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D E C I S I O N
of 16 July 2002

Case Number: T 0641/99 - 3.3.3

Application Number: 94114621.9

Publication Number: 0644207

IPC: C08F 8/00

Language of the proceedings: EN

Title of invention:

Superabsorbent polymer having improved absorption rate and absorption under pressure

Patentee:

STOCKHAUSEN LOUISIANA LIMITED

Opponent:

BASF Aktiengesellschaft, Ludwigshafen

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Novelty (yes) - implicit disclosure (no)"
"Inventive step (main request) (no) - (auxiliary request 1)
(yes) - problem and solution"

Decisions cited:

T 0185/88, T 0793/93, T 0038/96

Catchword:

-



Case Number: T 0641/99 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 16 July 2002

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Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 25 March 1999 and
issued in writing on 20 April 1999 revoking
European patent No. 0 644 207 pursuant to
Article 102(1) EPC.

Composition of the Board:

Chairman: R. Young
Members: A. Däweritz
J. Van Moer

Summary of Facts and Submissions

I. The grant of European patent No. 0 644 207 in respect of European patent application No. 94 114 621.9 filed on 16 September 1994 and claiming the priority of 17 September 1993 of an earlier application in the United States of America (123561), was announced on 2 January 1997 (Bulletin 1997/01) on the basis of 28 claims.

Claim 1 as granted read as follows:

"1. A superabsorbent polymer preparable by the process comprising the steps of:

(a) providing a solution containing carboxylic acid monomers or water soluble salts thereof, and a crosslinking agent;

(b) adding a carbonate blowing agent and a polymerization initiator, individually or in combination, to the solution to form a carbonated monomer solution;

(c) polymerizing the carbonated monomer solution at temperatures ranging from about 0°C to about 130°C to form a microcellular hydrogel;

(d) chopping or grinding the microcellular hydrogel into gel pieces having a particle diameter ranging from about 0.1 mm to about 5.0 cm;

(e) drying the gel pieces at temperatures ranging from about 85°C to about 210°C;

(f) grinding the pieces to form a polymer having a particle size of from about 0.05 mm to about 5.0 mm;

(g) mixing 100 parts by weight of the polymer with about 0.001 to about 30 parts by weight of a surface crosslinking agent; and

(h) reacting the polymer with the surface crosslinking agent to crosslink molecular chains existing on a surface of the polymer, forming the superabsorbent polymer."

Independent Claim 14 related to a "method of making a superabsorbent polymer having improved absorption under pressure and improved absorption rate when absorbing aqueous body fluids", wherein the method comprised the above steps (a) to (h) in identical wording.

Independent Claim 27 concerned a "method of improving the absorption under pressure of a superabsorbent polymer", wherein the method identically comprised the above steps (a) to (h) and a further step

"(i) exposing the superabsorbent polymer to aqueous body fluids, the superabsorbent polymer being under exertion of pressure."

The remaining claims were dependent claims, of which Claims 2 to 13 concerned preferred embodiments of the polymer of Claim 1, Claims 15 to 26 related to specific elaborations of the method according to Claim 14 and the method according to Claim 27 was further specified in Claim 28.

II. On 1 October 1997, a Notice of Opposition was filed in which revocation of the patent in its entirety was requested on the grounds of lack of novelty within the meaning of Articles 54(1) and (2) EPC and lack of inventive step within the meaning of Article 56 EPC.

The objections were supported initially by nine documents, and three further documents were cited by the Opponent in the course of the opposition procedure. Among the initially cited documents, the following were deemed by the Opposition Division to be of particular relevance:

D1: EP-B-0 248 963,

D2: EP-A-0 538 983,

D4: DE-C-40 20 780.

A further citation considered in detail under Articles 54(3) and (4) EPC by the Opposition Division was

D10: WO-A-95/02002.

III. By decision announced orally on 25 March 1999 and issued in writing on 20 April 1999, the Opposition Division acknowledged novelty of the subject-matter of the patent as granted (main request) or as amended (according to two auxiliary requests, see next paragraph) in particular with respect to these four documents, but revoked the patent for the reason of lack of inventive step in the sense of Article 56 EPC in view of a combination of the teachings of D1, D2 and D4.

The first auxiliary request referred to the same subject-matter as the main request with the exception that the particle diameter of the microcellular hydrogel chopped or ground in step (d) was limited to a range of from 10 mm to 5.0 cm. The second auxiliary request was restricted to the method of preparing the superabsorbent polymer and the method of improving the absorption under pressure of the superabsorbent polymer.

- IV. With effect from 31 May 1999, the ownership of the patent in suit was transferred to Stockhausen Louisiana Limited (Rule 20 EPC).

- V. On 21 June 1999, a Notice of Appeal was lodged by the Patentee (Appellant) against this decision with simultaneous payment of the prescribed fee.

In the Statement of Grounds of Appeal filed on 30 August 1999, the Appellant requested that the above decision be set aside and that the patent in suit be maintained as granted or, as an auxiliary request, based on an amended set of claims submitted therewith. According to the auxiliary request, the set of claims was limited to the subject-matter of Claims 14 to 28 as granted.

In order to support its case, further experimental data were filed (Annexes 1/1 to 2/4). Therein, Example 1 of the patent in suit was supplemented with a new Sample 6, carried out with the use of both sodium carbonate as a blowing agent and ethylene carbonate as a surface crosslinking agent according to the claimed subject-matter, and a further comparative Sample 5 carried out with the blowing agent but without surface crosslinking

treatment. Example 3 of the patent in suit was supplemented with comparative Samples 7 and 8 describing polymers prepared without blowing agents, whereby glycerol was used as a surface crosslinking agent in Sample 8. The samples were characterised in two tables (Tables 1 and 3) by their properties such as swelling rates, gel strengths, absorption capacities, absorption values under pressure (**AUP**) and the absorption permeabilities under pressure of the already swollen polymer for additional liquids still to be absorbed (**APUP**). In the description of the examples, further details of the process used and a method of determining the APUP were given.

In substance, the Appellant argued essentially as follows:

- (i) The technical problem to be solved by the patent in suit was seen in the provision of superabsorbent polymers showing a combination of excellent properties which had previously not been achieved: very good AUP, absorption rate, excellent gel strength and, in particular, an excellent APUP (page 3 of the patent in suit). The advantageous combinations of properties, including especially the APUP, were not to be expected in view of the state of the art (patent in suit: page 2, lines 30 to 36; page 3, lines 8 to 42).

- (ii) With respect to D2 as closest state of the art, which disclosed foamed superabsorbing polymers having an improved swelling rate and/or speed, the technical problem was further to improve that property and, additionally, the APUP of a

polymer already swollen. This was achieved in an unobvious way by a surface crosslinking treatment of the foamed polymers.

Due to the extremely short polymerisation time of less than 1 min with complete removal of any water or solvent, the polymers of D1 did not contain evenly dispersed gas bubbles and had therefore a completely different structure. Any CO₂ possibly derived from carbonate not used up in the neutralisation of the monomers would have been removed with the water steam and/or further solvents without any chance to form a microcellular structure.

D4 described the surface crosslinking of a superabsorbent polymer which has a structure different from that of the polymers in D2. Again, the advantageous combination of properties of the claimed polymers could not be expected.

- (iii) In any case, the improved APUP could neither be expected from any one of these documents nor from a combination thereof.

VI. In its counterstatement dated 14 August 2000, the Respondent (Opponent), on the one hand, maintained that the claimed subject-matter was not novel and, on the other hand, supported the findings of the Opposition Division as regards inventive step, and requested that the appeal be dismissed.

The Respondent argued substantially as follows:

- (i) Claim 1 related to a superabsorbent polymer defined exclusively in terms of process features (a) to (h) used in its preparation (product-by-process claim).

D1 disclosed steps (a) to (c) and (e) to (h). Only those process features which were manifest in the properties of the product could form the basis for a positive assessment of novelty of a product-by-process claim. Steps (d) and (e) of Claim 1 of the patent in suit were redundant process features which did not affect the properties of the end product claimed, but only disguised lack of novelty.

Both the process in D1 and that in the patent in suit started with a polymerisation in aqueous phase, and in both cases the water had to be removed before the product could be used as a superabsorbent, which was to be done with acceptably low consumption of energy in an acceptably short time. The patent in suit did not contain any hints as to the significance or influence of the process steps (d) and (e) on the properties of the final product.

- (ii) D10 described a superabsorbent polymer obtainable by means of a process comprising process steps (a) to (c) and (e) to (h) of the patent in suit. All its examples and comparative examples disclosed the comminution of the hydrogels prior to drying. Although the particle sizes after comminution were not disclosed, this fact could not amount to a delimiting feature, because the sizes did not affect the product as

such, but only the time necessary for drying. Moreover, after the grinding of the dried hydrogel, the particle sizes in Claim 1 of the patent in suit were in the usual range of such products as disclosed in D10.

- (iii) The problems to be solved were seen, on the one hand vis-à-vis D1, in providing a further superabsorbent polymer, and on the other hand vis-à-vis D2, in providing a superabsorbent polymer having improved properties. The solution found was obvious in view of a combination of D1 and D2, regardless of which of these documents was used as closest state of the art.

The argument that the short reaction time in D1 would prevent a microcellular structure was not convincing. Due to identical parameters and process features concerning the polymerisation, the hydrogels of D1 would have the same structure as those in D2 and in the patent in suit, otherwise the independent claims of the patent in suit would apparently not define all relevant features necessary to explain any structural differences between the products.

Moreover, since the polymers according to D2 already showed improved absorption properties in the absence of pressure, it would have been obvious to improve these properties for conditions under pressure by additionally crosslinking the surfaces of the particles in accordance with D1.

Similar arguments were raised with respect to a

combination D2 and D4. The superabsorbent polymers of D2 showed a high gel strength, high water absorption and high absorption speed, those of D4 an increased gel strength, high retention capacity and an improved absorption under pressure.

Therefore the solution of the problem underlying the patent in suit could be expected by the combination of the teachings of these documents.

- VII. By letter of 17 June 2002, the Appellant produced further arguments in support of its case and modified its previous request to be that the patent in suit be maintained as granted (main request) or, alternatively, on the basis of amended sets of claims in accordance with one of five new auxiliary requests.
- VIII. Oral proceedings were held on 16 July 2002. At the oral proceedings, the first issue considered was the novelty objection of the Respondent which was discussed on the basis of documents D1 or D10 with respect to the main request. After the decision on novelty of the main request had been announced by the Board, the Appellant withdrew all its auxiliary requests then on file and submitted new auxiliary requests 1 and 2, wherein in step (d) of each independent claim, as granted, "masticating by" had been inserted before the word "chopping".

Then the parties were given the floor to present their case with respect to inventive step of the main request and the two auxiliary requests. In their presentations, both parties referred to D2 as closest state of the art and to D4. The Appellant presented a sheet which showed

data from Tables 1 and 3 of the above Annexes 1/1 to 2/4 in a different form ("**Sheet of data**"), and the Respondent additionally raised an objection under Article 56 EPC on the basis of D2 and a document previously cited in the Notice of Opposition:

D6: EP-B1-0 450 924.

After a detailed discussion of these arguments in the light of the above data, the discussion was closed and the oral proceedings were interrupted for deliberation of the Board.

When the oral proceedings were resumed, the parties were informed by the Board that the discussion was reopened, because D6 had been published too late to be taken into account as state of the art, but that the Board had become aware that the patent application

D6a: EP-A2-0 450 924,

from which D6 was derived, had been published on 9 October 1991, ie before the effective date of the patent in suit. The Respondent argued that D6a should therefore be taken into consideration automatically instead of D6, and referred to decision T 185/88 of 22 June 1989 (abridged version published in OJ EPO 1990, 451) to support this opinion.

The oral proceedings were interrupted to give the parties the time to consider D6a in detail. When the oral proceedings were continued, the Appellant requested that the document should not be admitted under Article 114(2) EPC as being late filed. The same was requested by the Respondent with respect to two new

auxiliary requests (see below) which had been submitted by the Appellant, following the interruption, to replace its previous auxiliary requests.

After further deliberation, the Board decided to admit into the proceedings both the document D6a (Article 114(1) EPC) and, in its discretion, the two auxiliary requests of the Appellant.

IX. The new first auxiliary request ("Hilfsantrag 1") read as follows:

"1. A superabsorbent polymer preparable by the process comprising the steps of:

(a) providing a solution containing carboxylic acid monomers or water soluble salts thereof, and a crosslinking agent;

(b) adding a carbonate blowing agent and a polymerization initiator, individually or in combination, to the solution to form a carbonated monomer solution;

(c) polymerizing the carbonated monomer solution at temperatures ranging from about 0°C to about 130°C to form a microcellular hydrogel;

(d) chopping or grinding the microcellular hydrogel into gel pieces having a particle diameter ranging from about 0.1 mm to about 5.0 cm;

(e) drying the gel pieces at temperatures ranging from about 85°C to about 210°C;

(f) grinding the pieces to form a polymer having a particle size of from about 0.05 mm to about 5.0 mm;

(g) mixing 100 parts by weight of the polymer with about 0.001 to about 30 parts by weight of organic carbonates, polyquaternary amines or polyvalent metal compounds; and

(h) reacting the polymer with organic carbonates, polyquaternary amines or polyvalent metal compounds to crosslink molecular chains existing on a surface of the polymer, forming the superabsorbent polymer.

2. The polymer of claim 1 wherein the carbonated monomer solution of step (b) is an aqueous solution containing from about 20 wt. % to about 40 wt. % (meth)acrylic acid monomers consisting essentially of from 20 wt. % to 40 wt. % (meth)acrylic acid and from 60 wt. % to 80 wt. % sodium (meth)acrylate, from about 0.05 wt. % to about 2.5 wt. % blowing agent and from about 0.005 wt. % to about 2.0 wt. % crosslinking agent.
3. The polymer of claim 2 wherein the blowing agent of step (b) is a carbonate containing salt, a bicarbonate containing salt, or gaseous or solid carbon dioxide.
4. The polymer of claim 3 wherein the blowing agent is selected from the group consisting of CO_2 , Na_2CO_3 , K_2CO_3 , $(\text{NH}_4)_2\text{CO}_3$, MgCO_3 , $(\text{MgCO}_3)_4 \cdot \text{Mg}(\text{OH})_2 \cdot 5\text{H}_2\text{O}$, CaCO_3 , ZnCO_3 , and mixtures thereof.

5. The polymer of any of Claims 1-4 wherein the crosslinking agent of step (a) has at least two polymerizable double bonds, or at least one polymerizable double bond and at least one functional group reactive with the acid monomers or the water soluble salts thereof, or at least two functional groups reactive with the acid monomers or the water soluble salts thereof, or is a polyvalent metal compound.
6. The polymer of claim 5 wherein the crosslinking agent is a bis-acrylamide, a di, tri or polyester of an unsaturated mono or poly carboxylic acid polyol, a di or tri glycidyl ether of a polyol a multi-substituted allyl amine or mixtures thereof.
7. The polymer of any of Claims 1-6 wherein the polymerization initiator of step (b) is selected from the group consisting of hydrogen peroxide, sodium persulfate, azo catalysts, organic peroxides, sodium bisulfite, peracetate catalysts and mixtures thereof.
8. The polymer of any of Claims 1-7 wherein the carboxylic acid monomers of step (a) are selected from the group consisting of acrylic acid, methacrylic acid, acrylamide, methacrylamide, ethacrylic acid, alpha-chloroacrylic acid, alpha-cyanoacrylic acid, beta-methylacrylic acid, itaconic acid, citraconic acid, maleic acid, fumaric acid, maleic anhydride, vinyl sulfonic acids, allyl sulfonic acids, sulfoethylacrylate, sulfoethylmethacrylate, sulfopropylacrylate, sulfopropylmethacrylate, acrylamido N-methylene sulfonic acid, acrylamido-N-ethylene sulfonic

acid, 2-acrylamido-2-methylpropane sulfonic acid, acrylamide, methacrylamide and mixtures thereof.

9. The polymer of any of Claims 1-8 wherein the process further includes the step:
 - (i) drying the superabsorbent polymer by application of heat.
10. The polymer of any of Claims 1-9 wherein the carbonate blowing agent is added to the monomer solution no more than five minutes before the initiator is added.
11. The polymer of any of Claims 1-10 wherein the initiator is added to the monomer solution no more than fifteen minutes after the carbonate blowing agent is added.
12. A method of making a superabsorbent polymer having improved absorption under pressure and improved absorption rate when absorbing aqueous body fluids, wherein the method comprises the steps of:
 - (a) providing a solution containing carboxylic acid monomers or water soluble salts thereof, and a crosslinking agent;
 - (b) adding a carbonate blowing agent and a polymerization initiator, individually or in combination, to the solution to form a carbonated monomer solution;
 - (c) polymerizing the carbonated monomer solution at temperatures ranging from about 0EC to about

130EC to form a microcellular hydrogel;

(d) chopping or grinding the microcellular hydrogel into gel pieces having a particle diameter ranging from about 0.1 mm to about 5.0 cm;

(e) drying the gel pieces at temperatures ranging from about 85EC to about 210EC;

(f) grinding the pieces to form a polymer having a particle size of from about 0.05 mm to about 5.0 mm;

(g) mixing 100 parts by weight of the polymer with about 0.001 to about 30 parts by weight of organic carbonates, polyquaternary amines or polyvalent metal compounds and

(h) reacting the polymer with organic carbonates, polyquaternary amines or polyvalent metal compounds to crosslink molecular chains existing on a surface of the polymer, forming the superabsorbent polymer.

13. The method of claim 12 wherein the carbonated monomer solution of step (b) is an aqueous solution containing from about 20 wt. % to about 40 wt. % (meth)acrylic acid monomers consisting essentially of from 20 wt. % to 40 wt. % (meth)acrylic acid and from 60 wt. % to 80 wt. % sodium (meth)acrylate, from about 0.05 wt. % to about 2.5 wt. % blowing agent and from about 0.005 wt. % to about 2.0 wt. % crosslinking agent.

14. The method of claim 13 wherein the blowing agent of step (b) is a carbonate containing salt, a bicarbonate containing salt, or gaseous or solid carbon dioxide.
15. The method of claim 14 wherein the blowing agent is selected from the group consisting of CO_2 , Na_2CO_3 , K_2CO_3 , $(\text{NH}_4)_2\text{CO}_3$, MgCO_3 , $(\text{MgCO}_3)_4 \cdot \text{Mg}(\text{OH})_2 \cdot 5\text{H}_2\text{O}$, CaCO_3 , ZnCO_3 , and mixtures thereof.
16. The method of any of Claims 12-15 wherein the crosslinking agent of step (a) has at least two polymerizable double bonds, or at least one polymerizable double bond and at least one functional group reactive with the acid monomers or the water soluble salts thereof, or at least two functional groups reactive with the acid monomers or the water soluble salts thereof, or is a polyvalent metal compound.
17. The method of claim 16 wherein the crosslinking agent is a bis-acrylamide, a di, tri or polyester of an unsaturated mono or poly carboxylic acid polyol, a di or tri glycidyl ether of a polyol, a multi-substituted allyl amine or mixtures thereof.
18. The method of any of Claims 12-17 wherein the polymerization initiator of step (b) is selected from the group consisting of hydrogen peroxide, sodium persulfate, azo catalysts, organic peroxides, sodium bisulfite, peracetate catalysts and mixtures thereof.
19. The method of any of Claims 12-18 wherein the carboxylic acid monomers of step a are selected

from the group consisting of acrylic acid, methacrylic acid, acrylamide, methacrylamide, ethacrylic acid, alpha-chloroacrylic acid, alpha-cyanoacrylic acid, beta-methylacrylic acid, itaconic acid, citraconic acid, maleic acid, fumaric acid, maleic anhydride, vinyl sulfonic acids, allyl sulfonic acids, sulfoethylacrylate, sulfoethylmethacrylate, sulfopropylacrylate, sulfopropylmethacrylate, acrylamido N-methylene sulfonic acid, acrylamido-N-ethylene sulfonic acid, 2-acrylamido-2-methylpropane sulfonic acid, acrylamide, methacrylamide and mixtures thereof.

20. The method of any of Claims 12-19 further including the step of:

(i) drying the superabsorbent polymer by application of heat.

21. The method of any of Claims 12-20 wherein the carbonate blowing agent is added to the monomer solution no more than five minutes before the initiator is added.

22. The method of any of Claims 12-21 wherein the initiator is added to the monomer solution no more than fifteen minutes after the carbonate blowing agent is added.

23. A method of improving the absorption under pressure of a superabsorbent polymer, the method comprising the steps of:

(a) providing a solution containing carboxylic acid monomers or water soluble salts thereof, and

a crosslinking agent;

(b) adding a carbonate blowing agent and a polymerization initiator, individually or in combination, to the solution to form a carbonated monomer solution;

(c) polymerizing the carbonated monomer solution at temperatures ranging from about 0°C to about 130°C to form a microcellular hydrogel;

(d) chopping or grinding the microcellular hydrogel into gel pieces having a particle diameter ranging from about 0.1 mm to about 5.0 cm;

(e) drying the gel pieces at temperatures ranging from about 85°C to about 210°C;

(f) grinding the pieces to form a polymer having a particle size of from about 0.05 mm to about 5.0 mm;

(g) mixing 100 parts by weight of the polymer with about 0.001 to about 30 parts by weight of organic carbonates, polyquaternary amines or polyvalent metal compounds;

(h) reacting the polymer with organic carbonates, polyquaternary amines or polyvalent metal compounds to crosslink molecular chains existing on a surface of the polymer, forming the superabsorbent polymer; and

(i) exposing the superabsorbent polymer to aqueous body fluids, the superabsorbent polymer being under exertion of pressure.

24. The method of claim 23 wherein the superabsorbent polymer is contained within a diaper, an incontinence pad, a sanitary napkin or a bandage when the superabsorbent polymer is under the exertion of pressure."

Thus, in auxiliary request 1 ("Hilfsantrag 1"), features (g) and (h) in each of the independent claims have been amended by replacement of the terms "a surface crosslinking agent" and "the surface crosslinking agent", respectively, by "organic carbonates, polyquaternary amines or polyvalent metal compounds".

In auxiliary request 2 ("Hilfsantrag 2"), the corresponding amendment in each of the independent claims consisted in a limitation of the surface crosslinking agent to "organic carbonates".

The Appellant reiterated its previous arguments essentially as follows:

The technical problem underlying the patent in suit should be seen as the provision of a superabsorbent product showing an improved combination of (i) high absorbency (absorption capacity) under pressure (AUP), (ii) high absorption speeds (swell rates) under pressure and without application of pressure, (iii) high gel strength and (iv) high absorption permeability under pressure (APUP). Hitherto, the swell rates deteriorated, in general, when AUP and APUP were

improved to enhance the "dry feel", to the user, in the application of the superabsorbent polymer eg in hygienic and sanitary goods (see section V(i), above).

In support of this argument, the Appellant pointed to the experimental results in Annexes 1/1 to 2/4, in particular to Example 1 and Table 1 therein, which were not disputed between the parties. The results from the said Table 1 were shown on the said "Sheet of data" in a different form in order further to clarify the effects caused by the addition of **SCL** (surface crosslinking agent) or **BA** (blowing agent) or both during the preparation of the superabsorbent polymers. The Appellant asserted a synergistic effect caused by the use of these two agents, contrary to all expectations.

In particular, attention was directed to the reduction in swell rate associated with SCL, using ethylene carbonate as the SCL, according to Table 1 of the experimental results filed with the Statement of Grounds of Appeal, compared with the unexpected improvement of this property as well as gel strength, AUP and APUP when SCL was combined with the blowing agent technique to provide a microcellular product.

The Respondent presented essentially its previous arguments concerning its novelty objection again, and reiterated its arguments as regards inventive step on the basis of D2 as closest state of the art, D4 and D6/D6a. In particular, reference was made to Table 3 of the said Annexes 1/1 to 2/4 of the Appellant (above), to demonstrate that the swell rate was improved when crosslinking the surface of the superabsorbent by means of glycerol, ie in accordance with the disclosure of D6

or D6a. An improvement of the other properties to which the Appellant referred was expected by the skilled person anyway. Moreover, the properties of the product could not serve to support an inventive step of claims defined only in very general terms of process features. The surface treatment was taught by D4 and D6/D6a, regardless of which compound was actually used therein. Therefore, the subject-matter lacked an inventive step.

- X. The Appellant requested that the decision under appeal be set aside and that the patent be maintained in the form as granted (main request) or, in the alternative, on the basis of Claims 1 to 24 of the first auxiliary request ("Hilfsantrag 1") or of the second auxiliary request ("Hilfsantrag 2"), both filed during the oral proceedings.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Procedural Matters*
 - 2.1 During the oral proceedings, the Appellant submitted the said "Sheet of data" to further support its case. These data were based on Annexes 1/1 to 2/4 which had been submitted together with the Statement of Grounds of Appeal. Since, in the sheet, only information which had been already in the file was presented in a different form, it was admitted by the Board to the discussion.

2.2 In the course of the presentation of its case with respect to inventive step, the Respondent referred to Document D6 which had been cited in the Notice of Opposition filed on 1 October 1997 (pages 9 and 10 of the letter; viz. Example 1 of the document).

The only additional references to this document are found in the reply to the Notice of Opposition, dated 3 July 1998 (page 3), wherein the Patentee argued that D1 neither anticipated nor made obvious the claimed subject-matter and continued that this finding would also apply to a number of combinations of citations, including *inter alia* "D6 + D2 and D6 + D3", and in the decision under appeal (page 4), wherein reference was made to "D6 EP-B 450924: improvement of absorbents by surface treatment with a polyhydric alcohol."

This document did not play any role in the further proceedings before the Opposition Division or during the written proceedings before the Board.

D6 was published on 16 October 1996, ie after both the priority date and the filing date of the patent in suit. Consequently, it does not belong to the state of the art to be taken into account for the consideration of inventive step.

After having discussed this fact with the parties in the oral proceedings and after deliberation, the Board decided to take D6a, the basic patent application of D6, *ex officio* into consideration (Article 114(1) EPC).

The Respondent had referred to decision T 185/88 (above) to support its request that D6a should automatically replace D6 in the proceedings.

Decision T 185/88 deals, however, with a completely different situation. In that case, the first question dealt with in the decision was the admissibility of an opposition in view of the fact that the only document cited (a German patent specification DE-PS-...) was late-published and did therefore not qualify as a proof for lack of patentability. It was found, however, that the front page of the DE-PS (C-document) contained a clear reference to the date on which the corresponding unexamined application (as DE-OS, ie the A-document) had been laid open to public inspection, which preceded the priority date of the contested patent, and that it was immediately apparent that the corresponding unexamined application should have been cited, since in the Notice of Opposition reference had been made to the "previously published document DE-PS..." which was "discussed in the contested patent" and on examination it could be seen that the contested patent mentioned document DE-OS of the same number, i.e. the previously published A-document. (point 2.2 of the reasons).

The Board in that case was prepared, under the circumstances, to consider the content of an earlier A-document corresponding to the cited C-document evidently to avoid an opposition being thrown out as inadmissible on the basis of a clerical error. The Board in the present case does not, however, see that such a measure amounts to a finding that an opponent has the automatic right, at any stage of opposition or opposition appeal proceedings, to replace a document in the proceedings by another document to which it refers, but which itself is not in the proceedings, particularly where, in the present case, there is no ameliorating indirect reference in the Notice of Opposition to the relevant earlier document. On the

contrary, it was evidently the intention of the Opponent to rely on the C-document and only on the C-document.

Thus, the situation corresponds rather to that in T 38/96 of 11 May 1999 (not published in OJ EPO), wherein late filed document D26 was the A-document corresponding to D1 which had been cited in due time, but published too late to be taken into consideration. However, the content of D26 was prior art pursuant to Articles 54(3) and (4) EPC and the document was therefore admitted to the proceedings (Article 114 EPC; point 2 of the reasons).

The Board therefore exercised its discretion in a manner favourable to the Respondent in the present case.

2.3 In view of the resulting change of the situation for the Appellant, however, the Board admitted the new auxiliary requests ("Hilfsantrag 1" and "Hilfsantrag 2") referred to in section IX, above, to the proceedings, since these were made in response to the objection based on the new document.

2.4 With its letter dated 17 June 2002, the Appellant had submitted two publications

D14 Römpf, 10th edition, 1998, page 2549 and

D15 "Modern Superabsorbent Polymer Technology"
F.L. Buchholz, A.T. Graham, John Wiley & Sons, 1998,
pages 87 to 93,

both of which had been published only after the effective date of the patent in suit. Therefore, they are not considered sufficiently relevant to be taken into account by the Board. Hence, they are disregarded (Articles 114(1) and (2) EPC).

3. *Amendments (Articles 123(2) and (3) EPC)*

The limitation of the independent claims in both auxiliary requests to the use of "organic carbonates, polyquaternary amines or polyvalent metal compounds" and "organic carbonates", respectively, as surface crosslinking agents clearly complies with Article 123(3) EPC as it results in a restriction in the scope of the claim.

These amendments are supported by the application as filed (Claims 10 and 23 and page 13, lines 5 and 4 from below; patent in suit: Claims 10 and 23, page 6, lines 2/3) and, consequently, also meet the requirements of Article 123(2) EPC.

The claims in both auxiliary requests are based on Claims 1 to 9, 12 to 22 and 25 to 28, as granted. Due to the deletion of Claims 10, 11, 23 and 24 of the granted version, the subsequent claims were renumbered and the references to preceding claims contained therein were amended accordingly (see section IX, above). They also comply with the requirements of Articles 123(2) and (3) EPC.

4. *Novelty*

The Respondent conceded novelty of the claims defining the method of making the superabsorbent polymer

(independent Claim 14 of the main request, independent Claims 12 of both auxiliary requests) in admitting that neither of D1 nor D10 disclosed step (d).

Since independent Claim 27 of the main request and independent Claims 23 of both auxiliary requests, respectively, differ from the above independent method claims only in the presence of additional feature (i), this is also true for these claims.

With respect to the product claims defining the product in terms of a process, the question of novelty must be examined under two aspects: (i) which of the process features as defined in steps (a) to (h) are identically disclosed in the prior art relied upon by the Respondent and (ii) whether the individual process steps are manifest in the properties of the product so that the product was made available to the public by the said prior art.

In the case where a prior art document fails explicitly to disclose something falling within the claim, availability in the sense of Article 54 may still be established if the **inevitable** outcome of what is literally or explicitly disclosed falls within the ambit of the claim.

- 4.1 According to the decision under appeal, D1, D2, D4 and D10 were of particular relevance, but none of these documents was deemed to anticipate any product or method claim of the patent in suit. In the appeal proceedings, the Respondent maintained that the disclosures of both D1 and D10 took away novelty of the product claims. This point of view has mainly been based on the argument that steps (d) and (e) would not

affect the structure of the final product.

In view of these facts and arguments, the Board does not see any reason to deviate from the findings in the decision under appeal with respect to novelty over the documents D2 and D4 and focuses, therefore, on the remaining two documents D1 and D10.

4.2 D1 provides "a method of improving the water-absorbent properties of a water-absorbent resin characterised in that it comprises surface treating the water-absorbent resin with a sufficient amount of a polyquaternary amine substantially to increase the water absorption of said water-absorbent resin". Such resins have found wide uses in a variety of applications including sanitary and hygienic goods (page 2, lines 7 to 9 and 43 to 46).

4.2.1 The process for preparing the known solid water-absorbent resins of D1 includes the steps of preparing an aqueous monomer solution of (A) acrylic acid (neutralised 70 to 100 mol %), (B) optionally styrene and/or methyl methacrylate and (C) a water-miscible to water-soluble polyvinyl monomer in a combined concentration of (A), (B) and (C) of at least 30% by weight; initiating polymerisation of the monomers in such a way that, during polymerisation, the exothermic heat of reaction is substantially the only heat energy used to accomplish polymerisation and cross-linking and to drive off sufficient water to obtain a solid crosslinked resin having a water content of 15% by weight or less; and thereafter surface treating the said resin with a polyquaternary amine (independent process Claim 6; page 2, line 53 to page 3, line 4).

4.2.2 On page 6, line 12 to page 7, line 6, the process is further specified by way of example: An aqueous solution is at first prepared by combining acrylic acid with potassium and ammonium hydroxides, ammonium carbonate and a crosslinking agent. In the solution, the degree of neutralisation is in the range of about 70 to 90%. According to the Appellant, the disclosure on page 6 of D1 means that the acrylic acid in the monomer solution is neutralised by the above hydroxides and carbonate to a degree of 72% and that the total water content of the reaction mixture amounts to about 13%.

To this aqueous solution maintained at 70°C, which may additionally contain an organic solvent having a boiling point of 40 to 150°C, an azo initiator is then added and the mixture is poured onto and spread over a travelling endless belt in the form of a thin layer. After about 30 seconds, the mixture starts to polymerise, and the exothermic reaction is complete in about one minute. During the reaction, the temperature rises to a maximum of about 130°C which is sufficient to evaporate any water or solvent initially present in the reaction mixture. The polymer is allowed to complete curing for about 30 minutes at ambient temperature, allowing water and solvent to evaporate, to give a dry solid strip of polymer having a water content of less than 15%. The Respondent argued that, under these reaction conditions, the carbonate would still act as a blowing agent together with the evaporating water because it was less reactive towards the acid than the two hydroxides. This argument was strongly disputed by the Appellant.

The strip is then pulverised into a powder which is

then contacted and surface treated by evenly spraying a polyquaternary amine in methanolic solution over the powder. Thereafter the surface-treated powder is evenly distributed throughout the product (page 7, lines 1 to 4).

In the document, particular emphasis is repeatedly put on the fact that the exothermic heat of reaction is the only non-ambient energy source to drive water away from the resin to form the said crosslinked resin polymer having a water content sufficiently low to be powdered without intermediate drying step (Claim 6; page 3, lines 1 to 3 and 31; page 6, lines 52 to 57; page 10, lines 46 to 48; page 11, lines 1 to 4 and 15 to 17).

- 4.2.3 It follows that D1 does not disclose the chopping or grinding of a microporous hydrogel before the drying step as admitted by the Respondent.
- 4.2.4 Furthermore, there is no explicit reason for supposing that D1 discloses a microcellular product, since the document does not mention such a product, but refers to a dry solid strip, nor does it refer to the use of a blowing agent.
- 4.2.5 The submission by the Respondent, that the ammonium carbonate ingredient referred to under the heading "Chemicals" on page 6 of D1 must necessarily function as a blowing agent, so that the resulting product would inevitably be microcellular, was strongly disputed by the Appellant on the basis that, whilst evolution of gas from a chemical blowing agent is irreversible and the gas evolved therefrom remains evenly distributed in the forming polymer, water evaporation, as required in the polymerisation in D1, is an equilibrium process of

evaporation at hot and re-condensation at cooler spots within the polymerisation mixture. Moreover, such a repeated evaporation and re-condensation of water removes any carbon dioxide from the mixture, regardless of whether it is formed during the initial neutralisation of the monomers or during the following polymerisation step, and thus prevents a microporous structure from being formed. Hence, the structure of the resulting solid water-insoluble polymer in D1 which required the removal of the water during the polymerisation is different from that in the patent in suit and a microporous structure cannot be formed therefrom during the further steps of the process.

The Board sees no reason to reject this perception of the progress of the process exemplified in D1, since the Respondent neither showed that it had any inconsistency with the relevant disclosure of D1, nor supplied any evidence of its own which would support another conclusion. The onus of proof at this stage lay with the Respondent, however, which it has not discharged.

Consequently, it is held that D1 does not make available a microcellular polymer as defined in Claim 1 of the main or first or second auxiliary requests.

4.2.6 In other words, the novelty objection based on D1 must fail. It follows that D1 does not anticipate the subject-matter claimed in the independent claims of the patent in suit according to the main, first or second auxiliary requests.

4.3 Document D10 discloses a powdery, water-swellaible, crosslinked polymer, capable of absorbing aqueous

fluids (in particular body-fluids), the polymer being formed from unsaturated at least partially neutralised acid-functional monomers, whereby the polymer is characterised by an absorption capacity of at least 12 g of a 0.9% sodium chloride solution per gram of polymer under a load of 60 g/cm².

The document also discloses a process for the preparation of this polymer by polymerising acid group-containing monomers and a crosslinking agent in the presence of a blowing agent on the basis of carbon dioxide, thereby forming a hydrogel, drying the resulting polymer and treating its surface with 0.01 to 10% by weight, relative to the water absorbent resin, of at least one surface crosslinking agent (such as glycerol, polyalkylene glycols, polyamines and/or alkylene carbonates) at elevated temperatures (Claim 6).

The particle shape may be irregular, as originating from drying and comminuting steps. The sequence of comminution and drying steps and the particle sizes resulting therefrom were disputed between the parties. Whilst the Respondent based its arguments on the examples and comparative examples, the Appellant referred mainly to the paragraph bridging pages 7 and 8.

At the bottom of page 7, reference is made to drying and comminution; the examples refer to comminution, drying, grinding and sieving (eg page 11, comparative Examples 1 and 2; page 13, Examples 2 to 10). According to Claim 8, grinding is carried out after the drying step. The particle size is, in general, in the range of 20 to 3000 µm, preferably between 50 and 1000 µm.

- 4.3.1 Evidently, this size refers to the polymer after having been dried and optionally ground (see Claims 7 to 9; page 8, lines 2/3 and the examples), which was not contested by the Respondent. This means that D10 is silent about the size of the gel pieces after the comminution, if any, before drying.
- 4.3.2 Apart from the missing size of the gel pieces before drying, it must be noted that "Zerkleinerung" (comminution) means any physical activity reducing the size of the product. Therefore, it encompasses not only "chopping" and "grinding", but also "cutting". This means, however, that these terms do not have the identical meaning as regards the activity carried out. Furthermore, it is evident that the shapes and sizes of the gel pieces resulting from these different activities are not inevitably the same, let alone comply with their definition in the claims under consideration.
- 4.3.3 Thus, D10 not only fails to disclose the size of the relevant gel pieces, but also the specific form of energy input (chopping or grinding) required by the patent in suit for obtaining them.
- 4.3.4 The argument of the Respondent, that the manner of comminution, and the size of the resulting particles have no significance for the nature of the product, is not convincing, since it has not been shown that different sizes during the drying step would in fact have no impact on the final product.

On the contrary, it was strongly argued by the Appellant, that energy intensive mechanical treatment of a polymer such as chopping or grinding would indeed

have an effect on the structure of the resulting product, in particular, as it will result in a reduction of the molecular weight.

Moreover, the size of the gel pieces to be dried determines the ratio of their surface area, which serves as an interface for the water evaporation from the solid polymer phase to the surrounding gas phase (eg air), to their volume, and it is this ratio, which has an important influence on the drying time and on the heat energy to be imposed on the polymer: the lower the said ratio, the more unfavourable the necessary drying conditions, ie longer drying time or a higher amount of thermal energy needed, imparting higher thermal stress on the polymer and undoubtedly affecting its properties.

4.3.5 The further argument of the Respondent, that there were no limits in the subject-matter of the patent in suit on the amount of energy input does not alter the fact that no such step (in compliance with step (d) as defined in the patent in suit) is disclosed in D10, and the presence of such a step must be presumed, for the reasons given above, to have an effect on the resulting polymer which is not made available by D10.

4.3.6 Consequently, the Board has come to the conclusion that D10 does not anticipate the subject-matter of the independent claims of the main, first or second auxiliary requests.

4.4 The requirements of Articles 52(1) and 54 EPC are therefore met by the main and both auxiliary requests.

5. *Problem and Solution*

- 5.1 The patent in suit concerns a microcellular superabsorbent polymer.
- 5.2 Such a product is known from D2 which the Board regards as representing the closest state of the art. D1 cannot adequately fulfil this function, if only because it fails to disclose a microcellular polymer (see section 4.2.5, above).

Document D2 relates to improved superabsorbent polymer compositions, useful as absorbents for water and/or aqueous body fluids when incorporated into absorbent structures such as diapers, incontinence pads and sanitary napkins, and a process for their preparation. These absorbents are capable of retaining the absorbed fluids under moderate pressures (page 2, lines 1 to 14).

The superabsorbent polymers are, in general, based on polymerisable unsaturated carboxylic acids or their derivatives, such as acrylic and/or methacrylic acid and/or their water soluble salts, rendered water insoluble by crosslinking. The speed and/or rate of such water absorption of superabsorbent, substantially water insoluble, slightly crosslinked partially neutralised hydrogel forming polymer compositions is improved by carrying out, during their production, a sequence of steps 1 to 5, which are identical to steps (a) to (f) as defined in Claim 1 of the patent in suit (sections I and IX, above; D2: page 2, lines 14 to 21 and 51 to page 3, line 12 and page 5, lines 28 to 41). The resulting polymers show an improved rate of absorption of aqueous fluids while essentially retaining the gel strength and capacity of conventional superabsorbents made in the absence of carbonate

blowing agents (D2: page 6, Table I and lines 33 to 40; page 7, Table II). This is confirmed in the patent in suit (page 4, lines 19 to 26), which refers to this polymer as "core polymer" as described in US-A-5 154 713 and 5 118 719, both of which are derived from the same US patent application 781526 as D2.

The disclosure of D2 differs from the patent in suit in that it is silent with respect to an additional surface treatment of the superabsorbent "core" polymer.

- 5.3 In line with the arguments of the Appellant (see eg sections V(i) and V(ii), above) and with the introductory statements in the patent specification, the technical problem underlying the patent in suit may thus be seen in imparting high liquid permeability under pressure (APUP), high absorbency under pressure (AUP) and swell rate (absorption speed) to the superabsorbent polymer without seriously affecting gel strength and absorption capacity (patent in suit: page 2, and in particular page 3, lines 3/4, 26 to 34 and 41/42).
- 5.4 According to the patent in suit, this problem is solved by mixing and reacting the polymer obtained in steps (a) to (f), as referred to above, in further steps (g) and (h) with 0.001 to 30 parts by weight of a surface crosslinking agent (in all experimental data provided by the Appellant: ethylene carbonate or glycerol).
- 5.5 In order to demonstrate that this problem was actually solved by the subject-matter claimed in the patent in suit, the Appellant pointed, in addition to the examples in the patent in suit, to the experimental results in Annexes 1/1 to 2/4, mentioned above, in

particular to Example 1 and Table 1 therein. In order to put more emphasis on its arguments based on these results, the results were presented on the said "Sheet of data" in a different form.

On this sheet, changes in the swell rate, gel strength, absorption capacity, AUP and APUP of polymer samples are shown in order to demonstrate the effect of the addition of BA (sodium carbonate) or SCL (ethylene carbonate) or both in steps (b) and (g), respectively, of the method as defined in the independent claims of the patent in suit in comparison to polymers prepared in the absence of SCL (ie without steps (g) and (h)) or BA or both.

Thus, on the one hand, the comparison of samples 3 and 4 demonstrates that the addition of the said SCL results in a reduction of both the swell rate and absorption capacity, whilst the gel strength, AUP and APUP increase. On the other hand, the addition of the said BA in sample 5 (in comparison to sample 3) shows the opposite results, ie increased swell rate and absorption capacity, and decreased gel strength, AUP and APUP. Sample 6 demonstrates that a polymer sample prepared with sodium carbonate (BA) and ethylene carbonate (SCL) in comparison to a product prepared in the presence of only the said BA (sample 5) exhibits significant increases in swell rate (absorption speed), gel strength, AUP and APUP, although, according to Appellant, a reduction of the swell rate had been expected by a person skilled in the art.

Consequently, according to the data provided by the Appellant, the above technical problem was credibly solved by the subject-matter of the independent claims.

The Respondent has neither filed any results of experimental data of its own nor disputed the above results.

6. *Obviousness*

It remains to be decided whether this solution was obvious to a person skilled in the art having regard to the state of the art relied upon by the Respondent.

6.1 It is evident from the above considerations that D2 by itself does not provide the teaching necessary to solve the technical problem referred to above.

6.2 Main request

6.2.1 According to D6a, the characteristic properties expected in superabsorbent resins include high absorption capacity, high absorption rate, liquid permeability, and large gel strength (page 2, lines 16/17). For use as constituent material for sanitary goods which absorbs body fluid, the polymer should not only have good absorption rate, liquid permeability and absorption capacity under no pressure, but these properties are also required under pressure (page 2, lines 3/4 and 36 to 40). In order to obtain such an absorbent polymer, the resin having a carboxylic group is mixed with 0.01 to 30 parts by weight of a polyhydric alcohol, such as glycols and glycerols (page 3, lines 38 to 43), as a surface crosslinking agent, per 100 parts by weight of the absorbent resin, and its surface is then reacted therewith. In four out of six examples, glycerol is used.

6.2.2 During the oral proceedings, the Respondent argued that the solution offered by the patent in suit was obvious vis-à-vis the combination of D2 and D6a and found this argument supported by the results in Example 3 (Table 3) of Annexes 1/1 to 2/4, already mentioned above, which confirmed the teaching of D6a by demonstrating, in particular, that the use of glycerol as a surface crosslinking agent provided a superabsorbent having the desired properties (such as an increased swell rates under normal pressure, gel strength, capacity, AUP and APUP) and, thus, solved the above technical problem. This fact was conceded by the Appellant.

6.2.3 In view of these facts, confirmed by the above experimental data (which are based on Table 3 of the patent in suit and Table 3 of Annexes 1/1 to 2/4 mentioned above), the Board comes to the conclusion that D6a provides the teaching necessary to solve the above technical problem. The incentive to impart high liquid permeability under pressure (APUP), high absorbency under pressure (AUP) and swell rate (absorption speed) to the superabsorbent "core" polymer (obtainable in accordance with D2) without seriously affecting gel strength and absorption capacity is clearly derivable from D6a.

6.2.4 It follows that the subject-matter claimed according to the main request is obvious to a person skilled in the art in view of D2 and D6a. Consequently, the main request cannot be successful. It is therefore refused.

6.3 Auxiliary request 1

The teaching of D6a is clearly limited to the surface

treatment of superabsorbent carboxy-functional polymer powders with polyhydric alcohols. Surface crosslinking agents of this type are, however, excluded from the claims according to auxiliary request 1. In view of the differences between the experimental results in the above Annexes 1/1 to 2/4 (Table 1 and Table 3) obtained with different surface crosslinking agents, which results are not in dispute between the parties, it is evident that results obtained with one SCL cannot be extrapolated to another SCL. Consequently, the combination of D2 and D6a cannot render the subject-matter of auxiliary request 1 obvious. Thus, it remains to be examined whether the subject-matter claimed according to this auxiliary request is rendered obvious by the other prior art relied upon by the Respondent in these proceedings.

- 6.3.1 Document D4 explains the importance of, on the one hand, swell capacity and, on the other hand, gel strength in superabsorbent polymers and the influence of the gel strength in such polymers on the distribution and absorption of further fluid under pressure, to ensure fluid absorption, fluid transport and dry feel - despite any pressure exerted on the absorbent, eg by the load of a body (page 2, lines 31 to 42). More particularly, according to D4, hitherto known superabsorbent polymers have to be improved with respect to the retention and absorption capacities as well as the gel strength (page 2, lines 49 to 58) in order to dispense with the necessity of the use of high volume fluff in sanitary and hygienic goods, such as diapers, and to allow the volume of the article to be reduced. This aim has been achieved in D4 by surface treating a partially neutralised, crosslinked superabsorbent polymer on the basis of polymerisable

unsaturated acid monomers with 0.1 to 5% by weight of an alkylene carbonate (Claims 1 and 10). This surface treatment results in an improved absorption of fluid under pressure as regards rate and capacity with simultaneous achievement of high retention capacity ("TB"), high gel strength and high absorbency under load ("AUL"), and storage modulus G' (page 3, lines 21 to 24; page 4, line 37 et seq., the examples).

6.3.2 The document is, however, silent about the swell rate under normal pressure. The Appellant has demonstrated in Table 1 in the patent in suit and in Annexes 1/1 to 2/4, mentioned above (in particular, the reduction of the swell rate in sample 4 of Table 1 to 81% in comparison to sample 3, see the "Sheet of data"), that the addition of a surface crosslinking agent to a superabsorbent polymer results in a reduction of the swell rate unless specific measures are taken to prevent this decrease.

D4 does not provide any information about additional features necessary to avoid this deterioration of properties, it does not even address this deficiency caused by the surface crosslinking.

6.3.3 Therefore, the Board is convinced that D4 does not provide any incentive to overcome the relevant technical problem by modifying the "core" polymer obtainable in accordance with D2 by means of ethylene carbonate as a surface crosslinking agent with a reasonable expectation of success. The reduction of the swell rate due to surface crosslinking by means of ethylene carbonate, mentioned above, rather teaches away from the solution found in the patent in suit. Moreover, a synergistic effect between the blowing

agent and the surface crosslinking agent as asserted and proven by the Appellant during the oral proceedings on the basis of the above experiments (in particular with respect to sample 6 in comparison to sample 5 of Table 1: increase of the swell rate by a factor of 1.13, in addition to significant increases at the same time in gel strength, AUP and APUP) could not be foreseen from the document.

6.3.4 Furthermore, the different results obtained with ethylene carbonate, on the one hand, and glycerol, on the other, demonstrate that reliable conclusions cannot be drawn from the above opposite results (in Tables 1 and 3 of the Annexes 1/1 to 2/4, above) obtained with these two compounds as to the properties of a superabsorbent prepared instead with another surface crosslinking agent such as the other SCL compounds listed in the independent claims of the first auxiliary request (see section 6.3, above).

6.3.5 Nor does D1 add anything to D2 which would be significant for the solution of the technical problem, since it (a) does not relate to a microcellular core polymer and (b) discloses that superabsorbent polymer powder surface-treated with polyquaternary amines shows (in subsequent measurements) an increased initial water absorbency (under a certain pressure), a higher total water absorbency (under less pressure) and an increased total water retention (under the initially applied pressure again) than the untreated polymer and (c) the influence of different amounts of further non-polar comonomers incorporated in the polymer such as styrene and methyl methacrylate on these properties. There is no hint to an improvement in APUP, let alone swell rate.

- 6.3.6 According to established case law of the Board of appeal, the onus is on the Opponent in opposition proceedings convincingly to demonstrate that the claimed subject-matter is obvious with respect to the state of the art and/or that the technical problem is not solved in the whole range of the claims under consideration (see Case Law of the Boards of Appeal of the EPO, 4th edition, VI.J.6 *et seq.*). No such convincing argument or evidence has been produced by the Respondent (Opponent).
- 6.4 Consequently, the Board is satisfied that the subject-matter of independent Claims 1, 12 and 23 involves an inventive step, because neither D2 by itself, nor any combination of D2 with D4 and/or D6a and/or D1 provides an incentive to solve the technical problem so as to arrive at something within the ambit of these claims.
- 6.5 Claims 2 to 11, which relate to preferred embodiments of the polymer of Claim 1, Claims 13 to 22, which concern preferred of elaborations of the method according to Claim 12, and Claim 24, which further specifies the method of Claim 23, are supported by the patentability of the independent claims to which they are appendant and are thus also allowable.
- 6.6 Consequently, the Board has come to the conclusion that the subject-matter of the patent in suit as defined in the claims according to auxiliary request 1 meets the requirements of the EPC.

7. *Auxiliary request 2*

Since auxiliary request 1 is successful, there is no need to consider auxiliary request 2 any further.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The main request is refused.
3. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of Claims 1 to 24 forming the first auxiliary request ("Hilfsantrag 1") submitted during the oral proceedings and a description yet to be adapted.

The Registrar:

The Chairman:

E. Görgmaier

R. Young