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**Datasheet for the decision  
of 11 September 2013**

**Case Number:** T 0048/11 - 3.3.03  
**Application Number:** 02707179.4  
**Publication Number:** 1325937  
**IPC:** C08G59/40, C08L63/00, C08K7/02,  
C08J5/24, B29C70/06  
**Language of the proceedings:** EN

**Title of invention:**

EPOXY RESIN COMPOSITION, PROCESS FOR PRODUCING FIBER -  
REINFORCED COMPOSITE MATERIALS AND FIBER-REINFORCED COMPOSITE  
MATERIALS

**Patent Proprietor:**

TORAY INDUSTRIES, INC.

**Opponent:**

Momentive Specialty Chemicals Research  
Belgium S.A.

**Headword:**

**Relevant legal provisions:**

EPC Art. 54, 56

**Keyword:**

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

**Decisions cited:**

**Catchword:**



**Beschwerdekammern  
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Chambres de recours**

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Case Number: T 0048/11 - 3.3.03

**D E C I S I O N  
of Technical Board of Appeal 3.3.03  
of 11 September 2013**

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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
23 November 2010 concerning maintenance of the  
European Patent No. 1325937 in amended form.**

**Composition of the Board:**

**Chairman:** F. Rousseau  
**Members:** O. Dury  
C. Brandt

## Summary of Facts and Submissions

- I. The appeal by the opponent lies against the interlocutory decision of the opposition division posted on 23 November 2010 to maintain in amended form European patent No. EP 1 325 937, filed on 27 March 2002 as international application PCT/JP2002/002985 published as WO 2002/081540 and claiming priority from Japanese patent application JP 2001100339 filed on 30 March 2001.
- II. Notice of opposition to the patent was filed on 18 August 2008, requesting revocation of the patent in its entirety on the grounds of Art. 100(a) EPC (lack of novelty and of inventive step).
- III. With the decision under appeal the patent was maintained on the basis of the main request comprising 40 claims, of which claim 1, the only one relevant for the present decision, read:
- "1. An epoxy resin composition, comprising:  
component (a) epoxy resin,  
component (b) an imidazole derivative anionic polymerization initiator and  
component (c) proton donor,  
wherein the amount of component (c) based on 100 parts by weight of component (a) is 1 to 30 parts by weight; component (a) is a liquid; and components (b) and (c) are homogeneously dissolved in component (a); and wherein the initial viscosity of the composition at 25°C is between 1 to 30,000 mPa s."
- IV. The decision under appeal was based, *inter alia*, on the following documents:

D4: EP-A-0 025 178

D8: WO 02/42439,

D4 and D8 being identified as prior art documents according to Art. 54(2) and (3) EPC, respectively.

In its decision, the opposition division considered that the main request fulfilled the requirements of Art. 123 (2) (3) EPC.

It further held that D4 and D8 were the sole documents cited that disclosed imidazole derivatives (b) in epoxy compositions (a). However, D4 did not unambiguously disclose compositions comprising the amount of proton donor (c) and having the initial viscosity specified in claim 1. Compositions having a viscosity according to claim 1 were also not unambiguously disclosed in D8, in particular not in examples III.1 to III.3. Therefore, novelty was acknowledged.

D4 was seen as the closest prior art. It was not considered to be obvious to use proton donors (c) in an amount of 1-30 pbw based on 100 pbw epoxy resin (a) in order to shorten the curing time of reinforced epoxy compositions. The subject-matter of the main request was therefore inventive.

V. On 11 January 2011, the opponent (appellant) lodged an appeal against the above decision. The prescribed fee was paid on the same day. With the statement setting out the grounds for the appeal, received on 21 March 2011, the appellant requested that the patent be revoked.

VI. By letter of 9 August 2011, the respondent (patent proprietor) filed comments on the statement of grounds

of appeal and requested that the appeal be dismissed (main request) or, alternatively, that the patent be maintained in amended form according to any of auxiliary requests 1 to 4.

VII. In the communication issued on 22 April 2013 accompanying the summons to oral proceedings to be held on 11 September 2013, the Board identified relevant issues to be addressed during the oral proceedings.

VIII. While the respondent provided further arguments with letter dated 26 July 2013, the appellant did not provide any further comments and did not attend the oral proceedings, which took place in its absence.

IX. The appellant's arguments regarding the main request concern only claim 1 and its dependent claims. They may be summarised as follows:

#### Novelty

- a) Examples III.1, III.2 and III.3 of D8 disclosed epoxy resin compositions comprising an imidazole derivative and a proton donor within the range of claim 1 of the main request.
- b) The examples of the patent in suit showed that using an alcohol or an imidazole in an amount of 1 to 30 phr led to epoxy compositions having an initial viscosity below 30 Pa.s. Although the compositions of Examples III.1, III.2 and III.3 of D8 were different from these compositions of the patent in suit, it could be concluded that the initial viscosity of each of the compositions of Examples III.1, III.2 and III.3 was according to claim 1 of the main request.

- c) Example III.2 of D8 disclosed a composition comprising a mixture of Bisphenol A and trimethylolpropane, which are both suitable proton donors (c) specified in paragraphs [0053] and [0054] of the patent in suit. If compositions with either Bisphenol A or trimethylolpropane had an initial viscosity within the range specified in claim 1 of the main request, the same was valid for a blend of these two compositions. Therefore, the initial viscosity of the composition of at least example III.2 of D8 anticipated claim 1 of the main request.
- d) The results of experiments confirming that the initial viscosity of the compositions of Examples III.1, III.2 and III.3 of D8 were within the range claimed would be filed when available.
- e) The subject-matter of claim 1 was not novel.

Inventive step

- f) D4 aimed at providing systems with shorter cure cycles and usable for "reinforced materials based on glass or carbon fibers" and was the closest prior art.
- g) The skilled person would arrive at compositions according to claim 1 of the main request by combining D4 with D8.
- h) Therefore, the subject-matter of claim 1 and of the claims dependent on claim 1 was not inventive.

Cited documents

- i) Although reference to documents D1-D3 and D5-D7 (all specified in the contested decision) was made in section 2 of the statement of grounds of appeal, no objection was based on these documents.

- X. The respondent's arguments regarding claim 1 of the main request that are relevant for the present decision may be summarised as follows:

Cited documents

- a) The objections of the appellant were based only on D4 and D8. Any other document cited but not relied upon by the appellant did not form part of the appeal.

Novelty

- b) The subject-matter of claim 1 was novel *inter alia* because the initial viscosity at 25°C of the compositions described in Examples III.1 to III.3 was not directly and unambiguously disclosed in D8.

Inventive step

- c) D8 could not be considered for the assessment of inventive step because it was a prior art document according to Art. 54(3) EPC. Therefore, the attack of the appellant based on the combination of D4 and D8 could not succeed. That deficiency further left the appeal without any substance in respect of inventive step. The appellant had in particular failed to explain why the decision of the



opposition according to which the subject-matter claimed was inventive was wrong.

- d) In the absence of any better starting point and although it was far remote from the subject-matter now being claimed, Example 15 of D4 had to be considered as the closest prior art.

The subject-matter claimed differed from example 15 of D4 at least in requiring an amount of proton donor of 1 to 30 phr and an initial viscosity of 1 to 30,000 mPa.s.

The problem to be solved resided in the provision of epoxy resin compositions for resin transfer moulding (RTM) applications, which were suitable for making fiber-reinforced composite materials having a fiber volume fraction higher than 45% and allowed long injection time together with short cure time after injection.

The examples of the patent in suit showed that that problem was solved.

Although D4 dealt with the provision of compositions having long injection time, it did not address the other part of the problem relating to short cure time.

D4 provided no teaching to solve that problem by modifying the composition of its example 15 according to claim 1 of the main request. In that respect, the presence of imidazole in example 15 of D4 was accidental, being a residue from the precursor reaction in example 5 of D4. There was further no hint in D4 to solve the above problem

by reversing the relative amounts of maleate (possible proton donor (c)) and epoxy resin (component (a)) disclosed in the composition of example 15 of D4.

D4, in particular its examples, was further not concerned with composites comprising amounts of fibers as high as in the patent in suit.

Considering that D4 neither addressed the problem to be solved posed by the patent in suit nor led to the solution proposed by the main request, the subject-matter claimed was inventive.

XI. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed or, alternatively, that the patent be maintained in amended form according to any of auxiliary requests 1-4 filed with letter of 9 August 2011.

XII. The Board announced its decision at the end of the oral proceedings.

### **Reasons for the Decision**

1. The appeal is admissible.
2. The appellant was duly summoned to oral proceedings but did not attend, and the oral proceedings were continued

in its absence in accordance with Rule 115(2) EPC, the appellant being treated as relying only on its written case (Art. 15(3) RPBA).

3. Although reference to documents D1-D3 and D5-D7 (as specified in the contested decision) was made in the statement of grounds of appeal, no objection was substantiated by the appellant in relation to any of these documents. No case having been made in relation to these documents, they will not be addressed hereinafter.

Main request

4. Novelty
  - 4.1 The sole objection for lack of novelty raised by the appellant was that examples III.1 to III.3 of D8 anticipated claim 1.
  - 4.2 D8 is an international application published on 30 May 2002 and claiming priority from a US application filed on 16 November 2000. The conclusion of the opposition division that D8 was valid prior art according to Art. 54(3) EPC remained undisputed by the parties. The Board sees no reason to depart from that view.
  - 4.3 Example III.1 of D8 discloses a resin composition prepared by mixing
    - (a) 5 g epoxy resin EPON828, the parties not disputing that EPON828 is a liquid;
    - (b) 3 phr (parts per hundred resin) of a component Im.TMG, which according to page 8, lines 21-26 of D8 is an equimolar mixture of imidazole (Im: page 10, line 5) and tetramethylguanidine (TMG: page 10, line 10);

(c) 5 phr of a component TMP/BGE, which according to page 8, line 29 to page 9, line 2 of D8 is an "adduct" of trimethylolpropane (TMP: page 10, line 11) and butyl glycidyl ether (BGE: page 9, line 26). According to page 7, line 20 to page 8, line 8 together with page 11, lines 12-27 and the table on page 12 (column "Group B", second row) of D8, said "adduct" is a polyol;

whereby (b) and (c) were mixed before adding the epoxy. The mixture was gelled after one hour at 75 °C and cured at 120 °C for one hour.

4.4 Examples III.2 and III.3 both disclose a resin composition prepared by mixing

(a) 5 g epoxy resin EPON828,

(b) 1.2 phr imidazole and

(c) either 10 or 30 phr of a component BPA.2TMP, which according to page 8, lines 27-28 is a 1:2 molar mixture of bisphenol A (BPA: page 9, line 28) : trimethylolpropane, both of which are proton donors in the sense of claim 1 of the patent in suit (see page 6, line 51 and page 7, line 51);

whereby (b) and (c) were mixed before adding the epoxy. Each composition was heated to a rubbery solid (III.2) or a semi-solid (III.3) and then cured at 120°C.

4.5 None of examples III.1 to III.3 of D8 discloses the initial viscosity at 25°C of the compositions prepared therein.

4.5.1 Although that finding had led the opposition division to acknowledge novelty over D8, no evidence was provided by the appellant to prove the contrary. In particular, the experimental data announced in the statement of grounds of appeal (see section IX d) above) were not submitted by the appellant.

4.5.2 Contrary to the appellant's opinion, a mere similarity between the compositions of examples in the patent in suit and the compositions of examples III.1 to III.3 of D8 does not support the conclusion that the latter exhibit similar viscosity values. As already noted in the contested decision, the compositions of examples III.1 to III.3 in addition to the components used in the examples of the patent in suit contain further components in non-negligible amounts, the influence of which on the initial viscosity has not been demonstrated to be negligible. In the absence of corroborating evidence, the appellant's argument that the viscosity of the compositions prepared in examples III.1 to III.3 was bound to be within the range defined in claim 1 remains pure speculation.

4.5.3 Therefore, none of examples III.1 to III.3 of D8 directly and unambiguously discloses a composition having an initial viscosity according to claim 1 of the main request.

4.6 Apart from examples III.1 to III.3, no other passage of D8 was held to disclose the combination of technical features specified in claim 1 of the main request.

4.7 In view of the above findings, the appellant's sole objection for lack of novelty is rejected.

5. Inventive step

5.1 The patent in suit

5.1.1 The patent in suit deals with epoxy resin compositions suitable for making fiber-reinforced composite materials and relates to a process for producing fiber-

reinforced composite materials by impregnating a reinforcing fiber substrate placed in a mould with a liquid thermosetting resin composition, and heating to cure (paragraph [0001] of the patent in suit).

- 5.1.2 Paragraphs [0006] and [0011] of the patent in suit identified the problem to be solved as being that of providing epoxy resin compositions for resin transfer moulding (RTM) applications, which are suitable for making fiber-reinforced composite materials having a high fibre volume fraction (i.e. higher than 45%: see paragraph [0006]) and allow long injection time together with short cure time after injection.

As indicated by the respondent (letter of 9 August 2011: page 15, points 1-2 of section i)), it is in practice difficult to satisfy simultaneously both requirements for long injection time and short cure time, since a modification of the viscosity of the compositions having a beneficial effect on the injection time will be detrimental to the cure time and vice versa. Long injection time is particularly important for compositions comprising high fibre volume fraction because it allows better filling of the void space between the fibres.

Examples 1-7 of the patent in suit show that, in RTM applications, epoxy compositions according to claim 1 allow long injection time together with short cure time after injection when preparing fibre-reinforced composite materials having a high fibre volume fraction.

- 5.1.3 The epoxy resin compositions defined in claim 1 are *inter alia* characterized by the presence of an imidazole derivative anionic polymerization initiator.

5.2 The disclosure of D4

5.2.1 Document D4, taken by the appellant as starting point for its objection for lack of inventive step, concerns curable moulding compositions comprising a half ester of maleic anhydride with an organic polyol, maleic anhydride, an unsaturated monomer, an epoxide and reinforcing fibers (claim 1). They result from the addition of an epoxide with two or more 1,2-epoxide radicals to mixtures of an ethylenically unsaturated monomer with the reaction product of maleic anhydride and an organic polyol, that reaction product still containing maleic anhydride (claim 1; page 4, lines 10-38 and examples 8 to 10).

- (a) Concrete embodiments of the curable compositions according to claim 1 of D4 are disclosed only in examples 8 to 15, the epoxy resin being used in a minor amount as compared to the unsaturated monomer (styrene) and the half ester in all of these examples.
- (b) According to page 19, lines 13-24 of D4, the compositions are cured using both radical and polar bond forming reactions, the ethylenically unsaturated monomers copolymerizing with the carbon-carbon double bonds of the maleic half esters and maleic anhydride under free radical conditions. The terminal carboxyl groups on the half esters and the anhydride portion of maleic anhydride are said to condense with the epoxide functionalities to form hydroxyl esters via a polar mechanism. This passage also specifies that epoxide homopolymerisation may (emphasis added by the Board) occur simultaneously by a polar

pathway.

(c) Although an imidazole derivative is disclosed in example 5 of D4 for the preparation of the half ester of the maleic anhydride, it is not disclosed as playing any role as curing catalyst for the reaction of the epoxide functionalities, neither according to the general teaching of D4 concerning the curing catalyst for the epoxides (D4: paragraph bridging pages 20 and 21), nor in example 15 using the half ester obtained in example 5, example 15 specifying the use of a catalyst compound in accordance with the general teaching provided on page 20. The imidazole derivative is present in the composition of example 15 only as a residue from the precursor reaction in Example 5 of D4.

(d) Hence, the compositions disclosed in D4 do not qualify as "epoxy resin compositions", but rather as compositions mainly curable by reaction of unsaturated monomers (styrene) with the reaction product of maleic anhydride and an organic polyol, to which an epoxide additive having two or more radicals has been added to react with the hydroxyl groups of the maleate half esters and unreacted maleic anhydride (D4: page 4, lines 10-15 and examples 8 to 10).

5.2.2 Although D4 aims at providing moulding compositions that can be used in the manufacture of shaped articles, in particular fibre-reinforced plastic compositions, it does not concern compositions having a high fibre volume fraction in the sense of the patent in suit i.e. more than 45 %. Nor does it address the problem underlying the patent in suit, namely long injection



time together with short cure time after injection and a high fibre volume fraction.

- 5.2.3 Summing up, D4 does not address the problem of providing compositions suitable for RTM mouldings and having a fibre volume fraction higher than 45%, nor does it deal with the issues of long injection time together with short cure time, nor does it deal with epoxy resin compositions, let alone disclosing the use of imidazole as initiator for the polymerisation of epoxide. Therefore, D4 is not relevant for the problem addressed in the patent in suit for which the compositions of present claim 1 have been shown to provide a solution. Under such circumstances, the sole line of reasoning proposed by the appellant for analysing inventive step, which starts from the disclosure of D4, cannot lead to the conclusion that the subject-matter of claim 1 is obvious.

In the Board's opinion, choosing D4 as starting point for judging inventive step may only be arrived at by relying on technical similarities between the claimed invention and the features of D4, i.e. with knowledge of the claimed invention (hindsight).

- 5.3 Furthermore, D8 constitutes a prior art within the meaning of Art. 54(3) EPC and cannot be used for the assessment of inventive step (Art. 56, second sentence, EPC). Therefore, the appellant's sole objection for lack of inventive step based on a combination of D4 with D8 cannot be followed.
- 5.4 Consequently, it cannot be objectively concluded that the subject-matter of the patent in suit was, having regard to the state of the art, obvious to a person

skilled in the art and the appellant's objection of lack of inventive step must be rejected.

6. The main request of the respondent (patent proprietor) being allowable there is no need to consider the auxiliary requests.

### **Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



E. Goergmaier

F. Rousseau

Decision electronically authenticated