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D E C I S I O N
of 17 January 2002

Case Number: T 0713/98 - 3.3.3

Application Number: 93301935.8

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Language of the proceedings: EN

Title of invention:
Polymeric particles

Applicant:
ROHM AND HAAS COMPANY

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 83, 84

Keyword:
"Disclosure - enabling - undue burden"
"Claims - functional features"

Decisions cited:
T 0409/91

Catchword:

To the extent that the requirements of Article 84 EPC can only be fulfilled, in relation to a claim which is characterised by a functional feature defining a result to be achieved, if the feature is such that a person skilled in the art can, without exceeding his normal knowledge and skills, not only understand it, but also without undue burden implement it, the former requirement (understanding) is one of clarity and the latter (implementing) is one of support, both in the sense of Article 84 EPC. Furthermore, the latter requirement, viewed in relation to the disclosure as a whole, is highly relevant to the question of sufficiency, in the sense of Article 83 EPC (following T 409/91, OJ EPO 1994, 653).



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Boards of Appeal

Chambres de recours

Case Number: T 0713/98 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 17 January 2002

Appellant: ROHM AND HAAS COMPANY
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Pennsylvania 19105 (US)

Representative: Buckley, Guy Julian
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 27 January 1998
refusing European patent application
No. 93 301 935.8 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. Young
Members: W. Sieber
J. De Preter

Summary of Facts and Submissions

- I. European patent application No. 93 301 935.8 in the name of ROHM AND HAAS COMPANY was filed on 15 March 1993 claiming a US priority of 10 April 1992 (07/866924) and was published under No. 0 565 244 on 13 October 1993.
- II. By a decision which was issued 27 January 1998, the Examining Division refused the application. The decision was based on a main request and an auxiliary request both requests comprising a set of seven claims, the former having been filed on 26 February 1997 and the latter on 25 November 1997. Claim 1 of the main request read as follows:

"1. A process for making water-insoluble polymer particles, preferably in the form of an aqueous dispersion, said particles comprising a hollow core, surrounded by a shell, and at least one channel connecting the hollow core to the exterior of the particle and wherein said particle has an average diameter of from 0.1 to 5.0 μm (micron), wherein the process comprises the following steps:

(a) sequentially emulsion polymerizing in an aqueous medium containing a free radical initiator a core monomer system comprising one or more monoethylenically unsaturated monomers and at least 5 mole percent of a carboxylic acid or anhydride monomer, whereby dispersed core particles are formed having an average diameter of from about 0.02 to 1 μm (micron); and

(b) polymerizing in the presence of the dispersed core particles resulting from (a), a shell monomer system

comprising at least one monoethylenically unsaturated monomer having no ionizable group to form a shell polymer which encases the core particles, wherein any monoethylenically unsaturated carboxylic acid in the shell monomer mixture is present in an amount of no more than about 10 mole percent of the shell monomers,

the resultant core-shell particles having an average diameter before neutralization and swelling of from 0.07 to 4.5 μm (micron), the relative amounts of core-forming monomer(s) and shell-forming monomer(s) being such that the ratio of the weight of the core to the weight of the total polymer in the resulting dispersed particles is from 1:2 to 1:100; and

(c) neutralizing said core-shell particles with a base so as to swell said core

characterized in that said core-shell particles are neutralized such that the core swells, ruptures the shell and so forms particles containing a microvoid in the core and at least one channel connecting the microvoids to the exterior of the particle."

Claims 2-6 were directed to preferred embodiments of the process of Claim 1. Claim 7 was directed to the use of the particles formed by the process of any one of the preceding claims to strengthen polymer films, as an opacifying agent in coating compositions, and in paper coating compositions.

Claim 1 of the auxiliary request differed from Claim 1 of the main request by the addition, at the end of the first paragraph of step (b), of the following further limitation:

"and the equivalents of acid in the shell polymer does not exceed one-third the equivalents thereof in the core polymer",

as well as the deletion of the word "about" before "10 mole percent" in the same paragraph.

Claims 2 to 7 of the auxiliary request remained unamended.

III. According to the decision, the application was refused on the grounds that Claim 1 of the main request contravened Article 84 EPC and the respective Claims 1 of the main and the auxiliary request contravened Article 84 in combination with Article 83 EPC.

(i) Claim 1 of the main request was not allowed because an essential feature was missing in the claim.

(ii) Furthermore, the decision under appeal objected against Claim 1 of both the main and the auxiliary requests because the invention was defined in terms of a functional feature directed to a result to be achieved, ie "the core-shell particles are neutralized such that the core swells, ruptures the shell and so forms particles containing a microvoid in the core and at least one channel connecting the microvoids to the exterior of the particle". That functional feature was considered to be not allowable because the application did not provide a clear and complete technical teaching to a person skilled in the art of how to obtain the desired result.

(iii) Apart from the objections under Articles 83 and 84 EPC, the decision under appeal questioned the novelty of the subject-matter of Claim 1 of both requests. It was argued that there was a possibility that the prior art inherently disclosed the now claimed process. In particular, reference was made to the following document:

D1: EP-A-0 188 325.

However, the decision explicitly stated that the novelty objection did not form part of the reasons of the decision under appeal because that objection was raised for the first time during the oral proceedings.

Although inventive step was not discussed in the decision, the Examining Division contested the Applicant's view that the document EP-A-0 467 646, introduced by the Applicant himself, was the closest prior art for assessing inventive step.

IV. On 1 April 1998, a Notice of Appeal against the above decision was filed by the Appellant (Applicant) with simultaneous payment of the prescribed fee.

In the Statement of Grounds of Appeal, filed on 5 June 1998, the Appellant argued that the disclosure in the application in suit, ie the description and the examples, provided sufficient information to a person skilled in the art to perform the claimed process across a broad range of core-shell polymers. This was supported by a declaration of Dr. Mark Stephen Frazza.

V. In response to a communication of the Board, issued on 11 October 2001, the Appellant filed on 6 November 2001 a new set of six claims. Claim 1 read as follows:

"1. A process for making water-insoluble polymer particles, preferably in the form of an aqueous dispersion, said particles comprising a hollow core, surrounded by a shell, and at least one channel connecting the hollow core to the exterior of the particle and wherein said particle has an average diameter of from 0.1 to 5.0 μm (micron), wherein the process comprises the following steps:

(a) sequentially emulsion polymerizing in an aqueous medium containing a free radical initiator a core monomer system comprising one or more monoethylenically unsaturated monomers and at least 5 mole percent of a carboxylic acid or anhydride monomer, whereby dispersed core particles are formed having an average diameter of from 0.05 to 1 μm (micron); and

(b) polymerizing in the presence of the dispersed core particles resulting from (a), a shell monomer system comprising at least one monoethylenically unsaturated monomer having no ionizable group to form a shell polymer which encases the core particles, wherein any monoethylenically unsaturated carboxylic acid in the shell monomer mixture is present in an amount of no more than 10 mole percent of the shell monomers, and the equivalents of acid in the shell polymer do not exceed one-third the equivalents thereof in the core polymer,

the resultant core-shell particles having an average diameter before neutralization and swelling of from

0.07 to 4.5 µm (micron), the relative amounts of core-forming monomer(s) and shell-forming monomer(s) being such that the ratio of the weight of the core to the weight of the total polymer in the resulting dispersed particles is from 1:2 to 1:100; and

(c) neutralizing said core-shell particles with a base so as to swell said core

characterized in that said core-shell particles are neutralized such that the core swells, ruptures the shell and so forms particles containing a microvoid in the core and at least one channel connecting the microvoids to the exterior of the particle".

Claims 2-6 were identical to Claims 2-6 of the auxiliary request underlying the decision under appeal. Claim 7 (use claim) of that auxiliary request was deleted.

VI. The Appellant requested that the decision under appeal be set aside and a patent granted on the basis of the set of Claims 1 to 6 filed on 6 November 2001.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 The process of Claim 1 is based on a combination of Claims 1 and 4 as originally filed containing the following further amendments:

- 2.1.1 In step (b) it has been made clear that the shell polymer "encases" the core particle. This amendment is in line with original Claim 1 (ie "surrounded by a shell"), whereby the word "encasing" is explicitly disclosed on page 1, line 6 as originally filed.
- 2.1.2 In step (b) it has been indicated that "the equivalents of acid in the shell polymer do not exceed one-third the equivalents thereof in the core polymer". This amendment is based on page 10, lines 18-20 as originally filed.
- 2.1.3 The addition of the feature that the core-shell particles are neutralized "such that the core swells and ruptures the shell" finds support on page 1, lines 5-9 as originally filed. Page 13, line 15 explicitly refers to the "rupture" of the core-shell.
- 2.2 Claims 2-6 correspond to Claims 5-9 as originally filed.
- 2.3 In summary, the amendments meet the requirements of Article 123(2) EPC.

3. *Clarity and sufficiency*

According to Article 84 EPC, "The claims shall define the matter for which protection is sought. They shall be clear and concise and supported by the description."

- 3.1 According to the decision under appeal, furthermore, where the characterizing part of Claim 1 is a functional feature directed to a result to be achieved, the requirements of Article 84 EPC are met only if the person skilled in the art knows, without exceeding his

normal skills and knowledge, what he has to do (Reasons for the decision, point 5). In other words, the functional feature must not only be such that the skilled person can understand it, but he must also be able to implement it.

3.2 In the Board's view, whilst in relation to the claim itself, the former requirement (understanding) is one of clarity and the latter (implementation) one of support, both in the sense of Article 84 EPC, the latter viewed in relation to the disclosure as a whole, is also highly relevant to the question of sufficiency in the sense of Article 83 EPC (see T 409/91 OJ EPO 1994, 653, Reasons, points 3.3 to 3.5).

3.3 In the present case, the characterising part of Claim 1 is a functional feature which consists of a process step defined by the result which is aimed at, ie the core-shell particles are neutralized such that the core swells, ruptures the shell and so forms particles containing a microvoid in the core and at least one channel connecting the microvoids to the exterior of the particle.

3.4 A person skilled in the art would understand that, in the process of Claim 1, a relatively acid-rich core polymer is encapsulated with a relatively hydrophobic shell, and the core-shell particles so formed are then swollen by subjecting the particles to a base that permeates the shell and neutralizes the acid of the core, thereby causing the neutralized core to absorb water and to swell to such an extent that the pressure produced in the core causes a "rupture" of the shell. In this context, the passage on page 6, lines 18-22 refers to an "explosion". The "rupture" or "explosion"

causes at least one channel to form from the core through the shell to the exterior of the particle.

3.5 The decisive question for the issues of support (Article 84 EPC) and sufficiency (Article 83 EPC) is whether the disclosure in the application in suit contains sufficient information for the skilled person to perform the characterizing process step across a broad range of core-shell polymers without undue burden.

3.6 On page 11, lines 28-31, it is stated that in the process of the invention several parameters that can be varied are (i) the thickness of the shell, (ii) the 'softness' of the shell, (iii) the acid level of the core, (iv) the permeability of the shell to the swelling agent, and (v) the exposure time and temperature of the particles to the swelling agent.

The decision under appeal considered this list of parameters as a mere recitation of all possible parameters which could play a role in the process of channel formation without providing a complete technical teaching in such a complex process. The Board does not share this view because there is more technical information in the application as filed indicating how individual parameters can be influenced in order to reach the desired result.

3.6.1 As regards the thickness of the shell (i), it is disclosed in the application that it is preferable to use a thin shell which will more readily "explode" on neutralization (page 10, lines 29-31). Conversely, a thicker shell would be detrimental to the formation of the desired particles.

3.6.2 Concerning the 'softness' of the shell (ii), it is stated on page 11, lines 17-19 that, "if the glass transition temperature (T_g) of the core or shell is above standard ambient temperature, it may be necessary to heat the core-shell polymers above their T_g , or to add a solvent to soften the polymer particles, to effect swelling". On page 11, lines 23-24 it is stated that "The degree of swelling is also dependent on the hardness of the shell". These two passages are a clear indication to a skilled person that a 'softer' shell facilitates higher degrees of swelling.

3.6.3 With regard to the acid level of the core (iii), it is further disclosed on page 11, lines 20-22 that the required time of exposure to the swelling agent is related to the acid content of the core, ie that "the greater the acid content, the faster the degree of swelling and therefore the less the time". If the acid content is low, the temperature can be increased to facilitate swelling (page 11, lines 22-23). A skilled person can learn from this passage that there is a relationship between the acid level in the core and the rate of swelling. Implicitly this means that higher swelling of the core will lead to earlier rupture of the shell.

3.6.4 As can be seen from page 10, lines 8 to 23, the monomers used and the relative proportions thereof determine the permeability of the shell (iv) to the swelling agent. It is in particular the content of acid monomers in the shell that assures the permeability of the shell to a base swellant.

3.6.5 Table 1 in the application (page 14) demonstrates the effect of exposure time and temperature (v) on the

ammonia neutralization of the core-shell particles of Example 1. The data clearly show that the core-shell particles start exploding and releasing core acid into the supernatant liquid only after reaching a certain degree of swelling (for the particles of Example 1 > 1.9 g H₂O/g of polymer). Before this degree of swelling has been reached, no core acid is detected in the supernatant liquid, ie the shell of the particle has not yet ruptured. The variation of time and temperature in Table 1 shows that these two parameters influence the degree of swelling.

3.6.6 Finally, Comparative Example 4 describes the formation of core-shell particles having a microvoid in the centre and complete shells (page 17, lines 23-27). Example 5, apparently a repeat of Comparative Example 4 without a crosslinking monomer in the shell polymer, demonstrates the formation of channels in the shell (page 19, lines 1-2). A skilled person would learn from a comparison of these two examples that a crosslinked shell inhibits the swelling of the particle and is detrimental to the formation of the required channels.

3.6.7 Thus, there is both explicit and implicit disclosure in the application in suit which demonstrates how the relevant parameters can be varied in order to achieve the desired result.

3.7 The view, expressed in the decision under appeal, that the application in suit should contain an analysis of each of the factors involved in the process of Claim 1 or at least a discussion of the experimental results is not convincing, since it is clear, once the intention of "exploding" the shell has been disclosed and the relevant factors such as shell thickness, permeability,

etc. have been identified, that the direction of variation of each of these factors so as to facilitate the rupture of the shell on swelling is self-evident. Thus, the criticism in the decision under appeal that "the application provides the basis only for a series of unguided, random experiments" is, in the Board's view, not justified.

3.8 Summing up, the Board is of the opinion that the description contains enough technical information to perform the claimed process over a broad range of core-shell polymers without undue burden. Therefore, the functional feature in Claim 1 meets the requirement of support of Article 84 EPC as well as of sufficiency of Article 83 EPC.

3.9 Since, furthermore, the concept of an "explosion" is itself readily understandable and, in the context of the instructions given, provides a clear idea of what is to be implemented, the functional feature in Claim 1 is clear in the sense of Article 84 EPC.

Hence Claim 1 fully meets the requirements of Articles 83 and 84 EPC.

The same conclusion applies to Claims 2 to 6.

4. *Novelty*

The decision under appeal raised the question whether the rupture of the shells and the subsequent formation of channels occurred at least to a certain degree inherently in the prior art.

Whilst the presence of channels is indeed not expressed

verbatim in the available prior art, in particular in D1, a person skilled in the art knows that a passage must inherently exist in the sheaths of the particles formed in D1. This is because the person skilled in the art knows that the particles of D1 dry by volatilization, thereby rendering them opaque; this is why such particles are used as pigments in paints, for example as disclosed on page 12, lines 21 to 34, and page 13, lines 25 to 29. Further, a person skilled in the art knows that volatilization can only take place because the sheath is **permeable** to the water held in the microvoid. For the sheath to be permeable, it must contain passages through which the water can pass and which must extend from the microvoid interior to the exterior surface of the sheath. By defining the sheath as permeable, this clearly implies the presence of passages of some kind that extend from the microvoid interior to the exterior surface of the sheath. That such passages are present in the dried state is evident to a person skilled in the art because the particles dry when exposed to normal atmospheric conditions and so are rendered opaque. Without the sheath being permeable, the water held within the microvoid of a particle which is used, for example, in a paint would not dry and so would not be rendered opaque.

For the reasons given above, it appears that the particles formed in D1 that dry by volatilization, so being permeable to water, must contain passages that extend from the exterior surface of the sheath/shell to the interior microvoid. Therefore, the decisive question will be whether, for the formation of such passages some kind of rupture of the shell must inevitably take place, and, hence, whether Claim 1 in fact defines a process different from the prior art.

No decision was, however, taken by the Examining Division on the issue of novelty. In order not to deprive the Appellant of a level of jurisdiction in this matter, which, for the reasons given, would appear to require the clarification of certain points of fact, the Board has decided to make use of its powers under Article 111(1) EPC to refer the case back to the first instance to enable this question and that of inventive step to be determined.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance for further prosecution on the basis of the set of Claims 1 to 6 filed on 6 November 2001.

The Registrar:

The Chairman:

E. Görgmaier

R. Young