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**D E C I S I O N**  
**of 15 May 2002**

**Case Number:** T 0689/01 - 3.3.3

**Application Number:** 95307901.9

**Publication Number:** 0712895

**IPC:** C08L 25/16

**Language of the proceedings:** EN

**Title of invention:**

Impact modified alpha alkyl substituted vinyl aromatic-vinyl  
cyanide thermoplastic compositions

**Patentee:**

GENERAL ELECTRIC COMPANY

**Opponent:**

BASF Aktiengesellschaft, Ludwigshafen

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56, 114(2)

**Keyword:**

"Late filed document (not admitted)"  
"Inventive step (yes)"  
"Ex-post facto analysis"

**Decisions cited:**

T 1002/92, T 0085/93, T 0989/93, T 0534/98, T 0786/00

**Catchword:**

-



Case Number: T 0689/01 - 3.3.3

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.3**  
**of 15 May 2002**

**Appellant:** BASF Aktiengesellschaft, Ludwigshafen  
(Opponent) -Patentabteilung - C6-  
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**Respondent:** GENERAL ELECTRIC COMPANY  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 9 April 2001  
rejecting the opposition filed against European  
patent No. 0 712 895 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** C. Idez  
U. Tronser

## Summary of Facts and Submissions

I. The grant of the European patent No. 0 712 895 in respect of European patent application No. 95 307 901.9 filed on 6 November 1995 and claiming a US priority of 21 November 1994 (US 342963) was announced on 28 April 1999 (Bulletin 1999/17) on the basis of 9 claims.

Claim 1 as granted reads as follows:

"A thermoplastic composition consisting of:

(a) an alpha-alkyl substituted vinyl aromatic-vinyl cyanide copolymer present at a level of from 55 to 80 percent by weight based on the total weight of the composition, said alpha-alkyl substituted vinyl aromatic-vinyl cyanide copolymer comprising alpha-alkyl substituted vinyl aromatic at a level of from 50 to 90 percent by weight based on the total weight of the copolymer;

(b) an emulsion polymerized graft copolymer comprising

(i) a vinyl aromatic-diene rubber substrate present at a level of from 40 to 75 percent by weight based on the total weight of the emulsion polymerized graft copolymer, said substrate having a weight average particle size of between 0.21  $\mu\text{m}$  (microns) and 0.40  $\mu\text{m}$  (microns);

(ii) a vinyl aromatic-vinyl cyanide superstrate present at a level of from 25 to 60 percent by weight based on the total weight of the emulsion polymerized graft copolymer, said superstrate being formed by reacting a vinyl aromatic monomer and a vinyl cyanide monomer in the presence of a redox initiator and said vinyl aromatic-diene

rubber substrate, said emulsion graft copolymer being present at a level of from 5 to 45 percent by weight based on the total weight of the composition; and

(c) from 5 to 20 percent by weight of a non-graft non (alkyl substituted) styrene-acrylonitrile copolymer."

Claims 2 to 9 are dependent claims directed to elaborations of the thermoplastic composition according to Claim 1.

II. On 28 January 2000, a Notice of Opposition was filed by BASF Aktiengesellschaft in which revocation of the patent in its entirety was requested on the grounds of Article 100(a) EPC (lack of novelty and lack of inventive step).

The opposition was supported by the following documents:

D1: DE-A-2 927 572

D2: DE-C-2 140 437;

D3: Adolf Echte, "Handbuch der technischen Polymerchemie", VCH-Verlagsgesellschaft 1993, pages 323-324, 489-491;

D4: Römpp Chemielexikon, 9<sup>th</sup> Edition, Thieme Verlag 1989, page 42; and

D5: EP-B-0 253 236.

In the course of the opposition proceedings the Opponent further referred to document

D6: Excerpts from "Ullmann's, Encyclopedia of Industrial Chemistry", 6<sup>th</sup> edition, 1998, Electronic Release.

III. By a decision announced on 14 March 2001 and issued in writing on 9 April 2001, the Opposition Division rejected the opposition.

According to the decision, the subject-matter of Claim 1 of the patent in suit was novel over document D1, since D1 neither disclosed the weight ratio of the components (a) and (c) according to Claim 1, nor the combination of all the other features of that claim. In fact, one would have to make several choices in the teaching of D1 to come to a thermoplastic composition falling within the scope of Claim 1. Thus, the decision stated that the claimed subject-matter was novel.

Concerning inventive step, the decision held that D1 should be regarded as the closest prior art. Starting from D1 the technical problem was seen as to provide high gloss, reduced opacity, impact modified alpha-alkyl substituted vinyl aromatic-vinyl cyanide thermoplastic compositions. The arguments of the Opponent that it would have been obvious in view of D1 and the common general knowledge i.e. the Mie's theory referred in document D6 to incorporate styrene in the rubber component of D1 in order to reduce the opacity of the compositions could not be accepted. In order to arrive at a composition falling within the scope of Claim 1, it would not have been enough to incorporate styrene in the rubber component, but one would have had

to choose a specific polymerization for the rubber phase (i.e. redox system) and a specified amount of SAN for the matrix.

As indicated in the decision, none of the documents D2, D3, D4 and D5 referred to the opacity of ABS compositions. Thus, they would not provide a hint to the solution of the technical problem.

Consequently, the decision stated that the combination of features of Claim 1 was not obvious for a skilled person faced with the problem of providing alpha alkyl substituted vinyl aromatic-vinyl cyanide thermoplastic compositions having high gloss and reduced opacity.

- IV. A Notice of Appeal was lodged on 19 June 2001 by the Appellant (Opponent) with simultaneous payment of the prescribed fee. With the Statement of Grounds of Appeal filed on 14 August 2001, it submitted a further document referred to as E6: "Ullmann's Encyclopedia of Industrial Chemistry", 5<sup>th</sup> edition, Vol. A 21, page 650, (1992).

The arguments of the Appellant in the Statement of Grounds of Appeal could be summarized as follows:

- (i) The subject-matter of Claim 1 of the patent in suit differed from D1 by
  - (i.1) the feature that the rubber substrate of the graft copolymer (B) comprised a vinyl aromatic monomer,
  - (i.2) the feature that the grafting reaction has been carried out with a redox

initiator, and

- (i.3) the ratio of component (a) to component (c)
  
- (ii) The technical problem was to provide thermoplastic compositions having a high impact strength, a high gloss and a reduced opacity.
  
- (iii) In view of the disclosure of the patent in suit, it appeared that only the features (i.1) and (i.2) were relevant to the solution of this technical problem, since there was no information on the criticality of feature (i.3).
  
- (iv) Although D1 referred to both thermal grafting and redox grafting, it could be deduced that a redox initiator (Potassiumperoxodisulfate) was preferably used in order to obtain a composition in which the particles of the grafted copolymer had a particle size of 0.2 to 0.45 micrometers and did not agglomerate, this leading to the high gloss of the composition. Thus, the choice of a redox initiator did not represent an inventive selection.
  
- (v) In that respect, the comparison made in the patent in suit between Example A (thermal grafting) and Example 1 (redox grafting) was not fair since the sizes of the rubber particles before grafting were totally different. This comparison merely showed that smaller particles aggregated quicker than bigger ones.
  
- (vi) The grafted rubber of D1 might also comprise

styrene. The addition of styrene was merely not preferred in D1, since it was known that it would lead to a lower impact strength while, however, maintaining a high gloss of the composition.

- (vii) Starting from the compositions of D1, which exhibited a high gloss due of the use of a redox initiator, the skilled person wishing to obtain compositions with a reduced opacity, would also try the less preferred variants disclosed in D1, i.e. the addition of styrene and would establish that this reduced the opacity.
- (viii) Furthermore, it was known to the skilled person in view of document E6 that transparency of ABS compositions could be obtained if the refraction indices of the different phases were the same. Thus, it would have been obvious for the skilled artisan to add styrene in the rubber component in order to increase its refraction index and to render it close to the refraction index of the styrene/acrylonitrile and of the alpha methyl styrene acrylonitrile phases.
- (ix) The relative ratio of component (a) to component (c) would be determined by routine experiments and could not support the presence of inventive step.
- (x) Remaining Claims 2 to 9 did not contain additional features which would support the presence of inventive step.
- (xi) Thus, the subject-matter of the patent in suit



lacked inventive step.

V. With its letter of 4 September 2001, the Respondent (Patentee) filed an auxiliary request, Claim 1 of which being based on a combination of Claims 1 and 2 as granted. The arguments presented by the Respondent could be summarized as follows:

- (i) Document E6 should not be admitted into the proceedings since it had been filed late and had no direct relevance to the present case.
- (ii) Novelty of the subject-matter of the patent in suit had been accepted by the Appellant.
- (iii) The Appellant had merely considered the features (i.1) and (i.2) above in isolation and had submitted no argument concerning feature (i.3).
- (iv) The analysis of the Appellant was based on a mere hindsight view and had failed to show why the chosen possibilities were obvious in order to obtain the desired combination of properties.
- (v) Concerning the experimental results presented in the patent in suit, it was up to the Appellant to submit experimental evidence.
- (vi) Thus, the Appeal must be dismissed.

VI. Oral proceedings were held on 15 May 2002. At the oral proceedings, the discussion was essentially concentrated on issues concerning the admission of document E6 and the inventive step of the claimed subject-matter.

- (i) While the parties agreed that the Mie's theory belonged to the common general knowledge, there was, however, no corresponding agreement concerning the admission of document E6.
  - (i.1) The Respondent maintained its view that this document was late filed and not relevant since it merely taught that the refractive indices could be made equal by using a MABS matrix or completely substituting methyl methacrylate for acrylonitrile.
  - (i.2) The Appellant argued that E6 essentially corresponded to document D6 submitted in the opposition proceedings more than two months before the oral proceedings, i.e. in the delay set out by the Opposition Division in the annex to the summons to oral proceedings. This document was also pertinent since it referred to the of improvement of the transparency of ABS compositions, by matching the refractive indices of the different phases present in the composition.
- (ii) Concerning inventive step: while essentially relying on the arguments presented in the written procedure, the following further submissions were made by the parties:
  - (ii.1) The submissions of the Appellant could be summarized as follows:
    - (ii.1.1) The Appellant pointed out that the feature "redox initiator" used in

Claim 1 was ambiguous and did not exclude the use of a peroxide catalyst without a reducing agent. It also stressed that the description of the patent in suit (cf. page 3, lines 12 to 16) only referred to peroxide initiators and made no mention of reducing agents.

(ii.1.2) In its opinion, it was evident from the disclosure of D1 (cf. page 5, lines 23 to 27; page 9, lines 11 to 21) that this document taught the use of a redox system for making the graft copolymer.

(ii.1.3) It also considered that the comparison made in the patent in suit between Example 1 and Example A could not be regarded as demonstrating the effect of the redox polymerization in comparison to the thermal polymerization. It stated that this comparison merely showed that it was essential, as taught in D1, to agglomerate the particles of the rubber phase before melt mixing with the components of the rigid phase in order to obtain a high gloss.

(ii.1.4) According to the Appellant, it belonged to the general knowledge that styrene had a higher refractive index than butadiene and would hence increase the refractive index of the

rubber phase.

(ii.1.5) The Appellant did not dispute the fact that the use of styrene as comonomer in the rubber substrate represented a less preferred variant in D1, since, in view of comparative Example B of D1, the addition of styrene led to a loss of impact strength of the obtained composition. It pointed out, however, that the comparison between Example B and Example 1 of the patent in suit showed the same effect due to the use of styrene as comonomer. Thus, it concluded that the inventors of the contested patent had merely accepted the drawbacks of the addition of styrene, i.e. the expected improvement of transparency due to the matching of the refractive indices of the phases present in the compositions had been made at the cost of impact strength.

(ii.2) The Respondent argued essentially as follows:

(ii.2.1) The wording "redox initiator" could only be interpreted as referring to a redox system. It would be evident for the skilled reader that the use of a redox initiator implies the simultaneous use of a reducing agent.

(ii.2.2) It was true that D1 disclosed the use of peroxide components in particular

the use of potassium persulfate, but there was no clear teaching of the use of a redox system in D1 for the manufacture of the graft copolymer. On the contrary, and in view of document D3 (cf. page 323, line 2 from the bottom to page 324, line 3) and the Examples of D1, it was evident that a thermal polymerization was preferred.

(ii.2.3) The conclusions drawn by the Appellant from the comparison of Example A with Example 1 of the patent in suit could not be accepted. The rubber particles in Example 1 were still small particles, which could also have aggregated during the melt mixing with the hard phase components. The fact that they did not aggregate might be a consequence of the use of the redox system and of the thus improved coverage of the rubber substrate by the grafted superstrate.

(ii.2.4) Furthermore, D1 also stressed the necessity of using very careful polymerization conditions for producing the graft copolymer, in order to obtain compositions having a good gloss and a good impact strength. To the opposite, the teaching of the patent in suit allowed to obtain compositions exhibiting, in addition to a good gloss an a good impact strength, a reduced opacity a less

complicated manner.

- (ii.2.5) Comparative Example B of D1 showed that an addition of 10% by weight of styrene in the rubber substrate resulted in a drastic reduction of the impact strength of the composition (e.g. about 30%).
  
- (ii.2.6) In contrast, from the comparison between Example 1 and Example B of the patent in suit, it could be seen that the reduction of impact strength was merely 15% percent although styrene had been used in much higher amount than in Example B of D1.
  
- (ii.2.7) The claimed compositions contained more than two phases, i.e. the component (a), the component (c) and those resulting from components (b). Independently of the fact that the refractive indices of the different phases did not belong to the general knowledge of the skilled person, there was no teaching in the cited documents of how to match the refractive indices of these different phases, let alone any hint to incorporate styrene in the rubber substrate.

VII. The Appellant requested that the decision of the Opposition Division be set aside and the patent be revoked.

The Respondent requested that the appeal be dismissed.

## **Reasons for the Decision**

1. The appeal is admissible.

### *Procedural matters*

2. *Admissibility of late filed document E6 into the proceedings*

- 2.1 Document E6 has been filed by the Appellant on 14 August 2001 with the Statements of Grounds of Appeal and has been presented as indicating common general knowledge in the relevant technical field.

- 2.2 Document E6 is a page of a well known chemical encyclopaedia. It disclosed that standard ABS systems are opaque because their two phases have different refractive indices and refers in that respect to the Mie's theory. It further teaches that a transparent system can be obtained by using a MABS resin matrix or by completely substituting methyl methacrylate for acrylonitrile.

- 2.3 As mentioned above, both parties agreed that the Mie's theory belongs to the common general knowledge. Since this point is not disputed there is no need for the parties to submit a document establishing this part of common general knowledge (cf. also T 534/98 of 1 July 1999, not published in OJ EPO; Reasons, point 8).

- 2.4 The remaining part of document E6 shows that it belonged to the general knowledge at the filing date of

the patent in suit that the matching of the refractive indices may be achieved by using a MABS matrix or by completely substituting methyl methacrylate for acrylonitrile. It is therefore evident that this part of E6, which merely teaches to modify the refractive indices of the hard phase by incorporation of methyl methacrylate, is of no relevance for the assessment of inventive step of the contested patent which teaches to modify the rubber substrate (a component of the soft phase) with a vinyl aromatic monomer such as styrene, and that it will thus not be highly likely to prejudice maintenance of the contested patent. Thus, the Board, in the exercise of its discretion under Article 114(2) EPC, decides to disregard the remaining part of document E6 (cf. T 1002/92 (OJ EPO 1995, 605); cf. also T 85/93 of 17 October 1996, and T 786/00 of 22 December 2001, neither published in OJ EPO).

2.5 Consequently, for the reasons set out in paragraphs 2.3 and 2.4 above, document E6 is not admitted into the proceedings (Article 114(2) EPC).

### 3. *Novelty*

3.1 Whilst lack of novelty was alleged by the Appellant (Opponent) in view of document D1 in the course of the opposition proceedings, it follows from its submissions in the Statement of Grounds of Appeal, in which it has identified three differences (cf. paragraph IV.i. above) between the claimed subject-matter and the disclosure of D1, that it does not further challenge the novelty of the subject-matter of the patent in suit.

3.2 Novelty of the claimed subject-matter has also been



acknowledged by the Opposition Division, and the Board sees no reason to depart from that view.

4. *The patent in suit, the technical problem*

4.1 The patent in suit is concerned with modified ABS polyblends consisting of (a) an alpha-alkyl substituted vinyl aromatic-vinyl cyanide copolymer, (b) an emulsion polymerized graft copolymer and (c) a non alkyl-substituted styrene acrylonitrile copolymer. Such compositions are known from document D1.

4.2 Document D1 describes a thermoplastic composition comprising

(A) at least one copolymer containing a1) 60 to 80 wt% styrene and/or alpha-methyl styrene and a2) 20 to 40 wt% acrylonitrile,

(B) at least one graft copolymer present at a level of 10 to 50 wt% based on A and B and formed from b1) 40 to 80 wt% based on B of a rubbery polymer containing at least 93 wt% butadiene, and b2) 60 to 20 wt% of a hard phase from styrene and acrylonitrile in a weight ratio of 80:20 to 65:35 grafted onto the rubbery polymer b1 (page 2, line 20 to page 3, line 12). Component A can be a mixture of a styrene-acrylonitrile copolymer with an alpha-methylstyrene-acrylonitrile copolymer (page 4, lines 8 to 20). The rubber component b1 of the graft copolymer B can be a copolymer derived from at least 93 wt% butadiene and at most 7 wt% styrene and acrylonitrile (page 7, lines 26 to 29). Before being grafted with styrene and acrylonitrile, the rubber is in the form of

particles having an average diameter ( $d_{50}$ ) between 0.20 and 0.45  $\mu\text{m}$  (page 8, lines 30 to 32). Preferably, the graft copolymer is obtained by emulsion polymerization in two steps (page 5, lines 4 to 9). In the first step, the rubber substrate is emulsion polymerized using persulfates or organic peroxides and a reducing agent as initiators (page 5, lines 23 to 27), and in a second step the graft polymerization is carried out in the same polymerization system with further emulsifier and initiator, if necessary (page 9, lines 11 to 15).

- 4.3 The object of the patent in suit, as mentioned on page 2, lines 14 to 15 of the description, is to provide impact modified alpha-alkyl substituted vinyl aromatic-vinyl cyanide thermoplastic compositions with a high gloss and a reduced opacity.
- 4.4 Whilst the aim of D1 is to provide compositions exhibiting a good gloss and a good impact strength (page 2, lines 10 to 16), it does not refer at all to the problem of the reduction of opacity of ABS compositions.
- 4.5 The closest state of the art should normally be represented by a document which deals with the same problem. However, in the absence of such a document, the starting point for evaluating inventive step should be searched for in a document relating to a similar technical problem, or at least to the same or a closely related technical field as the patent in suit (cf. T 989/93 of 16 April 1997, not published in OJ EPO; Reasons, point 12).

4.6 It follows from the considerations in paragraphs 4.1 to 4.4 above that D1 belongs to the same technical field (i.e. ABS type compositions) and mentions the problem of obtaining compositions having a good combination of impact resistance and gloss. It thus meets the minimum requirements set out in decision T 989/93 in order to be used as a starting point for the assessment of inventive step.

4.7 Document D1 has been regarded by the Opposition Division and by the parties as the closest state of the art. In the absence of a better document, the Board sees no reason to depart from that view.

4.8 Thus, starting from D1, the technical problem may be seen as the provision of high gloss, reduced opacity impact modified alpha-alkyl substituted vinyl aromatic-vinyl cyanide thermoplastic compositions.

4.9 In view of Example 1 of the patent in suit, the Board is satisfied that the claimed problem is effectively solved by the claimed measures, i.e. using a specific elastomeric component (b) and a specific ratio of component (a) to (c) as specified in Claim 1.

5. *Inventive step*

5.1 It remains to be decided whether the claimed subject-matter was obvious to a person skilled in the art having regard to the relevant prior art.

5.2 As conceded by the Appellant in the Statement of Grounds of Appeal, the subject-matter of Claim 1 of the patent in suit, indeed distinguishes from the disclosure of D1 by the features (i.1), (i.2), and

(i.3) identified in paragraph IV.i above. In that respect, the argument of the Appellant during the oral proceedings of 15 May 2002 that the term "redox initiator" used in Claim 1 of the patent in suit does not necessarily refer to the use of redox system, is, in the Board's view, not well founded since the use of the wording "redox initiator" can only make sense in the context of a redox system.

5.3 As indicated above, document D1 is totally silent on the problem of reducing the opacity of ABS type compositions and cannot itself provide a hint to the solution of the technical problem.

5.4 Nor would a combination of D1 with the common general knowledge, based on the Mie's theory, that the opacity of ABS compositions is due to the difference in the refractive indices between the rubber phase and the rigid phase, lead the skilled person to a composition falling within the scope of Claim 1 of the patent in suit for the following reasons:

5.4.1 Firstly, there is no evidence that the compositions of D1 or of the patent in suit exhibit a phase system of only two phases in view of the presence of components (a), (b) and (c), and secondly there is no teaching on file indicating which phase(s) of this multiphase system should be modified, let alone how it (they) should be modified in order to match their respective refractive indices without impairing the gloss of the compositions. Thus, there is no indication in the state of the art of even an approach to the solution of the technical problem.

5.4.2 Thirdly, while it is true that D1 discloses the use of

styrene as comonomer for the rubber substrate, it does not link this addition with the problem of reducing opacity. Furthermore, it is evident that this variant represents a less preferred alternative (cf. page 7, lines 28 to 29), since the addition of styrene leads to a drastic loss of impact strength of the compositions, as shown by Comparative Example B of D1. Thus, D1 would, prima facie, discourage the skilled person from adding styrene into the rubber component.

5.4.4 Consequently, the argument of the Appellant that the skilled person, knowing that styrene has a higher refractive index than butadiene would consider this less preferred variant of D1 and that it would hence establish that the opacity of the composition can be reduced by addition of styrene into the rubber substrate is not supported by the disclosures relied upon, and to this extent is evidently based on an ex-post facto analysis.

5.4.5 Furthermore, even if, for the sake of argument, it would be accepted that the skilled person would have considered this alternative, it could not have been foreseen, as shown by the comparison between Example 1 and Example B of the patent in suit that the loss of impact strength in the compositions of the patent in suit would be, by far, less drastic (i.e. 15% instead of 30% as shown comparative B of D1, in spite of an higher amount of styrene) than could have been expected in view of D1. This indicates that, starting from D1, it would not have been enough to incorporate styrene into the rubber component to come to a composition falling within the scope of Claim 1 of the patent in suit, but that one would have had to choose, in addition, further measures not taught by the prior art,

such as a specific polymerization technique (redox system), and a specific ratio of component (a) to component (c). Neither of these additional measures both of which are essential to meet the requirements of Claim 1 of the patent in suit has been identified in D1, let alone shown to arise in an obvious way from it.

5.5 Documents D2 to D5 do not refer at all to the problem of reducing the opacity of ABS compositions. Hence, neither of these documents would offer to the skilled person a hint to the solution of the technical problem.

5.6 It follows from the above that the solution of the technical problem does not arise in an obvious way from the state of the art.

5.7 Consequently, the subject-matter of Claim 1, and, by the same token, that of dependent Claims 2 to 9 involves an inventive step.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young