

**Internal distribution code:**

- (A) [ ] Publication in OJ  
(B) [ ] To Chairmen and Members  
(C) [X] To Chairmen

**D E C I S I O N**  
**of 29 July 1999**

**Case Number:** T 0676/95 - 3.3.3

**Application Number:** 88304522.1

**Publication Number:** 0342283

**IPC:** C08L 101/00

**Language of the proceedings:** EN

**Title of invention:**

Thermoplastic and thermoset polymer compositions

**Patentee:**

Rohm and Haas Company

**Opponent:**

Röhm GmbH

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (yes) - non-obvious concretisation"

**Decisions cited:**

-

**Catchword:**

-



Europäisches  
Patentamt

European  
Patent Office

Office européen  
des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number: T 0676/95 - 3.3.3

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.3**  
**of 29 July 1999**

**Appellant:** Röhm GmbH  
(Opponent) Kirschenallee  
64293 Darmstadt (DE)

**Representative:** -

**Respondent:** Rohm and Haas Company  
(Proprietor of the patent) Independence Mall West  
Philadelphia  
Pennsylvania 19105 (US)

**Representative:** Marshall, Monica Anne  
J.A. Kemp & Co.  
14 South Square  
Gray's Inn  
London WC1R 5LX (GB)

**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 8 June 1995  
rejecting the opposition filed against European  
patent No. 0 342 283 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** C. Gérardin  
**Members:** P. Kitzmantel  
J. A. Stephens-Ofner

## Summary of Facts and Submissions

I. Mention of the grant of European patent No. 342 283 in respect of European patent application No. 88 304 522.1 in the name of Rohm and Haas Company, which had been filed on 18 May 1988, was announced on 17 February 1993 on the basis of 19 claims. Independent Claims 1, 12, 18 and 19 read as follows:

"1. A thermoplastic or thermoset polymer composition comprising thermoplastic or thermoset matrix polymer and, dispersed therein, from 0.1 to 40% by weight of the total composition of substantially spherical polymer particles having an average diameter of from 2 to 15 micrometers and a particle size distribution such that at least 90% by weight of the particles fall within  $\pm 20\%$  of the average particle diameter; subject to the proviso that when said polymer composition is a light-scattering composition based on a thermoplastic polymer matrix and the spherical polymer particles comprise from 0.1 to 10% of the total composition weight, the spherical polymer particles are not core/shell polymers having a core of rubbery alkyl acrylate polymer, the alkyl group having from 2 to 8 carbon atoms, copolymerised with 0 to 50% copolymerisable vinyl monomer, 0 or up to 5% crosslinker and 0 or up to 5% graftlinker (based on the total weight of the core) and a refractive index ( $n_D^{25}$ ) within  $\pm 0.2$  units of, but preferably no closer than  $\pm 0.003$  units to, the refractive index of the matrix polymer, and one or more polymer shells, the outermost of which is compatible with the matrix polymer, which shell(s) comprises 5 to 40% of the weight of the particles."

"12. A process for preparing a thermoplastic or thermoset polymer composition comprising thermoplastic, or thermoset matrix polymer and substantially spherical polymer particles, comprising only a single polymer phase, said single phase polymer particles having an average diameter of from 2 to 15  $\mu\text{m}$  and a particle size distribution such that at least 90% by weight of the particles fall within  $\pm 20\%$  of the average particle diameter, wherein the process comprises:

A) polymerizing a first aqueous emulsion of one or more monomers which, when polymerized, produce a particulate composition comprising polymer particles;

B)

1. swelling the particles of the particulate composition produced in A), or if appropriate the particles of B2), with one or more monomers, and
2. polymerizing the swelling monomer within the particles until all of the monomers have been polymerized,

steps B1 and B2 being repeated, if necessary, until at least 90% by weight of the particles of the particulate composition fall within  $\pm 20\%$  of a desired size, in which case such particles are to be referred to as single phase polymer particles, and blending said single phase polymer particles, in an amount of 0.1 to 40% by weight of the total composition, with said matrix polymer."

"18. Use of substantially spherical polymer particles in the formation of a light-scattering and/or reduced-gloss finish thermoplastic or thermoset polymer composition comprising a thermoplastic or thermoset matrix polymer and said spherical polymer particles, wherein said particles have an average diameter of from

2 to 15  $\mu\text{m}$ , a particle size distribution such that at least 90% by weight of the particles fall within  $\pm 20\%$  of the average particle diameter; subject to the proviso that when said polymer composition is a light-scattering composition based on a thermoplastic polymer matrix and the spherical polymer particles comprise from 0.1 to 10% of the total composition weight, the spherical polymer particles are not core/shell polymers having a core of rubbery alkyl acrylate polymer, the alkyl group having from 2 to 8 carbon atoms, copolymerised with 0 to 50% copolymerisable vinyl monomer, 0 or up to 5% crosslinker and 0 or up to 5% graftlinker (based on the total weight of the core) and a refractive index ( $n_p^{25}$ ) within  $\pm 0.2$  units of, but preferably no closer than  $\pm 0.003$  units to, the refractive index of the matrix polymer, and one or more polymer shells, the outermost of which is compatible with the matrix polymer, which shell(s) comprises 5 to 40% of the weight of the particles."

"19. Use, in sheet or moulded form, of a thermoplastic or thermoset polymer composition as claimed in any one of Claims 1 to 11; or as prepared in Claims 12 to 17, as, or as component of, a luminaire, a rear projection screen for e.g. television or film viewing, a decoration, an illuminated sign, a skylight, a lighting fixture, greenhouse glazing, a light box, a drafting table, an automotive part, e.g. a sun-roof or a cover for automotive lights, an artistic application, an antiglow screen for a CTR unit or a twin-wall glazing."

II. Notice of Opposition requesting revocation of the patent in its entirety on the grounds of Article 100(a) EPC was filed by Röhm GmbH on 16 November 1993.

The opposition was i.a. based on documents

D2: JP-A-64/10515 (German abstract in  
"Hochmolekularbericht, 39. Jahrgang, Nr. 22, Ref.-  
Nr. 6455-6770/64 (1964)")  
and

D3: DE-A-2 264 224 (= D3a) and DE-C-2 264 224 (= D3b).

III. By its decision issued in writing on 8 June 1995, the  
Opposition Division rejected the opposition.

It was held in that decision that the subject-matter of  
the patent in suit was novel over the cited prior art  
because at least the feature of the independent claims  
that the polymer particles have a particle size  
distribution such that at least 90% by weight of the  
particles fall within  $\pm 20\%$  of the average particle  
diameter was not disclosed either in D2 or in D3.

That decision also held that the claimed subject-matter  
involved an inventive step over D3, because this  
disclosure did not contain any hint at the use of  
polymer particles having the required narrow particle  
size distribution in the particle size range of from 2  
to 15  $\mu\text{m}$  specified in Claim 1 of the patent in suit.

IV. On 7 August 1995 the Opponents (Appellants) lodged an  
appeal against the decision of the Opposition Division  
and paid the appeal fee on the same day. The Statement  
of Grounds of Appeal was submitted on 18 October 1995  
and a further written submission on 24 September 1998.

V. The arguments presented by the Appellants in their

written submissions and during the oral proceedings held on 29 July 1999 may be summarized as follows:

- (i) Document D2 represented the closest state of the art, because it related to the use of light-scattering polymer compositions comprising multi-step emulsion polymerised crosslinked polystyrene particles having an average particle diameter in the range of from 0.5 to 5  $\mu\text{m}$ , i.e. overlapping the range of 2 to 15  $\mu\text{m}$  according to present Claim 1.
  
- (ii) The Appellants' partial reworking of Example 4 of D3 (cf. Annexes 1 to 3 of the Statement of Grounds of Appeal) as well as document

D5: R.H. Ottewill and J.N. Shaw, Studies on the Preparation and Characterization of Monodisperse Polystyrene Latices, in Kolloid-Zeitschrift und Zeitschrift für Polymere, **215**(2), 161 to 166 (1966)

showed that the emulsion polymerised particles used according to D2 would necessarily be of spherical shape and also had a very narrow particle size distribution.

- (iii) While the Appellants did not deny the importance for the achievement of a favourable balance of light scattering and light transmission of (a) a spherical shape of the particles, (b) the claimed particle size and (c) the claimed narrow particle size distribution, they maintained that the optimization of these parameters was a matter of

ordinary craftsmanship not requiring inventive effort.

VI. The Respondents (Proprietors of the patent) presented their counterstatements in written submissions dated 12 April 1996, 8 April 1998 and 6 May 1998 (the latter two submissions in response to the Board's communication of 1 October 1997) and at the oral proceedings. They can be summarized as follows:

- (i) Documents D2 and D3 were silent about the shape and the particle size distribution of the polymer particles.
- (ii) The Appellants' experimental results (Annexes 1 to 3 of the Statement of Grounds of Appeal) could not prove that these features belonged to the implicit disclosure of D2, because the reworking of Example 4 of D3 was defective and, moreover, technically unrelated to the disclosure of D2.
- (iii) While D5 did disclose the preparation by emulsion polymerisation of very small, monodisperse, spherical polystyrene particles, this document could not prove that the differently prepared particles used according to D2 and D3 must necessarily have a spherical shape and a narrow particle size distribution.
- (iv) The evidence filed with the Respondents' submissions of 8 April 1998 and 6 May 1998 demonstrated the critical importance for the desired improvement of the translucency of the particle characterization specified in Claim 1 of

the patent in suit.

- (v) The cited prior art would not, therefore, render obvious the claimed solution of the existing technical problem of providing light scattering materials having improved light transmission and diffusion.

VII. The Appellants requested that the decision under appeal be set aside and that the European patent No. 342 283 be revoked.

The Respondent requested that the appeal be dismissed.

### **Reasons for the Decision**

- 1. The appeal is admissible.
- 2. *Citations*
  - 2.1 Document D2

This document (German abstract) relates to the production of translucent synthetic resins, suitable for lighting appliances, by admixing to a transparent resin (e.g. polymethylmethacrylate = PMMA) 1 to 10% of particles of a crosslinked resin having a mean particle diameter of from 0.5 to 5  $\mu\text{m}$  and having a refractive index different from that of the matrix resin by 0.05 to 0.3 units. By way of example, the crosslinked resin may be prepared by polymerization in aqueous emulsion of a mixture of 95 parts of styrene and 5 parts of ethylene dimethacrylate, followed by polymerization of

the same mixture in aqueous emulsion and 4-fold repetition of this process.

## 2.2 Document D3

Both publications, DE-A (D3a) and DE-C (D3b), were cited in the Appellants' Notice of Opposition (point X, A, 3) filed 16 November 1993. Apart from the fact that Claim 1 of the C-publication is a combination of Claims 1 and 2 of the A-publication, the two publications are essentially identical. In this decision only the A-publication D3a will be referred to.

This document relates to the preparation of a crosslinked polystyrene emulsion polymer, which is dispersable in (i) methylmethacrylate monomer (MMA) or a monomer mixture consisting essentially of MMA or (ii) a melt of PMMA or a copolymer consisting essentially of MMA units. In a first step crosslinked polystyrene particles having a particle size of above 0.8  $\mu\text{m}$  are prepared by emulsion polymerization and in a second step a shell of PMMA or a copolymer consisting essentially of MMA units is graft polymerized onto these particles (cf. Claim 1). According to Claim 2 the polymerization of the core is accomplished in two stages. In the first stage, in the absence of an emulsifier, particles having a size of about 0.6  $\mu\text{m}$  are prepared, and in the second stage these particles are enlarged to a size of above 0.8  $\mu\text{m}$  by further polymerization of styrene in the presence of a crosslinking monomer and of an anionic emulsifier.

According to Claims 7 to 9 the polymer particles are

incorporated into a matrix of PMMA or a copolymer consisting essentially of MMA units rendering the matrix thereby dull, i.e. light diffusing. According to page 9, lines 7 to 11 the light diffusing effect should be such that the compositions are endowed with a high light transmission and an excellent light scattering with low remission.

2.3 Document D5

This document discloses the preparation of monodisperse polystyrene latices by the seed polymerisation technique, where in a first step a dispersion of small polymer particles is formed which, in a further step or steps, are enlarged to 500 to 5000 Å (= 0,05 to 0,5 µm) (page 162, bridging paragraph of first and second column; page 166, Summary).

3. *Novelty*

At the oral proceedings the Appellants dropped their previous novelty objections.

In any event, the Board finds that the subject-matter of the patent in suit is novel, because D2 and D3 are both silent about the feature of the narrow particle size distribution (such that at least 90% by weight of the particles fall within ±20% of the average particle diameter) required in all independent claims (cf. point 4.1 below).

4. *Inventive step*

4.1 The Appellants' submissions start from document D2 as

being the most relevant piece of prior art.

4.1.1 The explicit disclosure of D2 differs from the subject-matter of present Claim 1 in the following respects:

- (i) it does not mention the shape of the particles,
- (ii) it discloses a range of the particle diameter of from 0,5 to 5  $\mu\text{m}$ , i.e. overlapping the range of 2 to 15  $\mu\text{m}$  according to Claim 1 of the patent in suit, and
- (iii) it does not mention the particle size distribution.

4.1.2 In the Board's judgment, the crosslinked polystyrene particles, which are used according to D2 and which have been prepared by multi-step emulsion polymerisation, must necessarily be of "substantially spherical" shape, as required by Claim 1.

This results from D5, which stresses that the known polymer latices prepared by emulsion polymerisation are dispersions of **spherical** particles (page 161, right-hand column, lines 3 to 10). While the maximum particle size disclosed in D5 is (only) 0,5  $\mu\text{m}$  (cf. Summary), i.e. equal to the lower limit of the particle size range used according to D2, there is no reason to doubt that, on growing, spherical polymer particles will, under the conditions of emulsion polymerisation, keep their ("substantially": Claim 1 of the patent in suit) spherical shape.

This feature is therefore implicit to the disclosure of

D2.

- 4.1.3 As to the particle size range there is an overlap with the range specified in Claim 1 of the patent in suit of from 2 to 5  $\mu\text{m}$ . This range includes the value of 5  $\mu\text{m}$ , which - according to the worked examples in the description - is the most preferred particle size value of the claimed composition (cf. pages 15, 16, 17, 19 to 23, 25, 32, 38 to 40: Examples 3, 6, Tables I, III to VIII, Examples 40, 41, 75, 76, 97, 119).

The fact that according to Claim 1 of the patent in suit the upper limit of the particle size range is beyond the particle size range disclosed in D2 cannot, therefore, invalidate the fact that there is a substantial overlap of these ranges, with the consequence that the differently defined particle size range of the claimed composition cannot qualify as a distinguishing feature over D2.

- 4.1.4 According to D5, page 161, right-hand column, lines 6 to 10 the particle dispersions "**can** attain a high degree of monodispersity" and according to page 162, right-hand column, lines 1 to 8 the "degree of monodispersity improves as the latex particles increase in size, since **under suitable conditions** the small particles grow at a faster rate than the large ones." [emphasis by the Board].

D5 makes it, thus, clear that in order to achieve a monodisperse, i.e. a very narrow particle size distribution, appropriate polymerisation conditions must be used. Since D2 is silent about the concrete polymerisation conditions of the polymer particle

preparation, it is not legitimate to conclude that the achieved particle size distribution is sufficiently narrow, i.e. within the terms of Claim 1.

- 4.1.5 The evidence submitted by the Appellants in their "Annexes 1 to 3" (cf. point V(ii) supra) was designed to prove that according to D2 the particle size distribution must be very narrow, because - according to their reworking of Example 2, second step - this was the case for the particle size distribution obtained according to this Example of D3.

However, there is no proof for the Appellants' assumption that the preparation of the polymer particles used according to D2 followed the method used according to D3, Example 4, second step and, consequently, this line of argument must fail already for that reason and there is no need to enter in a discussion of the reliability of the reworking conditions as done by the Respondents (cf. point VI(ii) supra).

- 4.1.6 The feature concerning the particle size distribution is, thus, the only one that distinguishes the subject-matter of Claim 1 of the patent in suit from the disclosure of D2.

- 4.2 The problem underlying the patent in suit vis-à-vis D2 is the provision of light-scattering polymer compositions having improved light transmittance.

- 4.3 According to Claim 1 of the patent in suit this problem is to be solved by a particle size distribution of the polymer particles such that at least 90% by weight of

the particles fall within  $\pm 20\%$  of the average particle diameter.

- 4.4 The experimental evidence set out in the Respondents' submission dated 8 April 1998 (page 5, last four lines to page 6, half way down; especially Table (ii)) demonstrates that at a particle size distribution according to present Claim 1 (100% of the particles having 2.5  $\mu\text{m}$ ) a transmission of 79.2% can be achieved, whereas the transmission is only 74.6%, respectively 72.6% in the case of a particle size distribution outside the claimed range (80%, respectively 70% of the particles having 2.5  $\mu\text{m}$  and 20%, respectively 30% of the particles having 0.5  $\mu\text{m}$ ).

Therefore, the existing technical problem has effectively been solved by the subject-matter of Claim 1 of the patent in suit.

- 4.5 This solution of the existing problem is not obvious over D2, alone or in combination with D5.

D2 does not even mention the particle size distribution and D5 is a scientific paper on the characterization of polystyrene latices, and fails to disclose any use, let alone the use in light-scattering translucent materials.

Neither of these documents can, therefore, suggest to the skilled person that the claimed narrow particle size distribution is able to favourably influence the light transmission of light scattering materials comprising polymer particles.

4.6 The same conclusion can be drawn when document D3 is considered as the closest state of the art, because the disclosure therein, as far as the features distinguishing over the present invention are concerned, is equivalent to the disclosure of D2.

Again the particle size distribution is the only difference between the subject-matter of Claim 1 and the disclosure of D3, because, for the reasons set out in point 4.1.2 supra, the polymer particles are necessarily of spherical shape and, furthermore, they may have a size within the range of 2 to 15  $\mu\text{m}$  specified in Claim 1, in particular a size of 3 to 3.5  $\mu\text{m}$  [30000 to 35000 Å] (particle size of the core/shell particles prepared in the third stage; cf. page 13, line 1 to page 14, second paragraph of D3a).

While D3 comprises some information concerning the importance of the particle **size** for the efficiency of light transmittance (cf. point 2.2. supra), it is totally silent about the dependence of that property on the particle **size distribution**.

This document cannot, therefore, give any hint to the skilled person at the claimed solution of the existing technical problem, which is the same when starting from D3 as when starting from D2 (cf. point 4.2 supra).

4.7 For the above reasons, the subject-matter of Claim 1 is not obvious having regard to the disclosures of D2, D3 and D5.

4.8 The same conclusion applies to the subject-matter of

the further independent claims, which relate to the preparation (Claim 12) or to the use (Claims 18, 19) of the light-scattering polymer compositions as defined in Claim 1 including the inventive feature of the narrow particle size distribution.

- 4.9 Owing to their appendance to, respectively, Claim 1 and Claim 12 the subject-matter of the dependent Claims 2 to 11 and 13 to 17 also comply with the requirement of Article 56 EPC.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin