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D E C I S I O N
of 21 April 1999

Case Number: T 0672/96 - 3.3.3

Application Number: 87310371.7

Publication Number: 0273582

IPC: C08J 5/18

Language of the proceedings: EN

Title of invention:

Microporous materials incorporating a nucleating agent and methods for making same

Patentee:

MINNESOTA MINING AND MANUFACTURING COMPANY

Opponent:

Akzo Nobel Faser AG

Headword:

-

Relevant legal provisions:

EPC Art. 54, 84, 111, 123(3)

Keyword:

Main request: "Novelty (no) - prior disclosure - implicit features"

First auxiliary request: "Clarity (no) - functional definition corresponding to the core of the invention"

Second auxiliary request: "Novelty (yes) - use claim following G 0002/88"

Decisions cited:

G 0002/88

Catchword:



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Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number: T 0672/96 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 21 April 1999

Appellant: MINNESOTA MINING AND MANUFACTURING COMPANY
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Respondent: Akzo Nobel Faser AG
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Representative: -

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 5 June 1996
revoking European patent No. 0 273 582 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: C. Gérardin
Members: A. Däweritz
J.-C. De Preter

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 273 582 in respect of European patent application No. 87 310 371.7, filed on 25 November 1987 and claiming priority of 11 December 1986 of an earlier application in the United States of America (940731), was published on 28 April 1993 (Bulletin 93/17) on the basis of 16 claims.

Claim 1 as granted reads as follows:

"A method of making a microporous article, comprising the steps of:

melt blending to form a mixture comprising 15 to 80 parts by weight of crystallizable thermoplastic polymer, 0.1 to 5 parts by weight of nucleating agent per 100 parts by weight of said thermoplastic polymer, and 85 to 20 parts by weight of a compound with which said thermoplastic polymer is miscible and in which said thermoplastic polymer will dissolve at the melting temperature of said thermoplastic polymer but which will phase separate on cooling to a temperature at or below the crystallization temperature of said thermoplastic polymer;

forming a shaped article of the melt blended mixture;

cooling said shaped article to a temperature at which said nucleating agent initiates said crystallization sites within said thermoplastic polymer so as to cause phase separation to occur between said

compound and said polymer, thereby providing an article comprising an aggregate of a first phase comprising particles of crystallized thermoplastic polymer in a second phase comprising said compound with adjacent thermoplastic polymer particles being distinct but having a plurality of zones of continuity, wherein said particles have a size which is reduced as compared to the size said particles would have if no nucleating agent were present; and

stretching said shaped article in at least one direction to separate adjacent particles of thermoplastic polymer from one another to provide a network of interconnected micropores therebetween and to permanently attenuate the thermoplastic polymer in said zones of continuity to form fibrils."

Claim 10 as granted reads as follows:

"A microporous material comprising 15 to 80 parts by weight of crystallizable thermoplastic polymer, 0.1 to 5 parts by weight of a nucleating agent which is capable of inducing crystallization of said thermoplastic polymer per 100 parts per weight of said thermoplastic polymer, and 85 to 20 parts by weight of a compound with which said thermoplastic polymer is miscible and in which said thermoplastic polymer will dissolve at the melting temperature of said thermoplastic polymer but will phase separate on cooling to a temperature at or below the crystallization temperature of said thermoplastic polymer, said microporous material having an internal structure characterized by a multiplicity of spaced, randomly dispersed, non-uniform shaped, equiaxed

particles of said thermoplastic polymer coated with said compound, adjacent coated particles throughout said material being separated from one another to provide said material with a network of interconnected micropores and said adjacent thermoplastic polymer particles being connected to each other by a plurality of fibrils consisting of said thermoplastic polymer, said particles containing enough of said nucleating agent such that the size of said particles is reduced over the size said particles would have if no nucleating agent were present."

Claims 2 to 9 and Claims 11 to 16 concern preferred embodiments of the method according to Claim 1 and the material according to Claim 10, respectively.

II. On 28 January 1994, a Notice of Opposition was filed in which revocation of the patent in its entirety on the grounds of lack of patentability within the meaning of Article 100(a) EPC was requested.

The objections raised were based on 7 documents, one of which allegedly anticipated the subject-matter claimed in the patent in suit. Lack of inventive step within the meaning of Article 56 EPC was asserted with respect to the other citations.

In a further submission dated 21 March 1996, reference was additionally made to

D8: US-A-4 539 256

as representing the closest state of the art.

III. In oral proceedings held on 7 May 1996, the issue of novelty was discussed on the basis of this document. In that respect the reference to D1 in the minutes appears to be erroneous having regard to the cited passages of the document.

IV. By decision announced orally on 7 May 1996 and issued in writing on 5 June 1996, the Opposition Division revoked the patent.

i) In substance, the Opposition Division took the view that the subject-matter of the independent claims of the two requests under consideration, i.e. a main request based on the set of claims as granted and an auxiliary request based on 16 claims submitted during oral proceedings, was not novel over D8, in particular in view of Claim 1 in conjunction with column 6, lines 23 to 26 of the citation.

ii) In view of this finding, the Opposition Division did not consider the question of inventive step.

V. On 24 July 1996, a Notice of Appeal was lodged by the Proprietor (Appellant) against this decision. The prescribed fee was paid in due time.

i) In the Statement of Grounds of Appeal filed on 14 October 1996 and in an additional letter received 29 July 1997, the Appellant disputed the above conclusion. The argument of the Appellant focussed essentially on the meaning of the term "nucleating agent" deemed to relate in D8 and in the patent in suit to different chemical compounds

fulfilling different technical functions.

To support its arguments, it additionally referred to

D10: C.C. Carroll, Modern Plastics, September 1984, pages 108 to 112,

according to which the purpose of a conventional additive was to (a) improve the physical and mechanical properties of the polymer, (b) allow faster processing, (c) obtain a more uniform microstructure because of the reduced size of spherulites, and (d) increase transparency of the polymer. In the patent in suit, by contrast, an entirely new effect was taught, viz. to alter the formation of microporous material.

- ii) Together with the Statement of Grounds of Appeal, the Appellant submitted a new main request and three auxiliary requests I to III which were later amended in the submission received on 29 July 1997.
 - iii) In a further letter received on 22 March 1999, four additional auxiliary requests IV to VII were submitted. In some of them, the independent claims were drafted as use claims.
- VI. In its counterstatements, the Respondent (Opponent) supported the views of the Opposition Division substantially as follows:
- i) As in the prior art, the properties of the polymer

were modified in the patent in suit by using a nucleating agent, viz. the crystallization of the polymer and hence the size of its spherulites.

- ii) The wording of D8 did not suggest that the method of incorporating the nucleating agent into the polymer before the polymer was fed to the extruder was different in D8 and in the patent in suit (D8, column 6, line 18: "blended"; patent in suit, page 12, line 6: "dry blended").

 - iii) In order to obtain a nucleating effect in a given system comprising a polymer and further components, a person skilled in the art would select only such a compound known to act as a nucleating agent with the polymer, of which he could expect that it would have the same capability in the considered system.
- VII. Oral proceedings were held on 21 April 1999.
- i) The Appellant withdrew all its requests on file and submitted the following five requests:
 - 1. The main request is based on the set of claims as granted.

 - 2. Auxiliary request I differs from the Main request in that at the end of Claim 1 the following further feature is added: "; said article having an increased number of fibrils per unit volume as compared to the number of fibrils in case no nucleating agent were present." In Claim 10 the same

feature is added which differs from the above wording by the word "and" inserted after the semicolon.

3. Claim 1 of auxiliary request II reads as follows:

"Use of a nucleating agent as an additive in a melt-blended mixture comprising 15 to 80 parts by weight of crystallizable thermoplastic polymer and 85 to 20 parts by weight of a compound with which said thermoplastic polymer is miscible and in which said thermoplastic polymer will dissolve at the melting temperature of said thermoplastic polymer but which will phase separate on cooling to a temperature at or below the crystallization temperature of said thermoplastic polymer, in a method for increasing the number of fibrils per unit volume of a microporous article, whereby the nucleating agent is added in an amount of 0.1 to 5 parts by weight of nucleating agent per 100 parts by weight of said thermoplastic polymer, said method comprising the steps of:

C melt-blending said thermoplastic polymer, said compound and said nucleating agent;

C forming a shaped article of the melt blended mixture;

- C cooling said shaped article to a temperature at which said nucleating agent initiates said crystallization sites within said thermoplastic polymer so as to cause phase separation to occur between said compound and said polymer, thereby providing an article comprising an aggregate of a first phase comprising particles of crystallized thermoplastic polymer in a second phase comprising said compound with adjacent thermoplastic polymer particles being distinct but having plurality of zones of continuity, wherein said particles have a size which is reduced as compared to the size said particles would have if no nucleating agent were present; and

- C and stretching said shaped article in at least one direction to separate adjacent particles of thermoplastic polymer from one another to provide a network of interconnected micropores therebetween and to permanently attenuate the thermoplastic polymer in said zones of continuity to form fibrils."

Claims 2 to 9 concern preferred embodiments of the use according to Claim 1.

- 4. Auxiliary requests III and IV are based on the main request with the limitations of the thermoplastic polymer to polypropylene, and - in auxiliary request IV - additionally of

the particle size to 2 μm or less.

ii) The Appellant emphasised its previous submissions and based its main arguments to support all its requests essentially on the following assertions:

1. The nucleating agent in D8 was a conventional additive not intended to have any function in the TIPS (Thermally Induced Phase Separation) process as defined in Claim 1 of the main request. According to lines 18 and 19 in column 6, the additive could be used in limited quantity so as not to interfere with the formation of the microporous material, i.e. not to have any effect during the TIPS process and not to bring about any changes in the formation of the microporous material.

This was contrary to the present invention in which a nucleating agent was selected for a particular two-component system comprising a polymer and a compound miscible therewith in order to interact with these two components in the method of making a microporous article.

2. The nucleating agent in D8 was selected in accordance with the polymer without consideration of the TIPS process. According to column 6, lines 17 to 19 of D8, the conventional additives could be blended into the polymer. In column 5, line 16 to column 6, line 9 the polymer and its use in

a TIPS process were considered separately.

3. The nucleating agent in D8 was intended to have effects only on the polymer (cf. column 6, lines 17 and 18), as known for nucleating agents used in polymer alone, such as improvements of clarity etc. Typical conventional additives for polymers were referred to e.g. in

D9: Ullmanns Enzyklopädie der technischen Chemie, 4. Auflage, Band 19, Verlag Chemie, Weinheim, 1980, pages 202 and 203.

4. A nucleating agent for a polymer was different from a nucleating agent for a combination comprising a polymer and a miscible compound. This was evident from the experimental results accompanying the letter dated 30 April 1996, resubmitted with the Statement of Grounds of Appeal, demonstrating that a typical nucleating agent for polypropylene (DBS, dibenzylidene sorbitol) well-known e.g. from D10 was not suitable for the polymer/compound mixture according to the patent in suit. A selection along the lines disclosed on page 21 of the patent in suit, line 37 *et seq.* had to be made.

In view of the fact that not all nucleating agents were suitable, the nucleating agent was defined in functional terms in the

present claims.

5. In Example 4 of D8, only insufficient fibril formation was found so that the sheet formed failed while in Examples 10 and 11 of the patent in suit, which differed therefrom by the addition of a nucleating agent, microporous films could be successfully made.
6. D8 did not provide any information that a proper selection of a nucleating agent was necessary.

iii) The Respondent contradicted the Appellant's assertions along the lines of its written submissions.

1. In particular, it emphasised that compounds had in fact to show the known desired effect of a nucleating agent to qualify as a nucleating agent. Different new effects of a nucleating agent were not disclosed in the patent in suit.
2. Although the Appellant emphasized that different classes of compounds should be used, the patent in suit indicated on page 7, lines 19 to 26 that the well known nucleating agents could be used.

3. According to page 4, lines 29 to 30 a greater number of crystallization sites was initiated by the nucleating agent, which concurred with the facts reported in D9 and D10.
4. Column 6, lines 18 to 20 of D8 did not state that the additive did not have any effect, but that it was not to interfere with the formation of the microporous material. This expression meant according to some dictionaries that it did not adversely affect (prevent) such formation.
5. Auxiliary request II offended against Article 123(3) EPC because the use of a nucleating agent related to a subject-matter different from the originally claimed method of making a microporous article.

VIII. The Appellant requested that the decision under appeal be set aside and that the patent be maintained as granted according to the main request, submitted in the oral proceedings, or alternatively on the basis of one of the auxiliary requests, submitted in the oral proceedings.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request*
 - 2.1 D8 was unanimously considered by both parties as representing the closest state of the art. The Board concurs with this assessment.
 - 2.2 According to its Claim 1, D8 relates to "A method of making a microporous article, comprising
 - (a) melt blending to form a solution comprising 30 to 80 parts by weight of crystallizable thermoplastic polymer with 70 to 20 parts by weight of a compound with which said thermoplastic polymer is miscible and in which said thermoplastic polymer will dissolve at the melting temperature of said thermoplastic polymer but which will phase separate on cooling to a temperature at or below the crystallization temperature of said thermoplastic polymer;
 - (b) forming a shaped article of the melt blended solution;
 - (c) cooling said shaped article to a temperature at which said thermoplastic polymer crystallizes to cause phase separation to occur between said compound and said polymer thereby to provide an article comprising an aggregate of a first phase comprising particles of crystallized thermoplastic polymer in a second phase comprising said compound with adjacent thermoplastic polymer particles being distinct but having a plurality

of zones of continuity; and

(d) orienting said article at least in one direction to separate adjacent particles of thermoplastic polymer from one another to provide a network of interconnected micropores therebetween and to permanently attenuate the thermoplastic polymeric material in said zones of continuity to form fibrils."

Claim 14 of D8 reads: "A microporous material comprising about 30 to 80 parts by weight of crystallizable thermoplastic polymer and about 70 to 20 parts by weight of a compound with which said thermoplastic polymer is miscible and in which said thermoplastic polymer will dissolve at the melting temperature of said thermoplastic polymer but will phase separate on cooling to a temperature at or below the crystallization temperature of said thermoplastic polymer, said microporous material having an internal structure characterized by a multiplicity of spaced, randomly dispersed, non-uniform shaped, equiaxed particles of said thermoplastic polymer coated with said compound, adjacent coated particles throughout said material being separated from one another to provide said material with a network of interconnected micropores and said adjacent thermoplastic polymer particles being connected to each other by a plurality of fibrils consisting of said thermoplastic polymer."

2.3 Claims 1 and 10 of the patent in suit and Claims 1 and 14 of D8 show a number of common features:

2.3.1 All these claims refer to a "crystallizable thermoplastic polymer" in general.

- 2.3.2 Moreover, the definitions of the miscible compound are worded identically: "with which said thermoplastic polymer is miscible and in which said thermoplastic polymer will dissolve at the melting temperature of said thermoplastic polymer but (which) will phase separate on cooling to a temperature at or below the crystallization temperature of said thermoplastic polymer".
- 2.3.3 The amounts of the polymer and the miscible compound overlap to a large extent (30 to 80 parts by weight of the polymer and 70 to 20 parts by weight of the compound in D8 / 15 to 80 parts by weight of the polymer and 85 to 20 parts by weight of the compound in the patent in suit).
- 2.3.4 In both D8 and in the patent in suit identical steps are carried out: (a) a mixture (solution) comprising the thermoplastic polymer and the miscible compound is formed by melt-blending, (b) a shaped article is formed therefrom, (c) the article is cooled to induce crystallization and phase separation of the polymer and (d) stretching/orienting the shaped article.
- 2.3.5 These facts have not been disputed by the parties. None of these features can serve to establish novelty over the method as specified in the claims of D8.
- 2.4 The issue of novelty thus boils down to the question whether the presence of a nucleating agent, which is mandatory according to the wording of the independent claims, represents a distinguishing feature over the disclosure of D8.

2.4.1 It has not been disputed by the parties that the term "nucleating agent" is to be interpreted as a functional definition of the additive.

2.4.2 In D8, reference is made to the presence of conventional additive materials, such as nucleating agents (column 6, lines 17 to 26). "The amount of additive is typically less than 10% of the weight of the polymer component, preferably less than 2% by weight." This has not been disputed by the parties either.

2.5 However, the parties take different views about the meaning of "nucleating" agent as mentioned in this passage.

2.5.1 The Appellant bases its arguments on the indication (column 6, lines 18 to 21) that "the polymer may include blended therein certain conventional additive materials", such as a nucleating agent. In its view, this implies that the nucleating agent would be selected only with respect to the polymer in order to modify its properties, irrespective of the other component or the features of further processing. Moreover, the "conventional" nucleating agent should not interfere with the formation of the microporous material, whilst the patent in suit requires for each combination of polymer and miscible compound to select a particular nucleating agent capable of inducing crystallization of the polymer as explained on page 21, line 37 *et seq.* In other words, the Appellant interprets the term "not to interfere" as the requirement that no changes should be caused by the presence of the conventional component.

2.5.2 Relying on the functional definition of nucleating agents accepted by the Appellant, the Respondent refers to page 7, lines 19 to 26 and page 4, lines 28 to 30 of the patent specification to support its view that no specific choice has to be made amongst the known conventional nucleating agents as long as they act in their normal way. The definition of a compound as nucleating agent requires that it initiates a greater number of crystallization sites which causes the formation of smaller uniform crystallites or spherulites (cf. D9 and D10). Consequently, the passage in D8 "not to interfere" can only be interpreted as not to prevent or adversely affect crystallization.

2.6 In the Board's view, a proper interpretation of the critical passage of D8 would also require the following considerations:

2.6.1 The functional term "nucleating agent" can only be attributed to a specific compound on an empirical basis for a given system. The passage on page 21, line 27 *et seq.* of the patent specification gives an example for testing the suitability of a compound for this purpose. A compound qualifies as a nucleating agent suitable for a given system only if it gives rise to the effects which a skilled person would normally expect. Such typical effects are, in particular, a high number of small spherulites in homogeneous size distribution (D9, page 203, left column, last paragraph) or "more uniform microstructure because of the reduced size of spherulites" (D10, page 108, middle column, lines 5 to 7).

2.6.2 Obviously, these effects depend not only on the polymer

and the selected "nucleating agent", but also on other factors, such as the presence of further components. This has been convincingly demonstrated by the Appellant in Examples 19 to 29 of the patent in suit and in the experimental data dated 30 April 1996 based on different combinations of components, all of which are within the scope of the claims of the main request, e.g. Claims 13 and 16. In a system comprising polypropylene and dioctyl phthalate (DOP), the additive "dibenzylidene sorbitol" (DBS) does not function as a nucleating agent, whereas it does in a system comprising a mineral oil instead of DOP.

2.6.3 This was also confirmed by the inventor during oral proceedings, who explained that films can be made with all kinds of "nucleating agents" (irrespective whether they satisfy the definition as used by the Appellant or the definition as used by the Respondent) and that all these films are normally clear. Only upon stretching the films which comprise a nucleating agent in accordance with the main request turn opaque and micropores are formed. Evidence of this effect was provided during the oral proceedings.

2.6.4 There has been no dispute between the parties that in D8 as well as in the impugned patent, in the first step, a melt-blended mixture or solution is prepared which comprises the polymer and the miscible compound. The term "miscible" as well as the reference to phase separation upon cooling (in the subsequent processing step) in both specifications can only mean that the said melt-blended mixture or solution forms one single phase, i.e. it is homogeneous. According to Hackh's Chemical Dictionary, Fourth Edition, New York, McGraw-

Hill Book Company, 1972, page 432, "**miscible**" has the meaning of being "Capable of mixing or dissolving at all proportions".

It follows that the Appellant's interpretation that in D8 the "nucleating agent" is supposed to modify the polymer only, but not to have any interaction with the mixture as a whole in further processing, cannot be accepted. Therefore the Board comes to the conclusion that the requirement in D8 that the additive should not "interfere" with the formation of the microporous material can only mean that it should not adversely affect crystallization.

2.6.5 For these reasons, it is concluded that the additional references in Claim 1 of the main request to initiation of crystallization and to reduced particle size concern features encompassed by the normal meaning of the functional definition "nucleating agent". These features, consequently, cannot represent objective differences over the method disclosed in D8.

2.7 This finding is valid for both the method according to Claim 1 and the microporous material according to Claim 10. Consequently, the subject-matter of these claims is not novel over D8 within the meaning of Article 54(2) EPC, and the main request must therefore be rejected.

3. Auxiliary request I

In auxiliary request I, method Claim 1 differs from the corresponding claim of the main request by an additional feature of the product to be obtained ("said

article having an increased number of fibrils ..."). As the claim does not differ from the main request in terms of its process features, the additional feature must be regarded as an attempt to define the method by the result to be achieved. Since this result is not a property which a skilled person would know how to adjust without inventive contribution, as it corresponds to the core of the invention, the formulation of the claim must be regarded as unclear (Article 84 EPC).

Consequently, auxiliary request I must be rejected.

4. *Auxiliary request II*

4.1 Article 123(2) EPC

The additional feature in Claim 1 of auxiliary request II ("for increasing the number of fibrils per unit volume") finds its support on page 7, lines 7 and 8 of EP-B-0 273 582, corresponding to the last three lines on page 14 of the application as originally filed. Thus, the requirements of Article 123(2) EPC are met.

4.2 Article 123 (3) EPC

Auxiliary request II is directed to the use of a nucleating agent in a certain mixture which is processed in a specific way for increasing the number of fibrils per unit volume of the product.

According to decision G 2/88, this claim relates to a physical activity. It is similar in this respect to a

process or method claim. The starting compounds and the process features to be applied thereto are those specified in Claim 1 of the patent as granted.

Moreover, the claim is further limited by an additional feature concerning a technical effect which in accordance with decision G 2/88 should be interpreted in the use claim as including that technical effect as a functional technical feature.

Therefore, the scope of Claim 1 of auxiliary request II is narrower than that of Claim 1 of the patent in suit as granted and, consequently, this request complies with Article 123(3) EPC.

- 4.3 From the above considerations it follows that the feature "for increasing the number of fibrils per unit volume of a microporous article" is to be interpreted as defining a technical feature of the use claimed and is thus not objectionable under Article 84 EPC.
- 4.4 This feature is not derivable from the disclosure of D8. Therefore, novelty of Claim 1 over D8 is acknowledged in accordance with the above decision.
- 4.5 Claims 2 to 9 relate to preferred embodiments of the use as defined in Claim 1, they contain all limitations of that claim and therefore the above finding is valid for them as well.
- 4.6 Having regard to these findings, auxiliary request II meets the requirements of Articles 54(1) and (2), 84 and 123(2) and (3) EPC.

5. Although the Appellant requested the grant of a patent on the basis of auxiliary request II, this request cannot be granted, since the issue of inventive step has not been examined yet. To that end the Board makes use of its power pursuant to Article 111(1) EPC and remits the case to the Opposition Division for further prosecution.

6. In view of the above conclusion there is no need to consider the auxiliary requests III and IV.

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 auxiliary request II submitted during the oral proceedings.

The Registrar:

The Chairman:

E. Görgmaier

C. Gérardin