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D E C I S I O N
of 18 March 1998

Case Number: T 0065/96 - 3.3.3

Application Number: 82201156.5

Publication Number: 0103657

IPC: C08F 279/04

Language of the proceedings: EN

Title of invention:

ABS type resins having disperse particles of a rubber exhibiting a high solution viscosity and a method for its preparation

Applicant:

The Dow Chemical Company

Opponent:

Bayer AG, Leverkusen Konzernverwaltung RP Patente Konzern

Headword:

-

Relevant legal provisions:

EPC Art. 84, 100(a), 100(b)

Keyword:

"Insufficiency (no); ground of opposition abandoned"
"Novelty (yes) - true selection from overlapping ranges"
"Inventive step (yes) - technical problem not derivable from cited art"

Decisions cited:

T 0181/82, T 0198/84, T 0035/85, T 0229/85, T 0325/93

Headnote:

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Case Number: T 0065/96 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 18 March 1998

Appellant:
(Opponent)

Bayer AG, Leverkusen
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Representative:

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Respondent:
(Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office dated 14 December 1995
rejecting the opposition filed against European
patent No. 0 103 657 pursuant to Article 102(2)
EPC.

Composition of the Board:

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

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 103 657, on the basis of 19 claims, in respect of European patent application No. 82 201 156.5, filed on 17 September 1982, was announced on 13 March 1991 (Bulletin 91/11). Claim 1 reads as follows:

"A rubber-reinforced copolymer comprising a copolymer matrix derived from one or more monovinylidene aromatic monomers, one or more unsaturated nitrile monomers and, optionally, other comonomers, characterized by having at least 6 weight percent of a rubber based on the total weight of the rubber and copolymer, which rubber exhibits a viscosity, as a 5 weight percent solution in styrene, of at least 120 mPa.s (centipoise) dispersed as discrete particles in the matrix, said rubber particles containing occlusions of grafted and/or ungrafted copolymer and having a volume average particle size of 1.5 μm . or less."

Claims 2 to 7 are dependent claims directed to elaborations of the rubber-reinforced copolymer according to Claim 1.

Claim 8, an independent claim, is worded as follows:

"A method of preparing a rubber-reinforced copolymer of a monovinylidene aromatic monomer, an unsaturated nitrile monomer and, optionally, one or more other comonomers comprising the steps of mass polymerizing a solution of the rubber and the monomers under conditions such that phase inversion occurs and the

rubber becomes dispersed as particles and continuing polymerization, characterized by the use of rubber which exhibits a viscosity, as a 5 weight % solution in styrene, of at least 120 mPa.s (centipoises) in the monomer solution in an amount of at least 5 weight % based on the total weight of the monomers and the rubber; and polymerization conditions prior to phase inversion which form copolymer having a sufficiently high molecular weight such that upon phase inversion and forming of rubber particles, the rubber becomes dispersed at a volume average particle size of 1.5 μm or less without excessively agitating the polymerization mixture."

Claims 9 to 19 are dependent claims directed to elaborations of the method of Claim 8.

II. Notice of Opposition was filed on 14 November 1991, on the grounds of insufficiency, lack of novelty and lack of inventive step. The opposition was supported *inter alia* by the documents:

D2: US-A-3 903 200; and

D4: DE-A-2 713 258.

III. By a decision which dated 14 December 1995, the Opposition Division rejected the opposition.

According to the decision, the crux of the claimed method lay in the control of the molecular weight of the copolymer prior to phase inversion, sufficient information having been provided on this aspect both by the general description and the examples. Consequently,

the allegation of insufficiency had to be dismissed.

As to novelty, whilst all of the individual features of Claim 1 were to be found in D2, a specific embodiment having all the features in combination was lacking. The question hinged on whether the subject-matter of Claim 1 could have been arrived at by simply following the instructions in D2 together with the general knowledge. Real doubt existed, however, as to whether the relevant combination of features was thus realisable. Nor had the Opponent presented any evidence based on the processes in D2. Furthermore, the burden of proof was on the Opponent. It was concluded that the prior art did not tell the reader how to make what was claimed.

Nor had any persuasive challenge been made to the subject-matter claimed in respect of inventive step.

Consequently, the opposition was rejected.

- IV. On 16 January 1996, a Notice of Appeal against the above decision was filed, together with payment of the prescribed fee.

In the Statement of Grounds of Appeal, filed on 22 February 1996, the Appellant (Opponent) argued, firstly, that there was still insufficiency (Article 100(b) EPC).

Secondly, because all the relevant claimed features were admittedly to be found in D2, it was not understood how the disclosure could be other than

novelty destroying. The contradictory position taken in the decision under appeal in this respect amounted to a procedural error calling for reimbursement of the appeal fee.

Thirdly, in relation to inventive step, it was not understood how there could be an inventive step in using the known features. Fourthly, reference was made to, and copies were attached of, submissions made by the Appellant as Opponent in the opposition proceedings.

V. The Respondent (Patentee) argued, in a submission filed on 3 September 1996, that the submissions of the Appellant were either in fact objections under Article 84 EPC or an indication of lack of comprehension of the reasoning in the decision under appeal. The former was not a permissible ground of opposition, and the latter was not a reasoned argument against the decision. Consequently, the appeal should be held inadmissible on the ground that it did not address the rejection.

VI. Oral proceedings were held on 18 March 1998. At the oral proceedings, the Appellant expressly abandoned the ground of opposition under Article 100(b) EPC and also the demand for reimbursement of the appeal fee, and submitted, instead, new arguments relating to novelty and inventive step, the latter issue being discussed in connection with D4.

VII. The Appellant requested that the decision under appeal be set aside and the patent be revoked.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. *Admissibility*

The appeal complies with the requirements of Article 108 and Rule 64 EPC.

1.1 The argument of the Respondent, concerning the admissibility of the arguments submitted in the Statement of Grounds of Appeal (section V., above) cannot be accepted by the Board. Whilst irrelevancy and lack of cogency may lead to an unsuccessful outcome of the appeal, they cannot of themselves render it inadmissible.

1.2 Consequently, the appeal is admissible.

2. *Sufficiency (Article 100(b) EPC)*

This ground of opposition having been explicitly abandoned by the Appellant at the oral proceedings (section VI., above), the Board holds that the patent in suit meets the requirements of Article 100(b) EPC.

3. *Clarity (Article 84 EPC)*

A number of the arguments, submitted under the heading of insufficiency and referred to in the decision under appeal (Reasons for the decision, point 2, (a), (b)

and (c)) are relevant only to Article 84 EPC. The claims not having been amended since grant of the patent, however, and Article 84 EPC not being a ground of opposition, such arguments, regardless of how they are labelled, are inadmissible, and, consequently, they cannot be considered further by the Board.

4. *The technical problem (Product aspect)*

The patent in suit is concerned, in its product aspect, with a rubber-reinforced acrylonitrile/styrene (ABS)-type copolymer, having a desirable balance of physical properties, in particular toughness (impact strength) and gloss, in which the rubber is dispersed as discrete particles in the copolymer matrix, the rubber particles containing occlusions of grafted and/or ungrafted copolymer. Such a copolymer is, however, known from D2, which was considered to be the closest state of the art for the assessment of novelty.

4.1 According to D2, a continuous polymerisation process produces a rubber-modified ABS-type polymeric polyblend having first and second grafted rubber phase particles dispersed in a matrix polymer phase, the two rubber phases having different morphology, and in particular a bimodal distribution (column 2, lines 22 to 41).

4.1.1 The process involves continuous mass polymerisation of monomers having dispersed therein 0.1 to 15% by weight of a soluble first diene rubber, with shearing

agitation, to produce rubber-monomer particles having a particle size of 0.7 to 10 microns and having present occluded and grafted polymer; dispersing a second grafted rubber comprising crosslinked rubber particles having an average particle size of 0.01 to 0.5 microns in the first mixture to form a second partially polymerised mixture; continuously mass polymerising the second mixture under shearing agitation to form a third mixture; followed by devolatilising the third mixture to form a polyblend in which the second grafted rubber comprises 50 to 97% of the total of the first and second rubbers (Claim 1).

- 4.1.2 The monomer formulation comprises, at least principally, a monoalkenylaromatic monomer, preferably styrene, and an ethylenically unsaturated nitrile monomer, preferably acrylonitrile (column 3, lines 30 to 63).
- 4.1.3 The rubbers are preferably stereospecific polybutadiene rubbers formed by the polymerisation of 1,3-butadiene. They may have a cis-isomer content of 30 to 98% and a Mooney viscosity of 20 to 79 (column 5, lines 36 to 47).
- 4.1.4 In addition to the monomers, the formulation can contain catalyst and molecular weight regulators such as mercaptans, halides and terpenes (column 4, lines 28 to 31 and 54 to 58).
- 4.1.5 Whilst at least a portion of the first polymer polymerised is grafted as polymer molecules to the

rubber as a superstrate, the remainder is dissolved in the monomer composition forming a monomer-polymer solution. This is incompatible with the monomer-rubber phase and phase separation is observed. As the polymer concentration of the monomer-polymer phase increases and has a volume slightly larger than the monomer-rubber phase, the monomer-rubber phase separates as rubber-monomer particles aided by the shearing agitation (column 6, lines 15 to 38).

4.1.6 Higher stirring rates and shearing agitation can lower the size of the dispersed rubber particle, and hence must be controlled to provide sufficient stirring to size the particles to the predetermined size needed to insure homogeneous dispersion (column 6, lines 51 to 56).

4.1.7 At steady state polymerisation, the continuously charged monomer composition containing 0.1 to 15% rubber disperses almost instantaneously, under stirring, forming the rubber-monomer particles which on complete polymerisation form discrete rubber particles (column 6, lines 57 to 62).

4.1.8 The dispersed rubber phase increases the toughness of the ABS-type polymeric polyblend. The impact strength increases with the weight percent rubber dispersed in the polyblend, and is also determined by the size of the dispersed rubber particles, with the larger particles providing higher impact strength in the range of 0.7 to 10 microns. The diameter of the rubber particles also affects the gloss with smaller particles giving high gloss and the larger particles

giving low gloss to the polyblend. The range of 0.8 to 3 microns is most preferred for optimum impact strength and gloss. The small particles are added to give a bimodal distribution (column 7, lines 12 to 54).

4.1.9 According to Example 2, a formulation consisting of 2 parts by weight of stereospecific polybutadiene rubber having 35% cis-1,4-structure and a Mooney viscosity of 55, in 98 parts by weight of 75/25 styrene/acrylonitrile (S/AN) monomers and 0.1 part by weight of octadecyl 3-(3',5'-di-tertbutyl-4-hydroxyphenyl) propionate is fed continuously to an anchor-agitated (65 r.p.m.) initial reactor operated at a constant 50% fillage.

After a steady state polymerisation has been reached, a first partially polymerised mixture is removed and blended continuously in line with a second grafted rubber giving a providing a second partially polymerised mixture having a total of 20 weight percent of rubber giving a ratio of a first grafted rubber to a second grafted rubber of 10/90. The second rubber has a particle size of 0.2 microns.

The second partially polymerised mixture is fed continuously to a second, five-stage isobaric reactor, operating at about 40% fillage and having a horizontal shaft disc/paddle agitator. The third partially polymerised mixture from the final stage, after devolatilising to a melt, is extruded into strands, cooled and cut into pellets.

The first grafted rubber particles have a particle size of 1.5 microns. The ABS product has a bimodal rubber particle size distribution of first graft to second graft rubbers of 10:90 and a rubber concentration of 25%, providing excellent gloss and impact strength along with other physical properties (column 20, line 16 to column 21, line 43).

4.1.10 According to Example 4, Example 2 was followed, except that 10 parts by weight of stereospecific butadiene rubber was dissolved in 90 parts by weight of a 75/25 S/AN monomer mixture and charged continuously to the reactor. The mixture from the initial reactor is diluted with a 75/25 S/AN monomer blend to provide a dilution factor of 5 and a rubber content of about 2% by weight. This mixture is fed to the second reaction zone, and the process is followed to completion to give a polymer polyblend having excellent gloss, impact strength and other physical properties (column 22, lines 14 to 45).

4.2 Compared with this state of the art, the objective technical problem may be seen in the definition of a rubber-reinforced ABS-type copolymer exhibiting improved practical toughness and gloss, with good balance of physical properties, specifically impact strength at both room and low temperatures (e.g. -20°C).

4.3 The solution proposed according to Claim 1 of the patent in suit is to provide such a rubber-reinforced copolymer having at least 6 weight percent, based on the rubber and copolymer, of a rubber which exhibits a

viscosity, as a 5 weight percent solution in styrene, of at least 120 mPa.s (centipoise), dispersed as discrete particles containing occlusions of grafted and/or ungrafted polymer and having a volume average particle size of 1.5 μm or less.

4.4 A direct, quantitative comparison of the relevant physical properties of the claimed products with those of the products according to D2 is not possible, because the examples of the latter, although describing the impact strength and gloss of the products as being "excellent" do not specify them numerically.

4.5 Nevertheless, a relevant assessment of the effect forming the basis of the stated problem is possible in view of comparative data provided in the patent in suit itself, specifically in the Examples and Comparative Examples.

4.5.1 It is evident, in particular from Example 2 and the corresponding Comparative Example in the patent in suit, that a rubber-reinforced ABS-copolymer corresponding to the claimed subject-matter (samples 1 and 2) has very substantial increases of over 60% in Izod impact strength (both at room temperature and -20°C) and more than double the % gloss, as compared with a similar rubber-reinforced copolymer (sample A) differing only in that the particle size of the rubber is $2.9\mu\text{m}$, instead of $0.65\mu\text{m}$ or $0.88\mu\text{m}$ (page 9, Table 1).

4.5.2 In this connection, it is open to an Applicant or

Patentee to discharge his onus of proof by voluntarily submitting comparative tests with variants of the closest state of the art making identical the features in common with the invention so that the advantageous effect attributable to the distinguishing features of the invention is thereby more clearly demonstrated (T 0035/85 of 16 December 1986, not published in OJ EPO, Reasons for the decision, point 4; supplementing T 0181/82 "Spiro-compounds", OJ EPO 1984, 401).

- 4.5.3 It is thus evident that the parameters defining the solution of the technical problem are not arbitrary, but on the contrary must be fulfilled, in order to provide of the effect forming the basis of the problem.
- 4.5.4 Moreover, the results given in the patent in suit were not challenged by the Appellant.
- 4.5.5 Consequently, it is credible to the Board that the claimed measures provide an effective solution of the stated problem.

5. *Novelty (Product aspect)*

There is no mention in D2 of a rubber-reinforced ABS-type copolymer having the combined features forming the solution of the technical problem.

- 5.1 The argument of the Appellant, that all the relevant parameters had been mentioned "within a few lines" in D2 (column 2, lines 49 to 63) is irrelevant, because the location within the document of a disclosure does

not in itself suffice to show the true contextual relationship of the parameters, let alone establish that they are disclosed in combination, as required by the solution of the technical problem. In any case, one of the parameters, namely that of rubber viscosity, is referred to in a quite separate section of the disclosure (column 5, lines 43 to 47). Hence, the argument of the Appellant is not even supported by the disclosure of D2.

5.2 Furthermore, closer examination of the relevant passage of D2 including the "few lines" (section 5.1, above) shows that the parameters of amount of rubber and particle size of rubber are merely disclosed as independent ranges (0.1 to 15% and 0.7 to 10 microns, respectively) without any indication as to how, or indeed whether, they might vary with one another (sections 4.1.7, 4.1.8, above).

5.3 Whilst it was conceded by the Respondent at the oral proceedings that D2 disclosed ranges partly overlapping with those defined in the solution of the technical problem, the latter requires the simultaneous fulfilment of **three** values of the same parameters. Specifically, the rubber is to have at least a certain viscosity, to be present in at least a certain amount, and at the same time to have a particle size not exceeding a certain limit (section 4.3, above).

5.3.1 Put another way, if the three parameters in question are considered to be measured along three respective normal axes of a three-dimensional co-ordinate axis

system, the ranges x' , y' and z' disclosed for the respective parameters in D2 will be represented by a parallelepipedal volume V' of side x' , y' , z' within this co-ordinate system. The corresponding parameters of the claimed solution, represented, say, by ranges x , y , z will then be a volume V of side x , y , z in the same co-ordinate system. To the extent that the ranges x , x' ; y , y' and z , z' respectively overlap with one another, the volume V will be found within the volume V' . Consequently, it is only to the extent that the volumes V' and V coincide that the claimed solution can be regarded as a selection from within the disclosure of D2.

5.3.2 Since, however, the ranges in the claimed solution represent threshold values (lower limits in the case of the quantity and viscosity of the rubber and an upper limit in the case of the particle size), the overlapping part of volume V will evidently be found within in one extreme corner of the volume V' .

5.3.3 The argument of the Appellant at the oral proceedings, that the claimed ranges of the relevant parameters, being open ended, were by definition comparable in extent with the corresponding ranges disclosed in D2, so that could be no distinction on the basis of selection from D2, cannot be accepted for the following reasons:

5.3.3.1 Firstly, to the extent that the claimed ranges extend beyond the limits disclosed in D2, the volume V lies outside the volume V' , and claimed solution is in any case distinct from the latter disclosure.

Consequently, the question of selection in such a case does not arise.

5.3.3.2 Secondly, to the extent that there is overlap, and the volume V lies within the volume V', this fact alone (i.e. that Claim 1 requires a combination of **three** simultaneous selections) means that, even if the portion selected from each range x', y', z' represents a large fraction, say half, of that range, the corresponding **volume** representing the three simultaneously selected independent ranges represents the **cube** of that fraction, i.e. in the example given, only one eighth of the volume V'.

5.3.3.3 Furthermore, one of the relevant parameters, namely the rubber particle size maximum, at 1.5 μ m, represents only a very small fraction of the range of 0.1 to 10 μ m disclosed in D2. Consequently, the total volume V represented by the overlapping portion of the solution of the stated problem represents a very thin "slice", and hence a very small portion, of the volume V'.

5.3.3.4 In summary, the claimed solution of the stated problem, to the extent that it overlaps with the disclosure of D2 at all, represents a narrow selection therefrom.

5.4 Furthermore, the relevant examples of D2 cannot be regarded as making the claimed solution available to the skilled reader.

5.4.1 In particular, the rubber-reinforced copolymer produced according to Example 2 of D2, although

exhibiting a particle size of the relevant high viscosity polybutadiene rubber of 1.5µm (within Claim 1), contains only 2% by weight of this rubber (section 4.1.9, above), which is well below the allowed minimum of 6% specified in the solution of the technical problem.

5.4.2 Furthermore, the procedure of Example 4, although commencing with a higher proportion of the relevant high viscosity rubber, then dilutes it back to 2% by weight in the final product, and the relevant particle size of the rubber is in any case unspecified (section 4.1.10, above).

5.4.3 Nor is there any ground for assuming that the unspecified parameter (particle size) would automatically be fulfilled at the initially higher concentration of high viscosity rubber, in the operation, by the skilled person, of the procedure according to Example 4.

5.4.3.1 In this connection, it is made clear in the Affidavit of Mr. Van Nuffel, filed during the examination procedure (submission filed on 16 January 1989) and referred to during the opposition proceedings (submission of the Appellant, then the Opponent, dated 5 August 1992), that it is difficult to produce small rubber particles in an ABS resin at a high rubber content and at a high rubber viscosity (sentence bridging pages 4 and 5). This is because of the tremendous increase in the viscosity, during mass polymerisation of styrenic monomers, of the polymerising mixture, which will become higher when

the rubber content, rubber viscosity and matrix molecular weight are increased. When the viscosity of the polymerisation mixture increases, less mechanical energy can be transferred to the mixture, which results in the formation of larger particles (Affidavit, page 4, lines 2 to 21).

5.4.3.2 This is confirmed by the statement in the patent in suit, according to which "Specifically, although the particle size of dispersed rubber can be reduced by increasing the rate of mechanical agitation in the polymerization reactor, an ABS resin wherein the high molecular weight rubber exhibits a desirably small particle size (i.e., a volume average particle size of less than 1.5 micron) at a sufficiently high concentration to impart the desired properties to the final product has not previously been prepared using mass or mass/suspension polymerization techniques" (patent in suit, page 2, lines 40 to 44).

5.4.3.3 Thus, it is evident that there was an obstacle to the achievement of a small particle size of 1.5µm or less, simply by increasing the amount of mechanical energy transferred to the polymerising mixture, e.g. by stirring, in a mass polymerisation of styrenic monomers such as that set out in Example 4.

5.4.3.4 No evidence was submitted by the Appellant to refute this conclusion. Yet the onus of proof lay with the Appellant.

5.4.3.5 Consequently, the assertion of the Appellant at the oral proceedings, that the relevant smaller particle

size could be achieved merely by more energetic stirring, cannot be accepted.

5.4.3.6 On the contrary, it must be concluded that the unspecified particle size of the product according to Example 4, to the extent that the rubber concentration was initially 10%, was larger than 1.5 μ m.

5.4.3.7 In summary, the claimed solution is well removed from the relevant examples of D2.

5.5 Finally, the claimed solution is not arbitrary, since it solves a specific technical problem compared with the products according to D2 (section 4.5, etc., above).

5.6 Hence, the claimed solution, to the extent that it overlaps with the general disclosure of D2 at all, fulfils all the requirements of a true selection (cf. T 0198/84, OJ EPO, 1985, 209).

5.7 In other words, the solution of the stated problem is novel over D2.

5.8 According to D4, a polyblend composition of improved impact strength contains a mixture of at least one monoalkenyl aromatic monomer in which a sufficient amount of a diene rubber is dispersed to confer toughness, the rubber being in the form of crosslinked rubber particles, which are grafted with monomer as a polymer, having present occluded polymer and having a weight average particle size of 0.5 to 10 μ m. The rubber is a polybutadiene rubber with a broad

molecular weight distribution, a dispersion index of at least 2 and a microstructure with a cis-1,4-butadiene content of 30 to 85% (Claim 1).

- 5.8.1 Thus, D4 relates only to high impact strength polystyrenes (HIPS), there being no mention of ABS-type polymers or even of a nitrile monomer.
- 5.8.2 Consequently D4 does not disclose the solution of the stated problem.
- 5.9 In summary, the subject-matter of Claim 1, representing the solution of the stated problem, and hence that of dependent Claims 2 to 7, is novel.

6. *Inventive step (Product aspect)*

Lack of inventive step was only reasoned in connection with the disclosure of D4 as "closest state of the art".

- 6.1 The disclosure of D4 does not, however, relate to ABS-type resins at all, however, but is restricted to HIPS resins (section 5.8.1, above).
- 6.2 The argument of the Appellant, at the oral proceedings, that the similarity between the rubber particle size disclosed in D4 and that taught by the patent in suit would render it obvious to add a nitrile monomer to the preparation described in D4 and thus to arrive at the claimed product, is flawed in a number of respects.

- 6.2.1 Firstly, in the assessment of inventive step, the skilled person is, by definition, not aware of the subject-matter of the patent in suit. Consequently, any consideration relating to what is disclosed only in the patent in suit is automatically *ex post facto* and consequently cannot be used to render the subject-matter of the latter obvious.
- 6.2.2 Secondly, the concept that the thoughts of the skilled person, starting from D4 would automatically turn to converting the HIPS disclosed therein to an ABS-type polymer is not supported by the disclosure of D4 itself, which does not give any hint in this direction (section 5.8.1, above).
- 6.2.3 Nor has it been shown that such a consideration would belong to the general knowledge of the skilled person. On the contrary, according to the unrefuted submission of the Respondent at the oral proceedings, ABS type polymers were known to behave in a quite different way, in particular as to the type and size of rubber particles formed, from HIPS resins.
- 6.2.4 The argument of the Appellant at the oral proceedings, that the stress crack resistance (Spannungsrisssbeständigkeit) of HIPS was known to be much worse than that of ABS, and that it could be ameliorated by adding a nitrile monomer, is irrelevant to an appreciation of the relevant technical problem, which has to do with impact resistance and gloss (section 4.2, above), stress cracking being associated with a tensile strain having, if anything, the opposite tendency to that of impact.

- 6.2.5 In other words, the relevant technical problem is not derivable from the disclosure of D4.
- 6.2.6 Hence, if a technical problem were nevertheless derived by taking, as a starting point, D4 read in the light of the general knowledge of the skilled person, but in the absence of any knowledge of the patent in suit, the idea of transferring the teaching of D4 to ABS-type polymers would form part of the solution, and not part of the statement of problem.
- 6.2.7 Indeed, to formulate a technical problem, starting from D4, in terms of "providing an ABS polymer product...." would be open to objection, because it is not permitted to formulate a technical problem in terms which contain a pointer to the solution (T 0229/85, OJ EPO 1987, 237).
- 6.2.8 On the contrary, a consequence of the choice of D4 as the starting point in the state of the art is that the claimed product forming the solution of the stated problem is non-obvious with respect to such art, because any attempt by the skilled person to establish a chain of considerations leading in an obvious way to the claimed subject-matter gets stuck at the start, for lack of an identifiable relevant problem. Nor would the skilled person be led to combine with D4 a prior art disclosure more directly relating to ABS resins, since, in view of the above, the relevance of such a disclosure would not be apparent. In other words, if the relevant problem is not derivable, the solution to it is *a fortiori* not derivable, let alone

obvious (T 0325/93 of 11 September 1997, not published in OJ EPO, Reasons for the decision points 6.1 to 6.3).

6.3 In view of the above, the subject-matter of Claim 1, and therefore of Claims 2 to 7 does not arise in an obvious way from the state of the art. It therefore involves an inventive step in the sense of Article 56 EPC.

7. *The technical problem (Process aspect)*

The patent in suit, in its process aspect, concerns a method of preparing a rubber-reinforced ABS-type copolymer, comprising the steps of mass polymerising a solution of the rubber and S/AN monomers under conditions such that phase inversion occurs and the rubber becomes dispersed as particles and continuing polymerisation, using a rubber which exhibits a viscosity, as a 5 weight % solution in styrene, of at least 120 mPa.s (centipoises) in the monomer solution.

7.1 Such a process is known, however, from D2, which forms the closest state of the art for the assessment of novelty (section 4., etc., above).

7.2 Compared with D2, the technical problem is to be seen in the provision of a process such that the rubber, when used in an amount of at least 5 weight % based on the total weight of the monomers and the rubber, becomes dispersed at a volume average particle size of 1.5 μm . or less, without excessively agitating the polymerisation mixture.

7.3 The solution proposed according to the patent in suit is to control the polymerisation conditions prior to phase inversion so that, upon phase inversion and forming of rubber particles, the copolymer has a sufficiently high molecular weight that the rubber is readily dispersed throughout the continuous phase as discrete particles having the relevant small particle size. This is achieved in particular by reducing or avoiding the use of chain transfer agents, increasing the concentration or functionality of polymerisation initiators, and/or lowering the temperature of mass polymerisation prior to phase inversion (Claim 8; page 5, line 54 to page 6, line 49; examples).

7.4 It can be seen from the examples and comparative examples in the patent in suit that the means employed enable the production of a rubber reinforced ABS-type copolymer having the relevant particle size at the relevant high concentration of rubber, and thus credibly solve the technical problem.

8. *Novelty (Process aspect)*

The description in D2 makes no mention of controlling the molecular weight of the matrix copolymer, in particular to allow it to increase ahead of phase inversion, but rather relates the phenomenon of "phase separation" to the relative volumes of the monomer polymer and monomer rubber phases present (section 4.1.5, above). On the contrary, according to D2, at steady state polymerisation, in the initial polymerisation zone, the diene rubber disperses "almost instantaneously" (column 6, lines 57 to 62). Consequently, there is no disclosure of the crucial procedural measure characterising the solution of the relevant technical problem (section 7.3, above).

8.1 The argument of the Appellant at oral proceedings, concerning the use of molecular weight regulators in D2, was based on the concept that these would enable phase inversion to be delayed. Yet the opposite is true. According to the patent in suit, it is necessary to reduce the concentration of, or even avoid the use of such regulators (also known as "chain transfer agents"), because they affect the molecular weight of copolymer (page 5, line 54 to page 6, line 10). Thus, the measure relied upon by the Appellant, although admittedly conventional and disclosed in D2 (column 4, lines 30, 31), is one which would tend to prevent the formation of the relevant rubber particles of the desired small size.

8.2 Nor have such particles been shown to result from the process exemplified in D2 (section 5.4.3 etc., above).

8.3 Consequently, the solution of the stated problem is not disclosed in D2. In other words, the disclosure of D2 is not novelty destroying for the subject-matter of Claim 8.

8.4 The disclosure of D4 is not novelty destroying for the subject-matter of Claim 8 for reasons analogous to those given in the case of Claim 1 (section 5.8, etc., above).

8.5 Consequently, the subject-matter of Claim 8, and by the same token that of Claims 9 to 19, is novel.

9. *Inventive step (Process aspect)*

Lack of inventive step of the process aspect of the patent in suit was only reasoned in connection with the disclosure of D4 as "closest state of the art". Yet D4 is no more relevant to the process of Claim 8 than it is to the product of Claim 1, since it does not deal with the production of ABS-type polymers of any kind. Thus, for reasons analogous to those given in connection with the product aspect (section 6.1, 6.2 etc., above), the subject-matter of Claim 8 is not obvious in the light of this art. Hence, the subject-matter of Claim 8 and, by the same token, that of Claims 9 to 19 involves an inventive step in the sense of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier C. Gérardin