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D E C I S I O N
of 9 November 1998

Case Number: T 0590/95 - 3.3.3

Application Number: 89302232.7

Publication Number: 0339773

IPC: C08G 59/56

Language of the proceedings: EN

Title of invention:
A modified epoxy resin and process for preparing the same

Applicant:
Mitsui Chemicals, Inc.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no) - obvious combination of known features"

Decisions cited:
-

Catchword:
-

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Case Number: T 0590/95 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 9 November 1998

Appellant: Mitsui Chemicals, Inc.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 20 March 1995 refusing European patent application No. 89 302 232.7 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: C. Gérardin
Members: B. ter Laan
C. Holtz

Summary of Facts and Submissions

I. European patent application No. 89 302 232.7, filed on 6 March 1989, claiming priority of 7 March 1988 from an earlier application in Japan (JP 53069/88) and published on 2 November 1989 under No. 0 339 773 was refused by a decision of the Examining Division of the European Patent Office dated 20 March 1995. That decision was based on three sets of three, three and two claims, respectively, as the main and two auxiliary requests. Claim 1 of the main request read:

"A process for preparing a modified epoxy resin having an epoxy equivalent of from 600 to 2500 which comprises; (i) reacting an epoxy group of a bisphenol type epoxy resin (a) having secondary hydroxyl groups and an epoxy equivalent of from 150 to less than 2500 with a primary amine (b) in an amount of from 0.05 to 50 parts by weight per 100 parts by weight of bisphenol type epoxy resin (a) in the optional presence of a bisphenol (c) to produce a chain-extended epoxy resin having secondary hydroxyl groups and then (ii) at least partially esterifying the secondary hydroxyl groups of the chain-extended epoxy resin by reaction with a lactone in an amount such that the resulting modified epoxy resin contains from 0.1 to 50% by weight of lactone polymer (polyester)."

Dependent Claim 2 referred to a powder coating composition comprising a modified epoxy resin prepared in accordance with Claim 1 and a curing agent and Claim 3 was directed to the use of a powder coating composition as claimed in Claim 2 in the preparation of powder coatings.

Claim 1 of the first auxiliary request differed from Claim 1 of the main request in that the epoxy resin (a) had an epoxy equivalent of from 150 to 1800 and in the use of a primary mono-amine as the primary amine (b). Claims 2 and 3 had the same wording as those of the main request.

Claim 1 of the second auxiliary request referred to a powder coating composition comprising a curing agent and a modified epoxy resin prepared in accordance with Claim 1 of the first auxiliary request. Claim 2 had the same wording as Claim 3 of the main request.

II. The Examining Division held that the claimed subject-matter did not involve an inventive step. In particular, it was found that D1 (GB-A-2 101 605), which taught to use flexible lactone-modified epoxy resins still containing epoxy groups, optionally further modified with primary amines, for powder paints, was the closest prior art. The claimed subject-matter differed from it solely in the order in which the modifying agents, i.e. the amine and the lactone, were reacted with the epoxy resin. In the absence of any evidence of a technical effect which could be attributed to the preliminary reaction with the primary amine, the problem underlying the application in suit was defined as to provide an alternative to the process of D1. D3 (EP-A-0 222 600) referred to a two-step process of preparing polyol resins from epoxy resins based on a chain extension followed by a modification by which all the epoxy groups are consumed. Thus, this document disclosed a highly relevant alternative modification method, which the skilled person would consider when looking for an alternative to D1, leading him to the invention.

III. On 17 May 1995 a Notice of Appeal was lodged against that decision, together with payment of the prescribed fee. With the Statement of Grounds of Appeal filed on 13 July 1995, the Appellant (Applicant) submitted three sets of claims as the main and two auxiliary requests, which corresponded to the three requests upon which the decision of the Examining Division was based. The Appellant commented upon the issue of Articles 84 and 123(2) EPC, although the Examining Division did not have any objections to the claims in that respect anymore, as well as upon the question of inventive step.

IV. After a communication from the Board, in which several objections under Articles 123(2), 84 and 56 EPC were raised against the three sets of claims then on file, on 9 October 1998 three new sets of claims were filed replacing the claims that were filed with the Statement of Grounds of Appeal. Claims 1 of all requests differed from the above respective versions in that the optionally present bisphenol (c) was now specified. The Appellant indicated the basis for the amendments in the original application and provided comments regarding Article 84 EPC, but gave no further arguments as regards inventive step.

During oral proceedings held on 9 November 1998, the Board pointed out that the objections under Articles 123(2) and 84 EPC had not yet been overcome, but that those were not of such a nature that they could not be solved after a possible positive decision on the substantive issue of inventive step. Therefore, for reasons of procedural efficiency, first the general concept of all three sets of claims was to be discussed with a view to the presence of an inventive step. This approach was accepted by the Appellant.

V. The Appellant's arguments submitted in writing and during the oral proceedings, can be summarised as follows:

The claimed subject-matter differed in many more points from D1 than indicated by the Examining Division, and was therefore not obvious in the light of D1 and D3. Whereas the definition of the problem to be solved as the "provision of an alternative" could be accepted, D1 clearly taught that the reaction with amine was to be carried out **after** the reaction with lactone, thus limiting the scope of possible alternative methods. D3 referred to polyol resins without any epoxy groups left, so that the skilled person would not turn to that document for information regarding epoxy resin powder coating. Therefore, even if there was only one single difference between D1 and the claimed subject-matter, it would not have been deducible from D3. There was no reference in either of D1 or D3 to combine one with the other, so that their combination was the result of hindsight analysis. The only reason why D3 was mentioned by the first instance was that it disclosed a feature not revealed in D1. However, that did not represent an incentive for the skilled person to depart from the specific instructions of D1 with respect to the reaction order in an attempt to find an alternative process, as he might as well have chosen another one out of the numerous possibilities offered by the prior art. Thus it was clear that there was no "one-way street situation" involved in the present case.

The Appellant concluded that the claimed subject-matter was inventive. The request for reimbursement of the appeal fee made in the written proceedings was withdrawn during the oral proceedings before the Board.

VI. The Appellant requested that the decision of the first instance be set aside and that a patent be granted on the basis of Claims 1 to 3 of the main request or, alternatively, Claims 1 to 3 of the first auxiliary request, or Claims 1 and 2 of the second auxiliary request.

Reasons for the Decision

1. The appeal is admissible.

Novelty

The Examining Division did not deny the novelty of the subject-matter of the claims, and although the Board has some doubts in that respect concerning the product and the use claims, in view of the conclusion regarding inventive step it did not appear appropriate to consider the question of novelty in further detail.

Inventive step

2. The patent in suit concerns a modified epoxy resin and process for preparing the same.

2.1 Such epoxy resins are disclosed in D1, which the Board, like the Examining Division and the Appellant, regards as the closest state of the art.

2.2 D1 describes a lactone-modified epoxy resin obtained by reacting 97 to 5 parts by weight of a hydroxyl group-containing epoxy resin with 3 to 95 parts by weight of ε-caprolactone (Claim 1). The modification of epoxy resins, which have a structure and epoxy equivalent within the terms of the application in suit, by ring-opening polymerisation of ε-caprolactone with the

secondary hydroxyl group of the resins results in improvement of their flexibility (page 1, lines 31 to 34 and page 2, line 36 to page, line 12). D1 also discloses further modification of the terminal epoxy groups of the epoxy resin with an amine having an active hydrogen atom, thus improving the adhesion and corrosion properties of the resin (page 1, lines 37 to 42). Additionally, amines are mentioned as curing promoters, leading to improved chemical, mechanical and thermal properties (page 1, lines 43 to 45). The positive influence of ring-opening with amines of the epoxy groups of the epoxy resin, when mixed with a curing agent, in respect of storage stability and adhesion is further described on page 4, lines 46 to 49. To that end, primary or secondary amines may be used (page 4, lines 37 to 41 and line 62 to page 5, line 7). The modified resin of D1 can be used as a powder paint by mixing it with a blocked isocyanate (page 3, lines 45 to 46). D1 does not specify any preference for the order in which the reactions take place, but from page 5, lines 7 to 9 and Examples 10 to 13 it may be inferred that first the lactone and then the amine is actually reacted.

2.3 According to the description of the application in suit the object of the invention is to provide a process for preparing epoxy resins having improved flexibility and curing properties.

Although it is indicated that the two reactions with amine and lactone can be carried out in any desired order (page 8, lines 1 to 2), a preference for first reacting the amine and then the lactone is also mentioned (page 8, lines 2 to 3). However, the application in suit does not indicate any desirable effect of that particular reaction order and does not contain any examples comparing resins prepared by the process of D1 with those prepared according to the

claimed process. Since no other evidence is available, it is far from evident that flexibility and curing properties are in fact improved over the prior art resins obtained in D1, which are said to have all the properties required for the preparation of powder coating compositions.

2.4 In view of this, the technical problem underlying the application in suit has to be reformulated on a less ambitious basis, namely to provide an alternative process to prepare epoxy resins of similar flexibility and reactivity.

2.5 According to the application in suit that problem is to be solved by a process in which the epoxy resin is first reacted with a primary amine and then with a lactone.

2.6 The examples in the application show that the above-defined problem is effectively solved. In particular, it has been shown that the epoxy resins prepared according to the claimed process, like those of D1, are flexible and have good curing properties.

3. It remains to be decided whether the claimed subject-matter is obvious having regard to the documents on file.

As mentioned above, the appropriate flexibility is achieved by an esterification reaction based on the ring-opening polymerisation of ε-caprolactone onto the secondary hydroxy groups. In the subsequent reaction with the primary or secondary amine, which concerns the terminal epoxy groups, all or only part of these groups are consumed (page 1, lines 38 to 41; page 4, lines 37 to 41). Both reactions are specific and completely independent from each other.

Although D1 and the application in suit have so far been compared as two-step processes involving two subsequent modifications, the situation is such that in both cases the modified epoxy resin still contains epoxy end groups available for final curing with conventional crosslinking agents, in particular polycarboxylic acid anhydrides (D1: page 4, lines 87 to 10 in conjunction with page 4, lines 46 to 48; application in suit: page 8, lines 7 to 12). In both cases the final product which results from this three-step process does no longer contain any epoxy groups.

3.1 Such is also the case in the polyol resins described in D3 which are obtained by a process involving chain extension, ring-opening and esterification of bisphenol type epoxy resins.

According to Claim 1 of D3 a bisphenol type epoxy resin (a) may be reacted successively with (i) a primary amine as the main chain extender (b), (ii) a compound (c) containing at least the active hydrogen atom capable of bringing about ring-opening reaction of the terminal epoxy group, and (iii) a monocarboxylic acid (d) capable of esterifying the secondary hydroxyl groups. These three reactions may be carried out in any sequence (page 8, lines 7 to 10). In combination with a hydrocarbon type resin the resulting polyols provide coating compositions having excellent properties (page 21, line 12 to page 22, line 1; page 25, line 22 to page 26, line 16).

This document thus teaches that the various reactive groups of bisphenol type epoxy resins, i.e. hydroxyl and epoxy groups, may be reacted in any order without any detrimental effect on the properties of the polyol. A skilled person looking for an alternative process to the method known from D1, which is based on the specific sequence esterification of hydroxy

groups/chain extension/ring-opening, would self-evidently consider any embodiment within the disclosure of D3, in particular a preliminary chain extension with a primary amine, and thereby arrive at the claimed subject-matter without inventive contribution.

3.2 The same conclusion arises if one considers the optional feature of an additional modification of the epoxy resin with a bisphenol. This embodiment, which corresponds to a further chain extension increasing the molecular weight of the epoxy resin, is also envisaged in D3 (page 8, lines 21 to 23). In such cases, polyvalent phenols are co-used as a main chain extender together with the primary amines. This is exactly the definition of step (i) of Claim 1 of the application in suit which consequently cannot be regarded as an inventive feature.

3.3 It follows that the claimed subject-matter in its various embodiments derives in an obvious manner from the prior art and, therefore, does not involve an inventive step.

The above conclusions apply to Claim 1 of each of the three requests on file, since the three versions are based on the same non-inventive combination of features.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin