

Case Number: T 0739/92 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 16 July 1996

Appellant: HERCULES INCORPORATED
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Representative: -

Decision under appeal: Decision of the Opposition Division of the European Patent Office dated 16 March 1992, issued in writing on 19 May 1992 revoking European patent application No. 0 193 082 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: R. Young
J. A. Stephens-Ofner

Summary of Facts and Submissions

- I. The mention of the grant of European patent No. 0 193 082, in respect of European patent application No. 86 102 074.1, filed on 18 February 1986 and claiming US priorities of 19 February 1985 (US 702518) and 17 April 1985 (US 724133) was announced on 21 March 1990 (Bulletin 90/12). Claim 1 reads as follows:

"A thermosetting epoxy resin composition comprising a polyepoxide component having on average more than one epoxide group per molecule and a glass transition temperature below about 50°C, and an aromatic oligomer, characterized in that it contains an amount of an amine hardener sufficient to provide from 0.8 to 1.5 equivalents of active hydrogen atoms per one equivalent of epoxide groups in the composition, and from 20 to 50% by weight of the composition of an aromatic oligomer having a number average molecular weight between about 2,000 and about 10,000, a glass transition temperature between about 125°C and 250°C and at least 1.4 functional groups that react with either the polyepoxide component or the amine hardener."

Dependent Claims 2 to 8 are directed to elaborations of the thermosetting epoxy resin composition of Claim 1.

Independent Claim 9 is directed to a thermoset composite comprising a crosslinked epoxy resin matrix according to Claim 1 containing high strength filaments or fibres.

Dependent Claims 10 to 12 are directed to elaborations of the thermoset composite of Claim 9.

Independent Claim 13 is directed to a prepreg comprising a thermosetting epoxy resin composition containing high-strength filaments or fibres, and dependent Claim 14 to an elaboration of such a prepreg.

Independent Claim 15 is directed to a process for making a prepreg, and independent Claim 16 to a process for making a prepreg as claimed in Claim 13, respectively.

II. Notice of Opposition was filed on 3 August 1990 on the ground of lack of inventive step. The opposition was supported inter alia by the documents:

(1a): 1984 Schedule of Gordon Research Conferences
"Frontiers of Science" - New Hampshire;

(1b): Registration List of names for Gordon Research Conference on "Thermosetting Polymers", 18 to 22 June 1984, Colby-Sawyer College, New London, New Hampshire;

(1c): Manuscript, in poster form, consisting of a title page, five pages of reaction schemes, two pages of tabulated results, two pages of graphical and photographic results and one page of "conclusions", of a lecture by I. Yilgör et al., entitled "Modification of Epoxy Resins with Functionally Terminated Poly(arylethersulfone) oligomers";

(1d): A copy of the envelope, postmarked 2 July 1984, carrying the name of the lecturer I. Yilgör and addressed to

"Dr Helmut Tesch,
BASF Aktiengesellschaft
Kunststofflaboratorium
D-6700 Ludwigshafen
West Germany"; and

(1e): An internal report on the Conference written by Dr Tesch for internal use by the Opponent, dated 4 July 1984.

III. By a decision which was given at the end of oral proceedings held on 16 March 1992 and issued in writing on 19 May 1992, the Opposition Division revoked the patent.

According to the decision, the oral description represented by document (1c) belonged to the state of the art in the sense of Article 54(2) EPC, since the list of participants given in document (1b) showed that the conference was open to every specialist active in the relevant field. Furthermore, there was no secrecy agreement, since the participants were not prohibited from disseminating oral information from the conference, or from publishing information from it provided that they omitted any reference to the Conference.

Independent Claim 1 of the patent in suit differed from the composition disclosed in Example 7 of (1c), the closest

state of the art, in that the wt% of aromatic polysulphone was between 20 and 50% instead of 15%.

As to the problem solved by this difference, the additional information submitted on 16 March 1992 taught that the addition of 40% of a polysulphone oligomer (instead of 15%) improved toughness, whereas stiffness was decreased. This effect was, however, known from (1c), which taught that an increase in the amount of polysulphone oligomer improved the toughness of the cured resin. It would therefore have been obvious for the skilled person, wishing still further to increase the toughness of the cured composition, to raise the amount of polysulphone beyond the range taught in (1c) and thus arrive at a composition according to Claim 1 of the patent in suit.

Consequently, Claim 1 did not involve an inventive step. It was furthermore pointed out that the features of Claims 2 to 16 were known from the state of the art and had not been shown to solve a technical problem in an unexpected manner.

IV. On 20 July 1992, a Notice of Appeal against the above decision was filed, together with payment of the prescribed fee.

In the Statement of Grounds of Appeal filed on 28 September 1992, the Appellant (Patentee) argued essentially as follows:

(a) Document (1c) was not prior art because:

- (i) interested individuals had to be active in the field of the conference to be accepted as participants;
- (ii) the recording of the lectures by tapes, etc., and the photography of slide material were prohibited;
- (iii) participants were not allowed to disseminate printed references to the Gordon Research Conference and discussion;
- (iv) authors were requested to omit references to the conference in any publication; and
- (v) guests were not permitted to attend the Conference lectures and discussions.

This limited group of people, having accepted the above regulations, were bound to secrecy and could not be seen as the "public" in the sense of Article 54(2) EPC.

- (b) These considerations were in line with the decisions of:
 - (i) the Technical Board of Appeal 3.5.1, T 0300/86 of 28 August 1989;
 - (ii) the German Federal Court of Justice in the decision (X ZR 64/68) on "Rotterdam Geräte" (GRUR 1973, page 263); and
 - (iii) the German Patent Office decision 23 W (pat) 17/90 of 3 December 1991.

- (c) Evidence had not so far been provided that the lecture or posters of Dr I. Yilgör corresponding to document (1c) had in fact been presented at the Gordon Conference before the priority date, or that the relevant papers had been sent to Dr Tesch in July 1984, or that the notes written by Dr Tesch had been made available to the public before the priority date.

- (d) Notwithstanding the above, a hydroxyl terminated polysulphone was employed in the preparation of the oligomer in (1c), which required that the oligomer was pre-reacted with the epoxy resin to end-cap with epoxide in the presence of a catalyst and solvent (step 1). Later published papers by the same authors indicated that the pre-reaction step and use of a catalyst were necessary. It was an essential difference from the teaching of (1c) that, according to the patent in suit, no catalyst was necessary.

- (e) The person skilled in the art of manufacturing prepregs would have expected difficulties in processing higher loading levels of oligomer, since the incorporation of a dissolved, polymeric or oligomeric material into a formulation always increased the viscosity and the viscoelasticity, two factors which made prepregging difficult or nearly impossible.

The Appellant filed a new, restricted Claim 1 as an auxiliary request.

- V. The Respondent (Opponent) indicated, in a letter filed on 3 March 1993, that it would not actively be pursuing the opposition further and would not, therefore, be replying to the Statement of Grounds of Appeal.
- VI. The Appellant requested, as main request, that the decision under appeal be set aside and the patent be maintained in the form as granted, or else with Claim 1 according to the auxiliary request. As an auxiliary measure, oral proceedings were also requested (letter of 14 June 1996).

No request was received from the Respondent.

Reasons for the Decision

1. The appeal is admissible.
2. *Relevant state of the art; the status of document (1c)*

A key issue in the present decision is whether or not document (1c) belongs to the state of the art in the sense of Article 54(2) EPC.

- 2.1 The arguments of the Appellant concerning restrictions on the selection of the participants at the conference in question and their freedom to disseminate the information they obtained (section IV. (a) (i) to (v), above) have already been dealt with in adequate detail in the decision under appeal (section III, above, and Reasons for the decision, point 2.3). The Board sees no reason to differ from the reasoning given in respect of these arguments.

2.2 As regards the decisions quoted as precedents in this connection by the Appellant (section IV. (b) (i) to (iii), above), the situation of the participants at the Gordon Conference differs from these in the following respects:

2.2.1 According to (i), all the recipients of the relevant report were licensees of its originator, and the report was issued subject to the express condition that its contents were not to be communicated to third parties. Thus, there was an obligation of confidence arising both from the business relationship itself and the specific written (contractual) prohibition, the latter being of a blanket nature.

This is in contrast to the legal position of the Gordon Conference, whose participants were not licensees of the organisers, nor, for the reasons given in the decision under appeal, subject to a blanket contractual prohibition from communicating the information they obtained to third parties.

2.2.2 The difference of situation is even more marked in the case (ii) of the "Rotterdam Geräte", in which representatives of the Third Reich, known as the Rotterdam group, had the job of investigating and, if possible, copying radar equipment salvaged from crashed Allied aircraft (Reasons for the decision, point III. 10). There, the representatives were subject not just to an obligation of confidence in the line of business, but, as is customary under military law in wartime, to strict and complete secrecy.

2.2.3 The position is slightly different in (iii), which, according to the quoted passage, states that a typed

manuscript intended for publication does not become published merely because copies are circulated to a selected group of individual scientists and their colleagues in the course of a scientific discussion without an explicit confidence agreement.

Quite apart from the question of the applicability of decisions of the German Patent Office to EPO practice, the issue here is not so much whether (1c) is a published document by virtue of its circulation to selected people prior to the conference, but rather whether its contents, in particular the five pages of reaction schemes and two pages of tabulated results, were made available to the public at the Conference by virtue of their oral presentation and visual display as posters during the lecture.

- 2.2.4 In the latter connection, although the Appellant in the Statement of Grounds of Appeal reintroduced a previously expressed allegation that the content of (1c) had not been shown actually to have been presented by Mr Yilgör at the conference, a contrary admission had already been made in the letter dated 28 May 1991 (page 4, first complete para.). In any case, evidence is on file in the form of documents (1d) and (1e), which strongly supports the supposition that the content of (1c) was indeed actually presented at the lecture in question. This evidence has not been called into question, nor does it lack credibility to the Board.

Consequently, the legal precedents cited by the Appellant do not provide a sufficient basis for holding that the

participants at the Gordon Conference were not to be regarded as normal members of the public. Furthermore, there is no reason for the Board to doubt that the content of (1c) was actually presented to these participants at the Conference.

Therefore, the Board confirms the finding of the decision under appeal, that the content of (1c) forms state of the art in the sense of Article 54(2) EPC.

3. *The closest state of the art; the technical problem*

A. Main request

The patent in suit is concerned with a thermosetting epoxy resin composition yielding a cured thermoset having good impact resistance, i.e. toughness, comprising a polyepoxide having on average more than one epoxide group per molecule, and an aromatic oligomer (page 2, lines 1 to 13 and 42 to 49).

Such a composition is, however, known from document (1c), which is considered to be the closest state of the art.

3.1 According to (1c), epoxy resins may be modified with polysulphone oligomers to improve fracture toughness while retaining high modulus and chemical resistance (page 2).

According to the "Synthesis Scheme for Modified Networks" (page 3 of (1c)), the reaction, in a first step, of a diglycidyl ether of bisphenol A with an aromatic polysulphone oligomer having two hydroxyl end groups

results in an "epoxy capped PSF". To obtain this, desired amounts of PSF oligomer and epoxy resin are dissolved in methylene dichloride and the solvent removed under vacuum, the reaction conditions for capping being: use of a catalyst ("TMAH"), a temperature of 110EC and a time of 5h (page 5). The product is characterised using a number of techniques, including "HPLC", "GPC", "FT-IR", "NMR" and titration (page 5, "Capping Reaction of PSF with Epoxy Resin - Step I).

This product is then applied by mixing the capped PSF/epoxy resin system with DDS (4,4'-diaminodiphenylsulphone) at 150EC, cooling the mixture to 80EC and pouring it into a preheated silicone mould, curing for 2h at 145EC and postcuring for 2h at 180EC (page 6).

According to Examples 6 and 7, such polysulphone modified epoxy resins containing 10 wt% and 15 wt% respectively of a polysulphone oligomer having a molecular weight of 8 200 yielded cured products having a fracture toughness (K_{IC}) of 1.0×10^6 and 1.3×10^6 N/M^{3/2}, respectively (pages 7 and 8).

3.2 In view of the above, the Board is unable to concur with the finding of the decision under appeal, according to which (1c) discloses, in Example 7, a three-component composition separately containing:

- (a) diglycidyl ether of bisphenol-A (having a glass transition temperature of -15EC);
- (b) 4,4'-diaminodiphenylsulphone;

(c) 15 wt% aromatic polysulphone oligomer having a number average molecular weight of 8 200 and two hydroxyl end groups that react with the polyepoxide component, the glass transition temperature of such an oligomer being undisputedly about 170EC (Reasons for the decision, paragraphs 3.1, 3.2).

3.2.1 In particular, the presentation, in the decision under appeal, of separate values of the glass transition temperature for the epoxy component (a) and the oligomer component (c) respectively implies that they are separate chemical entities present simultaneously with the amine hardener. This cannot be the case, however, since according to page 3 of (1c) the functional oligomer is first reacted with the epoxy resin to yield an "epoxy capped PSF" which is subsequently reacted with the diamine to give a crosslinked network.

3.2.2 Quite apart from the fact that neither of these glass transition temperatures is so much as mentioned in (1c), nor has been explicitly admitted by the Appellant to be correct, it has already been established here (section 3.1, last sentence, above) that the relevant oligomer species prepared according to (1c) is the product of reaction of the PSF oligomer with the polyepoxide component in the presence of a solvent and a catalyst, the product being separately characterised as such.

Such a product would not, however, be characterised by two separate glass transition temperatures, but rather by a single transition temperature different from that of either of its constituent reactants.

- 3.2.3 In summary, the capped PSF/Epoxy Resin system of (1c) is a single adduct and not two separately characterised chemical species.
- 3.3 Compared with this state of the art, the technical problem underlying the patent in suit is seen as the provision of an alternative thermosetting polymer composition capable of yielding a cured product having increased toughness.
- 3.4 The solution proposed according to Claim 1 of the patent in suit is to omit the step of pre-reacting, in the presence of a catalyst, the epoxy component with the oligomer, and instead to combine the polyepoxide and oligomer components with the amine hardener, the polyepoxide having a glass transition temperature below about 50EC, and the oligomer (which need not be a PSF oligomer) being an aromatic oligomer having a number average molecular weight between about 2 000 and 10 000, a glass transition temperature between about 125EC and 250EC and at least 1.4 functional groups that react with either the polyepoxide component or the amine hardener, and being present in an amount of 20 to 50% by weight of the composition.
- 3.5 It can be seen from the comparative data filed by the Appellant on 16 March 1992, the accuracy of which has not been challenged, that an increased fracture toughness is indeed obtained when, following the procedure in Example 1 of the patent in suit, the amount of oligomer (corresponding to a condensation product of bisphenol-A and 4,4'-dichlorodiphenylsulphone) is increased from 15 wt% to 40 wt% (Example A vs. Example B in Table II).

Consequently, the Board finds it credible that the proposed measures provide an effective solution of the stated problem.

4. *Novelty*

Novelty of the claimed subject-matter not in dispute in the proceedings, and the Board sees no reason to arrive at a different conclusion on the matter.

Consequently, the subject-matter of Claims 1 to 16 is held to be novel.

5. *Inventive step*

It is necessary to consider whether the skilled person would have expected, starting from the disclosure of (1c), to arrive at a composition capable of providing thermoset products having improved fracture toughness by means of the modifications set out in section 3.4, above.

5.1 First of all, it is necessary to recall that the relevant finding of the decision under appeal was that it would have been obvious for the skilled person, wishing to increase the toughness of the cured compositions of (1c), to raise the amount of polysulphone beyond the range taught in (1c) and thus arrive at the compositions according to Claim 1 of the patent in suit (section III, above, and Reasons for the Decision, paragraph 3.5).

5.2 A closer examination of the disclosure of (1c) reveals, however, that a composition comprising all three reactants

is never formed according to the teaching of this document. On the contrary, a single, separately characterised adduct is reacted with the amine hardener (sections 3.2.1 to 3.2.3, above).

Consequently, an increase of the amount of oligomer in the system described in (1c) into the range above 20 wt% of the composition would not in itself be sufficient to yield a composition corresponding to the solution of the technical problem as defined by the Board (sections 3.3, 3.4, above).

- 5.3 In other words, even allowing the finding of the decision under appeal to be correct as far as the step of increasing the amount of oligomer in the system of (1c) is concerned, the result would not be a composition as claimed in Claim 1 of the patent in suit.

Consequently, and regardless of whether an increase in the fracture toughness would have been expected, the subject-matter of Claim 1 has not, in the Board's view, been shown in the decision under appeal to arise in an obvious way from the state of the art.

- 5.4 As to the question of whether the combined measures of raising the amount of oligomer from 15 wt% to 20 to 50 wt% and carrying out the other steps required by the solution of the stated problem are nevertheless obvious, no allegation to this effect has been made in these proceedings.

- 5.5 On the contrary, there is no suggestion in (1c) to omit the catalytic pre-reaction step which gives rise to the PSF/Epoxy resin adduct.
- 5.6 In this connection, the number average molecular weight of such an adduct will tend to be higher than that of components in a system where such complete pre-reaction is omitted, as in the patent in suit, and the presence of high molecular weight components contributes disproportionately highly to the overall viscosity of such a composition.
- 5.7 Hence, the Appellant's uncontested argument, that the skilled person would have expected a deleterious increase of viscosity and viscoelasticity by increasing the level of oligomer loading in the system of (1c), rendering prepregging difficult to nearly impossible, is convincing.
- 5.8 In other words, the solution of the stated problem is not only unsuggested by the state of the art, but is also associated with an unexpected technical effect (the fact that prepregging is still possible at the higher oligomer loadings).
- 5.9 Hence, the subject-matter of Claim 1 involves an inventive step in the sense of Article 56 EPC.
6. Although the decision under appeal made a general allegation that the features of the remaining Claims 2 to 16 were known to the prior art and had not been shown to solve a technical problem in an unexpected manner, no further reasoning was given, and no explicit finding that their subject-matter lacked patentability was made.

In the absence of such a finding and in view of the judicial rather than investigative function of the Boards of Appeal (T 39/93 of 14 February 1996, to be published in OJ EPO; Reasons for the decision, point 3.1.1), the Board sees no reason to raise any objection to the subject-matter of these claims under Article 114(1) EPC.

Consequently, there is no objection to the subject-matter of Claims 2 to 16.

B. Auxiliary requests

7. In the light of the above findings, it is not necessary further to consider Claim 1 of the auxiliary request, or to appoint oral proceedings.

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 in the form as granted.

The Registrar:

The Chairman:

P. Martorana

C. Gérardin