim 17 of the main request and does not meet the requirements of Article 123(2) EPC for the reasons given for claim 17 of the main request.

2.4 Feature (vii)

A continuous solar cell module encapsulation process, wherein the step of curing the silicone encapsulant is followed by attaching a junction box is not disclosed in the application as originally filed. Although figure 4 discloses that a junction box 32 is positioned on the silicone encapsulant 35, the application is silent about the exact moment of attaching the box. Paragraph

[0092] does not disclose that the attaching is a part of the claimed encapsulation process. The description related to figure 6 does not mention a junction box at all.

In other words, respective method claim 17 according to auxiliary requests 2, 4, 7, 11, 13 and 16, each comprising feature (vii), does not meet the requirements of Article 123(2) EPC.

2.5 Feature (f)

The application as originally filed discloses adhesion promoters according to feature (f) only for the specific silicone encapsulants according to paragraph [0020] (see paragraphs [0031] and [0039]) and only for the specific silicone adhesives according to paragraph [0046] (see paragraphs [0049] and [0050]). Adhesion promoters for both silicone encapsulants and adhesives in combination with any other type of silicone materials are not disclosed in the original application documents, see also claims 6, 8, 11 and 13 as originally filed.

In other words, claim 1 and the corresponding method claim 17 according to auxiliary requests 9 to 17 do not meet the requirements of Article 123(2) EPC.

3. Conclusion

As none of the proprietor's requests complies with the requirements of Article 123(2) EPC, the patent is to be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.
3. The appeal fee paid by the proprietor is partially reimbursed at 25%.

The Registrar:

The Chairman:



S. Sánchez Chiquero

T. Häusser

Decision electronically authenticated