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D E C I S I O N
of 10 May 2006

Case Number: T 0927/04 - 3.3.03

Application Number: 94115588.9

Publication Number: 0646613

IPC: C08G 64/14

Language of the proceedings: EN

Title of invention:

A branched polycarbonate and a process for producing the same

Patentee:

IDEMITSU PETROCHEMICAL CO. LTD.

Opponent:

Bayer MaterialScience AG

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 114(2)

Keyword:

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

T 0002/83, T 0117/86, T 0686/91, T 0472/92, T 1019/92,
T 0355/99

Catchword:

-



Case Number: T 0927/04 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 10 May 2006

Appellant: Bayer MaterialScience AG
(Opponent) Patents and Licensing
D-51368 Leverkusen (DE)

Representative:

Respondent: IDEMITSU PETROCHEMICAL CO. LTD.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 5 May 2004 and
posted 17 May 2004 rejecting the opposition
filed against European patent No. 0646613
pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: R. Young
Members: C. Idez
H. Preglau

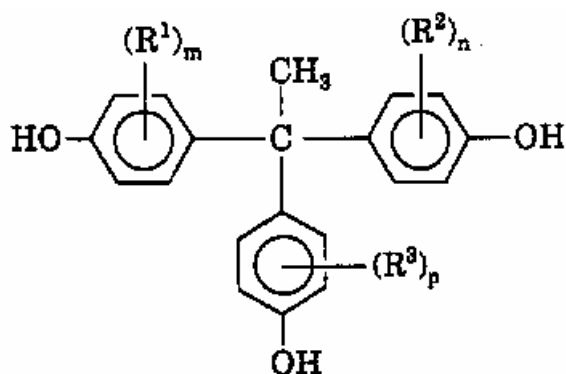
Summary of Facts and Submissions

I. The grant of the European patent No. 0 646 613 in the name of Idemitsu Petrochemical Co. Ltd in respect of European patent application No. 94 115 588.9 filed on 4 October 1994 and claiming priority of the Japanese patent application No 24917593 filed on 5 October 1993, was announced on 27 February 2002 (Bulletin 2002/09) on the basis of 9 claims.

Claim 1 read as follows:

"A process for producing a branched polycarbonate, which comprises:

a) providing a branching agent containing more than 200 ppm of sulfur and being selected from tris(4-hydroxyphenyl)methane, tris(4-hydroxy-3-methylphenyl)methane, tris(4-hydroxy-3,5-dimethylphenyl)methane, tris(3-chloro-4-hydroxyphenyl)methane, tris(3,5-dichloro-4-hydroxyphenyl)methane, and tris(3-bromo-4-hydroxyphenyl)methane, tris(3,5-dibromo-4-hydroxyphenyl)-methane and compounds represented by the following general formula (1),



(I)

wherein R^1 , R^2 and R^3 indicate each hydrogen, an alkyl group having 1 to 5 carbon atoms or halogen and m, n and p indicate each an integer of 0 to 4,

b) decreasing the content of sulfur of the branching agent to 200 ppm or less and

c) producing a branched polycarbonate by using the branching agent obtained in step (b) and adopting either the interfacial method or the melting method."

Claims 2 to 9 were dependent claims.

II. On 26 November 2002, a Notice of Opposition against the patent was filed by Bayer AG (later Bayer MaterialScience AG). The Opponent requested revocation of the patent in its entirety on the ground of lack of novelty and lack of inventive step (Article 100(a) EPC).

The opposition was supported *inter alia* by the following documents:

D1: US-A-RE 27682;

D2: EP-A-0 378 858;

D3: EP-A-0 411 433;

D4: EP-A-0 441 648; and the later filed, but admitted document

D7: Letter of Mr. James Mullen of Celanese Ltd dated February 4, 2003 to DuPont.

III. By a decision announced orally on 5 May 2004, and issued in writing on 17 May 2004, the Opposition Division held that the grounds of opposition raised and

substantiated by the Opponent did not prejudice the maintenance of the patent as granted and it therefore rejected the opposition.

According to the decision, the Opposition Division did not admit the late filed documents D8 (1,1,1 tris(4-hydroxyphenyl)ethane (THPE) Sales agreement dated 1 January 1990 between Hoechst Celanese Corporation Advanced Technology Group and a "buyer"), D9 (Interoffice Memo of Hoechst Celanese dated 27 September 1991), and D10 (Letter of Mr. Mathew L. Romberger of DuPont Electronics Polymers, L.P. dated May 3, 2004 to Bayer), all of which had been filed only one day before the oral proceedings, into the proceedings.

Concerning novelty, the Opposition Division came to the conclusion that the claimed subject-matter was novel over documents D1, D2, D3, and D4 and that document D7 could not support an alleged prior use.

Concerning inventive step, document D3 was considered as the closest prior art. Starting from D3, the technical problem was seen in the provision of a process for making branched polycarbonates with reduced discoloration during the melt method and with reduced mold rust after the interfacial method.

According to the decision, none of the cited documents gave an incentive to reduce the sulfur content of the branching agent in order to solve these problems. Thus inventive step was acknowledged.

IV. A Notice of Appeal was filed on 16 July 2004 by the Opponent (Appellant) with simultaneous payment of the

prescribed fees. With the Statement of Grounds of Appeal filed on 21 September 2004, the Appellant submitted the following documents:

D8: THPE Sales agreement dated 1 January 1990 between "a buyer" and Hoechst Celanese Corporation Advanced Technology Group;

D8a: THPE Sales agreement dated 1 January 1990 between General Electric Company and Hoechst Celanese Corporation Advanced Technology Group;

D9: Interoffice Memo of Hoechst Celanese dated 27 September 1991;

D10a: Letter of Mr. Mathew L. Romberger of DuPont Electronics Polymers, L.P. dated May 3, 2004 to Bayer;

D11: Letter of Mr. Mathew L. Romberger of DuPont Electronics Polymers, L.P. dated May 4, 2004 to Bayer;

D12: Letter of Mr. Mathew L. Romberger of DuPont Electronics Polymers, L.P. dated September 16, 2004 to Bayer;

D13: Letter of Mr. S. A. Klaeren of Hoechst Celanese dated October 23, 1989 to GE Plastics Group;

D14: Analyses of THPE Batches Shipped to GE;

D15(1): Interoffice Memo of Hoechst Celanese dated November 7, 1989; and

D15(2): Shippers Service, Inc Invoice Nr 12808 dated
10/20/89.

The Appellant argued essentially as follows:

(i) Concerning novelty:

(i.1) The skilled person knew that branching agents should be purified before being used in the preparation of polycarbonate.

(i.2) This was clearly shown by document D4.

(i.3) A THPE with a high purity would inevitably exhibit a low sulfur content.

(i.4) Thus, it could be concluded that the claimed combination of purification step and polycarbonate synthesis would have been carried out frequently and it thus lacked novelty.

(i.6) Document D7 showed that THPE had been produced by Hoechst Celanese Corporation before the priority date of the patent in suit.

(i.7) Table 4 of D7 showed that all the THPE batches disclosed therein except for one batch exhibited a sulfur content lower than 200 ppm.

(i.8) Documents D8a, D9 and D10a showed that THPE had been used in the manufacture of branched polycarbonate.

(i.9) Documents D13, D14, D15(1) and D15(2) showed that the THPE batch Nr. 90030 had been supplied to General Electric in October 1989.

(i.10) This batch had a sulfur content of 10 ppm (D7, Table 4) and it was evident that purification steps were necessary in order to reach this level of sulfur content.

(i.11) Consequently, the claimed subject-matter lacked novelty due to public prior use.

(ii) Concerning inventive step:

(ii.1) D3 would represent the closest state of the art.

(ii.2) Starting from D3 the technical problem would be to provide a process for the manufacture of polycarbonate, which led to reduced deposits during the processing of the polycarbonate.

(ii.3) It would have been obvious to carry out a purification process of the branching agent as disclosed in D4, in order to solve this technical problem.

(ii.4) The threshold value of 200 ppm of sulfur would be determined with routine experiments.

(ii.5) Furthermore, it was known to use THPE with a sulfur content of less than 200 ppm in the manufacture of polycarbonate.

(ii.6) The process for making polycarbonate following the purification step according to the patent in suit was the same as in the prior art.

(ii.7) No effect of the purification step had however been shown. Inventive step could not hence be acknowledged.

V. With its letter dated 1 April 2005, the Respondent filed three sets of claims representing a first auxiliary request, a second auxiliary request, and a third auxiliary request.

It also argued essentially as follows:

(i) Concerning the alleged prior use:

(i.1) Granted Claim 1 did not refer to purified THPE as such but to a process for producing branched polycarbonates.

(i.2) The claimed process was characterized by the following process steps:

- a) providing a specific branching agent containing more than 200 ppm of sulfur;
- b) decreasing the content of sulfur of the branching agent to 200 ppm or less and
- c) producing a branched polycarbonate by using the branching agent obtained in step (b) and adopting either the interfacial method or the melting method.

(i.3) In order to demonstrate prior use it should be shown that all three process steps were carried out before the priority date of the opposed patent.

(i.4) The Appellant had merely tried to demonstrate that a THPE with a sulfur content of less than 200 ppm existed somewhere before the priority date of the opposed patent.

(i.5) Documents D8/D8a were sales agreements between General Electric Company and Hoechst Celanese Corporation. Such kind of documents were not intended to be publically available. The same held true for document D9 which was an Interoffice Memo.

(i.6) Documents D8/D8a hence could not be used as an evidence that process step (c) was available to the public.

(i.7) The Appellant had not provided any clear evidence that before the priority date of the opposed patent the production of branched polycarbonates was the only use of THPE.

(i.8) D10 had been disregarded by the Opposition Division.

(i.9) D10a was not similar to D10. It was requested that these documents should not be taken into account in the decision with respect to the alleged public prior use.

(i.10) According to D10/D10a ("Technology and Specification") only one grade or quality of THPE was available to the market.

(i.11) Table 4 of D7 however showed that the sulfur content of the various lots differed within a wide range.

(i.12) If these different lots were interpreted to be of one grade, this would imply that no specific purification of THPE was carried out in order to reduce the content of sulfur to a certain level.

(i.13) According to D14 (first paragraph of the letter) THPE was produced at Coventry plant, however, dried and shipped to GE by Salsbury Chemicals.

(i.14) The analyzed sample of lot Nr. 90030 (cf. Table 4 of D7) had been obtained from the "producer Coventry" but not from "Salsbury" who dried and therefore modified the product of "Coventry" and shipped THPE to GE.

(i.15) Thus, the analytical data provided in D7 did not refer to the shipped product but a kind of precursor, which, apparently contained much more sulfur than the "Coventry" lot.

(i.16) The reference to lot Nr. 90030 in D15(2) was made in handwriting and could have been added at any time so that it was not reliable.

(i.17) D15 (2) did not prove that GE received any THPE and used it for the preparation of branched polycarbonates, let alone a THPE with a sulfur content of 200 ppm or less.

(ii) Concerning novelty over D4:

(ii.1) D4 dealt with a process for purifying THPE.

(ii.2) No clear reference was made in D4 to sulfur let alone the sulfur content before and after the purification process.

(ii.3) Consequently, the first two process steps of Claim 1 were not clearly and unambiguously derivable from D4. The same held true for the use of the purified THPE in the production of branched polycarbonates.

(iii) Concerning inventive step:

(iii.1) D3 would represent the closest state of the art.

(iii.2) The objects of the opposed patent were to provide a process for producing branched polycarbonates having excellent heat stability and not causing mold corrosion when produced by the interfacial method and having excellent heat stability and color tone when produced by the melting method (see also paragraph [0061] of the patent in suit).

(iii.3) The Examples of the opposed patent clearly demonstrated that the sulfur content was important for solving the problems underlying the opposed patent.

(iii.4) Even if it might be true that D4 dealt with a purification method for THPE and that the teaching of D4 could theoretically be combined with D3 (or D2 or D1), this was not sufficient for the finding of a lack of inventive step:

(a) D4 did not give any hint that the content of sulfur had to be reduced to 200 ppm or less in order to solve the above problems.

(b) Furthermore, D4 did not only fail to provide any suggestion with respect to reducing the S content, it even taught away since it described as an optional measure rinsing with an aqueous sodium dithionate solution.

(iii.5) The Appellant had also tried to argue that due to an existing commercial product THPE with less than 200 ppm sulfur there was no object at all and therefore no inventive step.

(iii.6) It had however not been shown that a branching agent with a sulfur content of less than 200 ppm was publically available before the priority date of the opposed patent.

(iii.7) Before the opposed patent it was not known that sulfur was responsible for the corrosion and coloration problems.

(iii.8) This was also clear from D8/D8a since sulfur was not mentioned in the list of the maximal amounts of impurities required by General Electric.

VI. With its letter dated 22 July 2005, the Appellant submitted the following document:

D16: Shippers Service, Inc. Invoice No. 12808 dated 10/20/89.

It also argued essentially as follows:

(i) The fact that a sales agreement existed and that General Electric bought THPE from Hoechst Celanese Corp. was not secret.

(ii) As indicated in the Statement of Grounds of appeal, the use of THPE in the production of branched polycarbonate was known before the priority date of the patent in suit.

(iii) It was true that D10a was not identical with D10 but this did not affect its reliability.

(iv) One grade meant that THPE met certain quality requirements. The lot numbers referred to various batches which met these requirements.

(v) The lot Nr. 90030 was dried in Salsbury. This drying step did not modify the sulfur content.

(vi) D16 corresponded to D15(2). D16 clearly showed that General Electric did receive THPE. D16 was part of the chain of evidence which showed that General Electric had received THPE with a sulfur content of less than 200 ppm.

VII. In its letter dated 10 April 2006 the Respondent argued essentially as follows:

(i) A sales agreement was not a document which was available to the public but was only available to the involved parties.

(ii) Business relationships were not commonly known to a third party ("the public").

(iii) The modifications in the document D10(a) caused serious doubts about the credibility of said document.

(iv) According to the Appellant "one grade" meant that THPE met certain requirements. If those requirements were those in Exhibit A of the sales agreement (D8a), it was clear that THPE had not to meet certain requirements with respect to sulfur as sulfur was not mentioned in Exhibit A at all.

(v) Consequently, it was clear that no specific purification of THPE had been carried out in order to reduce the content of sulfur below a certain level.

(vi) The Appellant had stated that at Salsbury no purification was carried out but only a drying step. The claims of the patent in suit related to a process comprising the process steps (a), (b) and (c).

(vii) The analytical data of lot Nr. 90030 mentioned in Table 4 of D7 referred to the product obtained at Coventry (i.e. THPE which had not been dried).

(viii) The degree of "wetness" was not known so that no information about the sulfur content of the dry THPE of lot Nr. 90030 could be taken from Table 4 of D7.

(ix) Furthermore, in view of the very different analytical results obtained for the lot 1071 in Table 4

of D7, one had to conclude that the analytical data provided in Table 4 of D7 were not very reliable.

(x) It was doubtful whether the handwritten notes with respect to the lot on document D16 were already present on October 20, 1989. It was assumed that they had been added later and it was not clear when they had been added.

VIII. Oral proceedings were held before the Board on 10 May 2006.

At the oral proceedings, the discussion essentially focussed on (i) the introduction of the documents D8, D8a, D9, D10(a), D11, D12, D13, D14, D15(1) and D15(2) into the proceedings, (ii) on the assessment of novelty in view of the alleged prior use, and (iii) on the assessment of inventive step taking D3 as the closest state of the art.

The arguments presented by the Parties concerning points (i), (ii) and (iii) may be summarized as follows:

Concerning point (i):

(i.1) By the Appellant:

(i.1.1) Documents D8, D8a, D9, D10(a), D11, D12, D13, D14, D15(1) and D15(2) had been submitted with the Statement of Grounds of Appeal in response to the decision of the Opposition Division, to consider that document D7 could not support the alleged prior use.

(i.1.2) In particular documents D8, D8a, D13, D14, D15(1) and D15(2) completed the chain of evidence starting from document D7 and establishing the objected prior use, since they showed, in the Appellant's view, that a batch of THPE with the number 90030 had been delivered to General Electric for the manufacture of polycarbonate.

(i.1.3) The Appellant, however, indicated that it would not insist on the introduction of documents D9 and D10(a) since there were still other documents in the proceedings which showed that THPE was on the market for polycarbonate application before the priority date of the patent in suit.

(i.2) By the Respondent:

(i.2.1) Documents D8, D8a, D9, D10(a), D11, D12, D13, D14, D15(1) and D15(2) were late filed.

(i.2.2) The patent in suit related to a process for making a branched polycarbonate and comprising different steps.

(i.2.3) The late filed documents were not concerned with a process for making a branched polycarbonate. They merely showed that THPE had been shipped to General Electric.

(i.2.4) Thus, they were not very relevant.

The Board, after deliberation, informed the Parties that documents D8a, D12, D13, D14, D15(1) and D15(2)

were introduced into the proceedings. The discussion moved then to point (ii).

Concerning point (ii):

(ii.1) By the Appellant:

(ii.1.1) D8(a) showed that THPE had been sold by Hoechst Celanese to General Electric for use in polycarbonate applications. In that document the confidential elements of the sales agreement relating to the price of the THPE had been deleted. D8(a) was available to the public.

(ii.1.2) There were only two processes at the industrial scale for producing polycarbonates, i.e. the interfacial process and the melt process.

(ii.1.2) Documents D13 to D15(2) showed that THPE of lot Nr. 900300 had been delivered to General Electric in October 1989.

(ii.1.3) Document D7 showed that the lot Nr. 900300 had a sulfur content of less than 200 ppm.

(ii.1.4) It was clear from the different values of sulfur content indicated in Table 4 of D7, that one would have to go through that several steps corresponding to different levels of sulfur content to arrive at the low level of sulfur (10 ppm) indicated for lot Nr. 900300.

(ii.1.5) Even if the information concerning the process for the manufacture of THPE had been deleted from

document D7 (cf. page 5 thereof), it was in any case clear that a purification step such as the one disclosed in document D4 (the applicant of which was also Hoechst Celanese) would have taken place at the end of the manufacturing process.

(ii.1.6) This purification step would inevitably reduce the level of sulfur content.

(ii.1.7) Under contract D8(a), there was an obligation of General Electric to use THPE for the manufacture of branched polycarbonate.

(ii.1.8) Consequently, prior use of the process according to Claim 1 had been established.

(ii.2) By the Respondent:

(ii.2.1) In document D7 reference was made to the sulfur content of the THPE lot Nr. 900300 at the Coventry plant.

(ii.2.2) According to D14, this lot had been afterwards dried at the Salsbury plant, and shipped from Salsbury to General Electric.

(ii.2.3) There was no indication of the sulfur content of the lot Nr. 900300 when it left the Salsbury plant.

(ii.2.4) In Exhibit A of document D8(a), there was no specification of the level of sulfur for the THPE to be sold to General Electric.

(ii.2.5) The priority date of document D4 was the 9 February 1990. It was hence doubtful as to whether the purification process disclosed in D4 could have been applied to the THPE shipped to General Electric in 1989.

(ii.2.6) In any case D4 did not refer to the reduction of the sulfur content in THPE. It further suggested a rinsing step with sodium dithionate of the purified product.

(ii.2.7) There was no evidence as to whether the lot Nr. 90030 had been indeed received by General Electric.

(ii.2.8) Even if it would have been received, there was no evidence that it had been used in the manufacture of branched polycarbonate, let alone that it had been used in a interfacial process or in a melt process for the manufacture of polycarbonate.

(ii.2.9) It could not even be excluded that General Electric might have developed a further process for the manufacture of polycarbonate.

(ii.2.10) Consequently, there were missing links in the chain of evidence provided by the Appellant in order to demonstrate the alleged prior use.

Concerning point (iii):

(iii.1) By the Appellant:

(iii.1.1) Document D3 was concerned with the same problems as the claimed invention, i.e. obtaining a

branched polycarbonate with a reduced coloration while maintaining a good heat stability as reflected by the taking-off parameter of the branched polycarbonate.

(iii.1.2) According to D3 (page 2, lines 33 to 36), it was known that the use of THPE as branching agent led to polycarbonate having a pale yellowish green color.

(iii.1.3) D4 disclosed a process for purifying THPE which enabled to obtain a THPE with a white color.

(iii.1.4) Thus, starting from D3, it would have been obvious for the skilled person aiming to obtain polycarbonate with an improved coloration to carry out a purifying process as disclosed in D4 on the branching agent before using it in the manufacture of the branched polycarbonate in the process disclosed in D3.

(iii.1.5) Even if D4 did not expressly refer to sulfur, the threshold value of the sulfur content in the branching agent could be easily determined by routine experiments.

(iii.2) By the Respondent:

(iii.2.1) Starting from D3, the technical problem was to provide a process for the manufacture of a branched polycarbonate, which, when produced by the interfacial method, did not show deterioration in heat stability or cause mold corrosion, and which, when produced by the melting method, did not show deterioration in heat stability or in color tone.

(iii.2.2) The Examples in Table of the patent in suit showed that this had been achieved by using a branching agent which had been purified in order to exhibit a sulfur content lower than 200 ppm.

(iii.2.3) D4 did not mention sulfur in the impurities to be removed.

(iii.2.4) There was no link in D4 between the sulfur content of the THPE and the white coloration of the purified product. It could not even be excluded that the rinsing with sodium dithionate might improve the white tone of the purified product.

(iii.2.5) Furthermore, improving the white tone of THPE did not imply anything for the coloration of a polycarbonate produced therefrom.

(iii.2.6) The influence of the sulfur content in the branching agent on the mold corrosion and on the coloration of the obtained polycarbonate was not known before the priority date of the patent in suit.

(iii.2.7) In that respect, it was to be noted that General Electric which was one the biggest producers of polycarbonate, did not even specify a sulfur content for the THPE it intended to buy from Hoechst Celanese (cf. Exhibit A of D8(a)).

IX. The Appellant requested that the decision under appeal be set aside and the European patent No. 646 613 be revoked.

The Respondent requested that the appeal be dismissed, or in the alternative that the decision under appeal be set aside and the patent be maintained on the basis of one of the 3 auxiliary requests, all submitted with the letter dated 1 April 2005.

Reasons for the Decision

1. The appeal is admissible.
2. *Admissibility of documents D8, D8(a), D9, D10(a), and D11 to D16 into the proceedings.*
 - 2.1 As stated in decision T 117/86 (OJ EPO 1989, 401) facts and evidence in support of an opposition which are presented after the nine-month period has expired are out of time and late, and may or may not be admitted into the proceedings as a matter of discretion under Article 114(2) EPC.
 - 2.2 Since the grant of the European Patent EP 0 646 613 was announced on 27 February 2002, the nine-month period ended on 27 November 2002.
 - 2.3 In this connection, the Board notes firstly (i) that documents D8, D9 and D10 have been submitted by the Appellant with its letter dated 4 May 2004, i.e. one day before the oral proceedings before the Opposition Division, (ii) secondly that the Opposition Division did not admit these documents into the opposition proceedings and thirdly that documents D8 and D9 have been resubmitted by the Appellant with the Statement of Grounds of Appeal on 21 September 2004. Furthermore,

documents D8a, D10a, D11, D12, D13, D14, D15(1) and D15(2) were submitted by the Appellant with the Statement of Grounds of Appeal on 21 September 2004, and document D16 was submitted with the letter dated 22 July 2005 of the Appellant.

- 2.4 It is therefore clear that documents D8 to D16 must be considered as late filed.
- 2.5 According to the case law of the boards of appeal, the main criterion for deciding on the admissibility of late-filed documents is their relevance, i.e. their evidential weight in relation to other documents already in the case, but further considerations which can play a decisive role in the question of admittance of late filed evidence are the degree of lateness and whether the late filing can be seen as representing an abuse of the proceedings (cf. T 1019/92 of 9 June 1994; not published in OJ EPO, Reasons, point 2.2)
- 2.6 In this context, the Board notes that the Opposition Division decided not to admit document D8, since it was *prima facie* not relevant for demonstrating a prior use since the name of the "buyer" had been deleted from that document.
- 2.7 The Board, having considered the evidence of D8 and the Opposition Division's decision that such evidence was not admissible, is satisfied that the Opposition Division did not misuse its discretion under Article 114(2) EPC when it elected to disregard document D8.

- 2.8 Consequently, the Board decided not to introduce document D8 into the proceedings (Art. 114(2) EPC).
- 2.9 The Board further notes that the Opposition Division decided not to admit documents D9 and D10, since they were not signed. According to the Appellant document D10(a) is a signed version of document D10, and the authenticity of document D9 is certified by document D11.
- 2.10 Even if it would be considered that the objections to the introduction of documents D9 and D10 into the proceedings raised by the Opposition Division might now have been overcome by the submission of D10(a) and D11, the Board however observes that, at the oral proceedings before the Board, the Appellant indicated that documents D9 and D10(a) were intended to support the fact that THPE had been on the market before the priority date of the patent in suit for use as branching agent for polycarbonate, but that it admitted that this fact was already established by documents D1 to D4.
- 2.11 Thus, under these circumstances, the Board can only come to the conclusion that documents D9 and D10(a) do not fulfill the criteria of relevance mentioned above in paragraph 2.5 above. Consequently, documents D9 and D10(a) were not admitted into the proceedings (Art. 114(2) EPC).
- 2.12 Since document D9 was not introduced into the proceedings, the same conclusion necessarily applied to document D11, which had been submitted in order to establish the authenticity of that document.

- 2.13 Concerning documents D8a, D12, D13, D14, D15(1) and D15(2), the Appellant argued that these documents have been filed as a response to the decision of the Opposition Division to consider that prior use was not supported by document D7.
- 2.14 According to the Appellant they constituted essential elements of the chain of evidence in order to show that the THPE lot Nr. 90030 referred to in D7 as having a sulfur content of 10 ppm had been delivered to General Electric for polycarbonate applications.
- 2.15 In that respect, the Board notes that D8(a) appears to overcome the main objection raised against the introduction of document D8 into the proceedings by the Opposition Division, since it mentions the name of the "buyer" (i.e. General Electric), and that documents D12 to D15 (2) appear *prima facie* to be very relevant for the issue concerning the alleged delivery of THPE of the lot Nr. 90030 to General Electric, and therefore for the issue of prior use.
- 2.16 In the Board's view, it is legitimate for a Party who has lost in opposition proceedings to try to improve its position in appeal by filling a presumed missing link, as in the present case, with respect to the issue of prior use. Taking further into account that the documents D8(a), D12, D13, D14, D15(1) and D15(2) have been submitted at the earliest possible moment by the Appellant, namely at the beginning of the appeal proceedings, the filing of these documents hence cannot represent an abuse of proceedings.

2.17 Consequently, the Board decided to introduce these documents into the proceedings.

2.18 Document D16, whose disclosure is very similar to that of document D15(2) (i.e. it only differs from document D15(2) by the indication of the gross weight of the drums of chemical), was not relied on by the Appellant at the oral proceedings before the Board, so that there was no need for the Board to decide on its introduction.

3. *Novelty*

3.1 While during the opposition proceedings lack of novelty of the subject-matter of the patent in suit has been alleged by the Appellant in view of documents D1, D2, and D3, the Board firstly notes that during the appeal proceedings the Appellant did not contest the conclusion of the Opposition Division concerning D1 to D3 in that respect. The Board sees also no reason not to share the view of the Opposition Division in that respect.

3.2 The Board further notes that the Appellant during the appeal proceedings still relied on document D4 as support of its objection of lack of novelty and developed its argumentation concerning the alleged prior use with the support of the further documents D8(a) and D12 to D15(2).

3.3 Document D4 relates to a process for the purification of THPE from a substantially solid crude admixture containing THPE and impurities resulting from the catalytic production of THPE from 4-hydroxyacetophenone and phenol, the process comprising:

a) washing said crude admixture with a saturated solution of THPE in a solute comprising from 60% to 75% by weight of water and from 25% to 40% by weight of methanol; and

b) isolating the thusly washing crude admixture from the formed effluent washing composition, and dissolving said washed crude admixture in methanol, and

c) adding sufficient water and sodium borohydride to said dissolved, washed crude admixture to form a precipitate of THPE, and

d) filtering said precipitate to thereby form a purified THPE and a filtrate; and

e) rinsing the resultant filtered precipitate of THPE with a solution of sufficient methanol and water, which optionally contains THPE up to the saturation point, and conducting the rinsing for a sufficient time to remove substantially all residual colored impurities from said precipitate (Claim 1). Optionally, the process might comprise the subsequent step of rinsing the filtered precipitate from step (d) with an aqueous solution of sodium dithionate (Claim 8).

3.4 According to D4, although pure THPE is white, the reaction product is a reddish-brown mixture of pure and impure product. As further indicated in D4, THPE is used as a hardener for epoxies and as a crosslinker for polycarbonates, and as such its color must be white (page 2, lines 11 to 13).

3.5 According to D4 the production of THPE may be performed by the reaction of 4-hydroxyacetophenone with phenol, wherein phenol is the supporting solvent as well as a reagent and this reaction takes place under catalytic conditions, with hydrochloric acid and beta-

mercaptopropionic acid as preferred co-catalyst. According to D4 the resulting reaction product contains significant amounts of impurities, and the impure, substantially solid crude admixture contains THPE, residual 4-hydroxyacetophenone, phenol, chlorides, THPE isomers, bis-(hydroxyphenyl)ethene isomers, color bodies and other unidentified parts which are sought to be removed (page 3, lines 42 to 48).

3.6 The Board cannot, however, find in D4 any mention of the sulfur content either of the impure THPE before purification or of the THPE obtained after the purification process disclosed therein. Nor could it be implicitly deduced from the respective purity grades of the purified THPE exemplified in Tables II and V of D4 between 99.5 and 99.8% that their sulfur content would inevitably be at most 0.02% (i.e. 200 ppm).

3.7 In this context, the Board notes that Claim 1 of the patent in suit requires, explicitly, that the following steps be carried out:

- a) the step of providing a specific branching agent containing more than 200 ppm of sulfur;
- b) the step of decreasing the content of sulfur of the branching agent to 200 ppm or less and
- c) the step of producing a branched polycarbonate by using the branching agent obtained in step (b) and adopting either the interfacial method or the melting method.

3.8 According to the decision T 355/99 of 30 July 2002 (not published in OJ EPO), it is not sufficient for a finding of lack of novelty that the claimed features

- could have been derived from a prior art document, there must have been a clear and unmistakable teaching of the claimed features (Reasons, point 2.2.4).
- 3.9 Thus, the question boils down to whether there is, in D4, a clear and unmistakable teaching of the combination of features mentioned above in paragraph 3.7.
- 3.10 In that respect, it is evident (cf. paragraph 3.5, above) that D4 is totally silent on the sulfur content of the THPE before purification and after purification, so that at least for these reasons it cannot destroy the novelty of the subject-matter of Claim 1 of the patent in suit.
- 3.11 This conclusion would not be altered, even if one would consider that the process of D4 might eventually enable the obtaining of THPE with a sulfur content of at most 200 ppm, since it would not be clearly and unambiguously derivable from D4 that these specific THPEs would inevitably be used in the manufacture of branched polycarbonates, since, as indicated in D4 (cf. paragraph 3.4 above), THPE may also be used as hardener for epoxy resins.
- 3.12 Consequently, the subject-matter of Claim 1 must be regarded as novel over D4. The same conclusion applies a fortiori for the subject-matter of dependent Claims 2 to 9.
- 3.13 It remains hence to be decided as to whether the claimed subject-matter has been made available to the public by prior use as alleged by the Appellant.

- 3.14 In the present case it is immediately evident that all the evidence in support of the alleged prior use lies within the power and knowledge of the Appellant (Opponent).
- 3.15 Consequently, in accordance with the principles set out in decision T 472/92 (OJ EPO 1998, 161, Reasons for the decision point 3.1), the Appellant must prove its case up to the hilt, for little if any evidence will be available to the patentee to establish the contradictory proposition that no prior public use had taken place.
- 3.16 Transposed to the context of the present case, it must hence be established beyond reasonable doubt that, before the priority date of the patent in suit, the combination of the steps (a), (b) and (c) referred to in paragraph 3.7 above have been made available to the public by prior use.
- 3.17 This reciprocally implies that the objection of prior use would fail provided it could not be established that one of the steps (a), (b) or (c) of the claimed process according to the patent in suit has been made available to the public by prior use.
- 3.18 In this connection, the Board deems it appropriate to take the most favourable starting points for the Appellant for the assessment of prior use, which are:
- (i) It would be assumed in view of documents D12, D14 and D15(2) that 1653 lbs of the THPE of the lot Nr. 90030 has been shipped by Salsbury Chemicals from

their site in Charles City (Iowa) to the plant of General Electric at Mount Vernon (Indiana) in October 1989; and

(ii) it would be further assumed in view of documents D12 and D15 (1) that these 1653 lbs of THPE of lot Nr. 90030 have been received by General Electric at its plant in Mount Vernon.

3.19 In that context, the issue as to whether step (c) has been made available to the public boils down to the following questions:

(α) as to whether it is established beyond any reasonable doubt that General Electric has effectively used THPE of the lot Nr. 90030 as such in the manufacture of branched polycarbonate either by the interfacial method or the melt method;

and if the question (α) can be answered positively

(β) as to whether it is established beyond any reasonable doubt that the THPE of lot Nr. 90030 when used in the manufacture of polycarbonate by General Electric exhibited a sulfur content of up to 200 ppm.

3.20 Concerning question (α), while the Appellant has referred to document D8(a) to show that THPE was bought by General Electric for polycarbonate application (cf. D8a paragraph 1(a)), there is however no evidence on file either that THPE of the lot Nr. 90030 shipped to General Electric in October 1989 fell under the conditions specified in D8(a) for the use of THPE, since this sales agreement has been concluded only in

January 1990, or that this lot has been effectively used as such by General Electric in the manufacture of branched polycarbonates.

3.21 In the Board's view, there is no irrefutable proof of the use of the THPE of lot Nr. 90030 as such in the manufacture of polycarbonate by General Electric. While such proof might have been provided by way of a declaration of General Electric in that respect, the Board can, however, only state that no such declaration has been submitted by the Appellant. Consequently, it cannot be excluded that the THPE of the lot Nr. 90030 was never used in the manufacture of polycarbonate, or, in the event that it had been used, that it was mixed with other batches of THPE of unknown origin and hence of unknown sulfur content before use.

3.22 Even if question (α) would have been answered positively, it would, in the Board's view, further not have been established beyond reasonable doubt what was the sulfur content of the THPE of lot Nr. 90030 when used by General Electric for the following reasons:

3.22.1 While Table 4 of document D7 indicates that a sample of THPE of lot Nr. 90030 exhibited a sulfur content of 10 ppm, this analysis refers to a sample of THPE of lot Nr. 90030 as produced at the Coventry plant of Hoechst Celanese Corporation.

3.22.2 It is however clear from document D14 that THPE of lot Nr. 90030 was sent from the Coventry plant to the Salisbury plant of Hoechst Celanese Corporation in order to be dried, and that, according to D14, that THPE was further sent to the site of Salsbury Chemicals

- in Charles City, and from there to the plant of General Electric at Mount Vernon.
- 3.22.3 The Board can only state that there is no evidence on file concerning the respective sulfur contents of the THPE of the lot Nr. 90030 when dried at Salsbury, when received by Salsbury Chemicals at Charles City, when received at Mount Vernon by General Electric and when used by General Electric at Mount Vernon.
- 3.22.4 In other words, there is no irrefutable proof that the sulfur content of the THPE of lot Nr. 90030 when used by General Electric in the manufacture of branched polycarbonate would have inevitably corresponded to the sulfur content detected in the sample of that lot as analysed in D7.
- 3.22.5 On the contrary, D7 itself casts a reasonable doubt, in the Board's view, concerning the content of sulfur in the THPE lot Nr. 90030 allegedly used in the manufacture of polycarbonate by General Electric at its Mount Vernon plant.
- 3.22.6 This is firstly because D7 refers to a customer complaint concerning a high level of sulfur in a lot of THPE produced at Coventry and hence shows that a difference might occur between the sulfur content of the THPE as produced at the Coventry plant of Hoechst Celanese Corporation and the sulfur content of that THPE when received by a customer, so that sulfur contamination during transport and storage cannot be excluded.

3.22.7 This is also because, as shown by the values indicated for the THPE lot Nr. 1071 in Table 4 of document D7, the amount of sulfur may vary considerably within the same batch of THPE, so that it cannot also be excluded that the 1653 lbs of THPE of the lot Nr. 90030 sent to General Electric might have exhibited a totally different sulfur content than that of the sample of that lot analyzed in D7.

3.23 Consequently, the Board can only come to the conclusion that it has not been proven by the Appellant beyond any reasonable doubt that at least step (c) was made available to the public by the prior use.

3.24 It thus follows from the above (cf. point 3.17 above) that the objection of prior use raised by the Appellant must fail, and that the subject-matter of Claims 1 to 9 must be considered as novel.

4. *Problem and solution*

4.1 The patent in suit relates to a process for the manufacture of branched polycarbonate either by the interfacial method or by the melt method.

4.2 Such processes have been disclosed in documents D1 and D3.

4.3 D1 relates to a process for preparing branched polycarbonates which are particularly suitable for extrusion due to their melt stability at elevated temperatures (column 1, line 60 to column 2, line 2). The branched polycarbonate is substantially free of crosslinking and comprises a polycarbonate polymer

containing residues of an organic dihydroxy compound having up to ten carbon atoms, about 0.01 to about 2 mol percent of an organic trihydric or tetrahydric phenol and about 0.1 to about 8 mol percent of monohydric phenol, the mol percentages being based on the mols of the organic dihydroxy compound, said branched polycarbonate having a relative viscosity of from about 1.2 to about 1.55 measured on a solution of 0.5 gram in 100 ml. of methylene chloride at 25°C, an average molecular weight of between about 30,000 and about 100,000 measured by light diffraction and a melt viscosity of between about 20,000 and about 300,000 poises at 280°C (Claim 1). As branching agent THPE might be used (column 2, line 47). The process for the preparation of the branched polycarbonate comprises reacting a carbonic acid derivative with an aromatic dihydroxy compound containing up to about ten carbon atoms, from about 0.01 to about 2 mol percent of an organic trihydric or tetrahydric phenol and about 0.1 to about 8 mol percent of a monohydric phenol, the mol percentages being based on the mols of the organic dihydroxy compound (Claim 7). According to D1, both the interfacial process and the melt method might be used in the manufacture of the branched polycarbonates (column 6, lines 55 to 71).

- 4.4 D3 relates to a process for making a branched polycarbonate having an intrinsic viscosity $[\eta]$ in methylene chloride at 20°C of 0.3 to 2.0 dl/g; a branching parameter $G = [\eta] / [\eta]_{lin}$ (wherein $[\eta]_{lin}$ means an intrinsic viscosity of straight chain polycarbonate having the same weight average molecular weight as in the branched polycarbonate (according to light scattering method of 0.05 to 0.9; and a degree of

branching $\lambda = n_w/M_w$ (wherein n_w and M_w mean weight average number of branching and weight average molecular weight, respectively) of 0.2×10^{-4} to 2.0×10^{-4} .

According to D3, the process comprises reacting dihydric phenols, a polyfunctional organic compound having three or more functional groups and phosgene to produce a polycarbonate oligomer, and then polycondensing the polycarbonate oligomer with dihydric phenols and monohydric phenols under the stirring conditions to give the interfacial area of emulsion of not less than $40 \text{ m}^2/\text{L}$ (page 3, lines 2 to 9, and 15 to 19).

- 4.5 The branching agents to be used in the process of D3 include phenolic compounds such as 1,1,1-tris(4-hydroxyphenyl)methane, THPE, 1,1,1-tris(2-methyl-4-hydroxyphenyl)methane, 1,1,1-tris(2-methyl-4-hydroxyphenyl)ethane, 1,1,1-tris(3-methyl-4-hydroxyphenyl)methane, 1,1,1-tris(3-methyl-4-hydroxyphenyl)ethane; 1,1,1-tris(3,5-dimethyl-4-hydroxyphenyl)methane, 1,1,1-tris(3,5-dimethyl-4-hydroxyphenyl)ethane, 1,1,1-tris(3-chloro-4-hydroxyphenyl)methane, 1,1,1-tris(3-chloro-4-hydroxyphenyl)ethane, 1,1,1-tris(3,5-dichloro-4-hydroxyphenyl)methane, 1,1,1-tris(3,5-dichloro-4-hydroxyphenyl)ethane, 1,1,1-tris(3-bromo-4-hydroxyphenyl)methane, 1,1,1-tris(3-bromo-4-hydroxyphenyl)ethane, 1,1,1-tris(3,5-dibromo-4-hydroxyphenyl)methane, and 1,1,1-tris(3,5-dibromo-4-hydroxyphenyl)ethane (page 4, line 54 to page 5, line 12).

- 4.6 As indicated in D3, its aim is to provide branched polycarbonates which are suitable for blow moldings due to an improved melt resistance and exhibit good hue and improved impact resistance (page 2, line 45 to 48).
- 4.7 As stated in the decision T 0686/91 of 30 June 1994 (not published in OJ EPO), a document not mentioning a technical problem that is at least related to that derivable from the patent specification, does not normally qualify as a description of the closest state of the art.
- 4.8 According to the patent in suit (cf. paragraph [0005]), the object of the patent in suit is to provide a branched polycarbonate, which, when produced by the interfacial method, shows no deterioration in heat stability and did not cause mold corrosion, and which, when produced by the melt method, shows no deterioration of heat stability and no inferior color tone.
- 4.9 It is therefore clear that the patent in suit is concerned with two different problems arising from the manufacture of branched polycarbonates, i.e. on the one hand, a problem linked with the interfacial process, and, on the other hand, a problem linked with the melt method.
- 4.10 In this connection, the Board notes that both the Opposition Division and the Parties have considered document D3 as representing the closest state of the art.

- 4.11 In that respect, the Board however observes that D3 relates only to the interfacial method, while D1 relates to both the interfacial method and the melt method. Both documents further deal with the problem of stability of the melt of the branched polycarbonate, which is, in the Board's view, also linked to the heat stability of the branched polycarbonate.
- 4.12 Although, in view of the criteria set out in the decision T 0686/91, D1 could have been considered as representing the closest state of the art, since it deals with the two aspects of the process of the patent in suit, the Board, however, notes that the branched polycarbonates prepared according to Examples 1 to 3 and to Comparative Example 1 of the patent in suit have been obtained under process conditions as defined in D3 (i.e. using an interfacial process in which the interfacial area of the emulsion is not less than $40 \text{ m}^2/\text{L}$, i.e. more precisely between 90 to $100 \text{ m}^2/\text{L}$).
- 4.13 In the Board's view, this allows a fair comparison between the properties of the branched polycarbonates obtained using the interfacial processes according to the patent in suit and the interfacial process according to D3, so that D3 would constitute a more appropriate starting point for the assessment of inventive step for the alternative relating to the use of an interfacial process according to the patent in suit.
- 4.14 It is nevertheless evident that D3 cannot represent the closest state of the art in view of the alternative relating to the use of a melt method according to the

patent in suit, and that D1 would represent a better starting point in that respect.

- 4.15 Thus, starting from D3, the technical problem might be seen in the provision of a process which allows the manufacture of branched polycarbonate showing no deterioration in heat stability and not causing corrosion of the molds, and starting from D1, the technical problem might be seen in the provision of a process which allows the manufacture of a branched polycarbonate showing no deterioration of heat stability and no inferior color tone.
- 4.16 The solution proposed according to Claim 1 of the patent in suit is to use a branching agent, which has been subjected to a purification process in order to reduce its sulfur content to 200 ppm or lower, in the preparation of a branched polycarbonate by either the interfacial process or the melt method.
- 4.17 The comparison between Examples 1 and 3 and comparative Example 1 shows that the corrosion of the mold is decreased and that the heat stability is maintained in view of the slight variation of the taking-off parameter, when a branching agent with a low sulfur content (i.e. 120, 84 and 10 ppm in Examples 1 to 3, respectively, in comparison to 234 ppm in Comparative Example 1) is used in the interfacial process (cf. Table 1).
- 4.18 The comparison between Examples 4 and 5 and Comparative Example 2 shows that the color tone (yellowness index) is improved and that the heat stability is maintained in view of the slight variation of the taking-off

parameter, when a branching agent with a low sulfur content (i.e. 120 and 10 ppm in Examples 4 and 5, respectively, in comparison to 234 ppm in Comparative Example 2) is used in the melt method (cf. Table 1).

4.19 Consequently, the Board is satisfied that the technical problems have indeed been solved by the claimed measures.

5. *Inventive step*

5.1 It remains to be decided whether the proposed solution was obvious in respect to the cited prior art, i.e. D1, D2, D3 and D4.

5.2 Concerning D1 and D3, the Board can only state that they neither says anything about the sulfur content of the branching agent to be used, let alone the influence of the presence of sulfur in the branching agent on the final properties of the branched polycarbonate.

5.3 Consequently, neither D3 nor D1 can evidently suggest the solution proposed in the patent in suit.

5.4 The Board notes that the Appellant has relied in particular on a combination of D3 with D4 for challenging the presence of inventive step.

5.5 In that context, the question to be answered is not whether the skilled person could have arrived at the invention by combining D3 with the teaching of D4, but whether he would have done so because the prior art incited him to do so in the hope of solving the

- objective technical problem (see T 2/83, OJ EPO 1984, 265).
- 5.6 While it is true, as submitted by the Appellant, that document D4 refers to a process for the purification of THPE and that it further refers to the use of THPE as crosslinker for polycarbonate, it cannot be denied that D4 says nothing about the sulfur content of the purified THPE obtained, let alone the effect of the sulfur content of the THPE on the corrosion properties of the branched polycarbonate when prepared by the interfacial process.
- 5.7 In other words, the skilled person would not get any hint or clue from D4 about the role played by the sulfur content of the branching agent on the corrosion properties of the final polycarbonate when prepared by the interfacial method.
- 5.8 Thus, even if it would be further considered that the process of D4 might allow to obtain a THPE with a sulfur content of 200 ppm or lower, the skilled person would not have any reason to combine the teaching of D3 with that of D4 in order to solve the technical problem underlying the patent in suit.
- 5.9 Although D4 indicates that the THPE when used as crosslinker for polycarbonate must be white (cf. point 3.4 above), the same conclusion would apply to the combination of D1 with D4. This is firstly because D4 does not only fail to make any link between whiteness of the branching agent and its sulfur content but it furthermore suggests as an optional embodiment a rinsing step with a sulfur containing compound (cf.

Claim 8). This is also because D4 is totally silent on the effect of the sulfur content of the branching agent on the color properties of the branched polycarbonate when prepared by the melt method.

5.10 Document D2, which relates to the manufacture of branched polycarbonates by equilibration reaction of linear polycarbonate with polyhydric phenol in the melt (cf Claims 1, 5), is absolutely not concerned with the sulfur content of the polyhydric phenol. It cannot therefore provide any hint to the solution of the technical problem starting from D1.

5.11 Thus, in view of the above, the Board comes to the conclusion that the subject-matter of Claim 1 and by the same token that of Claims 2 to 9 cannot be rendered obvious by D1 taken alone or in combination with either with D4 or D2, or by D3 taken alone or in combination with D4.

5.12 It thus follows that the requirements of Article 56 EPC are met by all the Claims 1 to 9.

5.13 Since the appeal fails already in relation to the Main Request of the Respondent, there is no need to consider any one of the 3 Auxiliary Requests, all submitted with the letter dated 1 April 2005.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young