

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 29 May 2019**

Case Number: T 0382/16 - 3.3.03

Application Number: 08717011.4

Publication Number: 2115016

IPC: C08F2/48, C08F2/50, C08F20/00

Language of the proceedings: EN

Title of invention:
PRODUCTION OF SUPERABSORBENT POLYMERS ON A CONTINUOUS BELT
REACTOR

Patent Proprietor:
BASF SE

Opponent:
Evonik Degussa GmbH

Relevant legal provisions:
EPC Art. 54, 56, 114(2)
EPC R. 50(3)
RPBA Art. 12(4)

Keyword:

Unsigned submissions retaining their original date of receipt
Late submitted material - correct exercise of discretion (no)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

G 0007/93



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0382/16 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 29 May 2019

Appellant: Evonik Degussa GmbH
(Opponent) 45116 Essen (DE)

Respondent: BASF SE
(Patent Proprietor) Carl-Bosch-Strasse 38
67056 Ludwigshafen am Rhein (DE)

Representative: BASF IP Association
BASF SE
G-FLP-C006
67056 Ludwigshafen (DE)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted on 18 December
2015 rejecting the opposition filed against
European patent No. 2115016 pursuant to Article
101(2) EPC.

Composition of the Board:

Chairman D. Marquis
Members: F. Rousseau
R. Cramer

Summary of Facts and Submissions

I. The appeal lies against the decision by the opposition division, posted on 18 December 2015, rejecting the opposition against European patent No. 2 115 016.

II. Claim 1 of the patent read as follows:

"1. A process for production of superabsorbent polymers comprising polymerizing a monomer solution, comprising at least one ethylenically unsaturated acid-functional monomer, at least one crosslinker and at least one photoinitiator, on a continuous belt reactor, wherein the consistency of the formed polymer gel at the end of the continuous belt reactor is controlled by adjusting the intensity of energy-rich radiation, the consistency of the formed polymer gel depends on the monomer conversion and the drying on the continuous belt, the polymer gel moves downward at the end of the continuous belt reactor and a rotating knife cuts the downward moving polymer gel."

Dependent claims 2 to 9 constituted preferred embodiments of claim 1.

III. The following items of evidence were cited inter alia before the opposition division:

D1: EP 1 589 040 A1

D2: WO 02/066520 A1

D3: EP 1 440 984 A1

D8: EP 1 510 317 A1

D9: EP 1 754 725 A2

IV. According to the reasons for the decision D9 was admitted into the proceeding as it constituted a prior

art closer to the claimed method than the documents cited in the notice of opposition, while D8 which was not more relevant than D9 was not admitted in the proceedings. Novelty was acknowledged in particular since D9 did not disclose a control of the consistency of the gel during polymerization by an adjustment of the light intensity and that the polymer gel fell downward at the end of the continuous belt reactor. The replacement in Example 12 of D9 of a lamp used in Example 8 did not represent an adjustment of light intensity during the polymerisation but the selection, according to the need, of a different light quantity for the polymerization. The closest prior art was represented by D9 from which the method of claim 1 of the granted patent differed by not using a cooling belt right after the polymerisation reactor and a step of adjusting the light intensity during polymerisation. Whereas the omission of the cooling belt used in D9 was an obvious measure for the skilled person, an adjustment of the light intensity during polymerisation was not suggested in any of D9, D1, D2 and D3. An inventive step was therefore acknowledged.

- V. An appeal against that decision was lodged by the opponent (hereafter appellant). The statement setting out the grounds of appeal submitted with letter of 15 April 2016 included the following document:

D10: DE 38 25 366 A1.

- VI. The patent proprietor (respondent) submitted with their rejoinder (letter of 23 August 2016) comparative tests dated 15 Mai 2014 which will be referred to as D11.

- VII. The appellant submitted with a letter of 5 March 2019 that the rejoinder of the respondent had not been

signed by a person authorized to represent the respondent. It was argued that a remedy to this deficiency would presuppose the existence of a communication under Rule 50(3) EPC which had not been issued.

- VIII. The respondent replied with a letter of 12 March 2019 indicating that the last page of the rejoinder of 23 August 2016 (page 5) bearing the signature of the representative had not been transmitted. Accordingly, the whole rejoinder including the missing page 5 with a signature of the representative was submitted with said letter of 12 March 2019.
- IX. In the communication of the Board of 8 April 2019 sent in preparation for the oral proceedings, the Board indicated that having regard to respondent's letter of 12 March 2019 and in analogy to the provisions of Rule 50(3) EPC, it was considered that the submissions made by the respondent with letter of 23 August 2016, i.e. pages 1 to 4 and experimental report D11, shall retain their original date of receipt.
- X. Oral proceedings before the Board took place 29 May 2019.
- XI. As far as relevant to the present decision, the submissions of the appellant can be summarized as follows:

Novelty

- (a) Claim 1 had to be interpreted according to its broadest usual technical meaning, which did not necessarily correspond to the most logical interpretation. Claim 1 foresaw that the UV

radiation intensity was made dependent on the viscosity or the consistency of the formed polymer gel. The patent as granted however did not contain any indication that the adjustment of the UV radiation intensity was performed during or parallel to the polymerisation step. The patent in suit did not foresee any control loop or dynamic adjustment of the viscosity. Accordingly, claim 1 had to be broadly interpreted. As indicated in paragraphs [0017] and [0024] of the specification the consistency could be even determined by visual inspection and the radiation intensity could be varied by switching on or off the UV lamps. After the polymerisation the consistency of the gel could be examined and in a second run the intensity of the UV radiation could be varied in order to adjust the consistency of the gel. In fact an adjustment of the radiation intensity was implicit for any process for the production of super absorbent polymers using such type of polymerisation process.

- (b) Example 12 of D9 referred to Example 8 of that document and it was trivial that the UV intensity had to be adjusted at some point during the process described in D9. The replacement in Example 12 of one of the black light mercury lamps used in Example 8 by another lamp resulted in a change of light quantity applied and therefore to an adjustment of the light intensity during the process. Claim 1 did not provide any quantitative definition of the consistency of the gel, but merely that the gel had to be able to move downwards at the reactor end, which was the case in document D9. The horizontal cooling belt described in Example 12 of D9 had to be considered to be part of the continuous belt reactor used in that example

and a continuous belt reactor within the meaning of the patent in suit could include between the polymerisation belt and the cutting device an additional belt used for a drying step. On that basis, Example 12 of D9 read in the light of its Example 8 to which it referred anticipated the subject-matter of claim 1 of the granted patent.

Inventive step

- (c) The closest prior art was represented by the polymerisation process disclosed in Example 12 of D9. Technical report D11 which did not relate to a polymerization on a belt reactor and did not concern an adjustment of the light intensity as a function of the gel consistency could not prove the existence of any technical effect arising from the features distinguishing the claimed process from that described in Example 12 of D9. In the absence of any evidence for such effect the technical problem successfully solved by the subject-matter of operative claim 1 solely resided in the provision of a further method.
- (d) The claimed solution of adjusting the intensity of the energy-rich radiation was suggested by any of documents D1 to D3 which all concerned the same technical field as D9.
- (e) D3 taught that the viscosity of the gel could be adjusted by varying the light intensity, also in the context of a polymerisation carried out on a moving belt (paragraphs [0009], [0032], [0037], [0051], [0052], [0055] and [0073] and Example 6). D3 taught a stepwise polymerisation process, the polymerisation being interrupted for a shaping step

necessitating a control of the viscosity, which viscosity was controlled by varying the intensity of the UV-radiation (page 5, line 58; paragraphs [0029], [0036] and [0047]; page 6, lines 9-11 and 14-17; page 8, lines 4-7).

(f) D1 described the continuous synthesis of water absorbent polymers on an endless belt using UV radiation (page 2, lines 7-9; page 3, lines 51-56; page 4, line 48; page 10, line 48; Figure 1). D1 also taught to adjust the intensity of the UV-radiation as a function of the evolution of the polymerization reaction (page 11, lines 11-13; paragraph [0075]), while it was sought to reduce the amount of residual monomers in the obtained polymer (page 10, lines 43-53). D1 taught to adjust the height of the ceiling of the polymerisation device in order to avoid the polymer attachment to the ceiling and to adjust the intensity of the UV radiation. In Examples 1 to 3 of D1 (paragraph [0089]; page 3, lines 13-18; page 13, lines 47-52) the polymerisation was carried out while changing the intensity of the UV-radiation in response to the contraction of the polymer gel. Hence, D1 suggested to vary the intensity of the UV-radiation during the polymerisation process.

(g) D2 taught to use a polymerisation in a two step procedure using two different light intensities, these separated steps being essential to the process of D2 (page 3, lines 17-28 and page 5, lines 1-6). D2 also sought to reduce the amount of residual monomers in the obtained polymer (page 1, lines 4-5; page 2, line 11; page 3, lines 7-9). Moreover, this document suggested to vary to the intensity of the UV-radiation in order to obtain

products having a specific molecular weight (page 7, lines 14-22). Thus, D2 taught the skilled person to adjust the intensity of the UV-radiation during the polymerisation in order to influence the consistence of the polymer gel.

- (h) As to moving the polymer gel downward at the end of the continuous belt reactor, this measure was not only suggested by D9 itself since the use of a cooling belt was merely optional (paragraph [0170]), but also by D8 (example 1).
- (i) Claim 1 of the granted patent lacked therefore an inventive step over D9.
- (j) D8 described a process which differed from that of operative claim 1 only in that it did not disclose a step of adjusting the light intensity during polymerisation according to the meaning attributed to this feature by the opposition division. It was therefore more relevant than D9 and should be for this reason admitted to the proceedings. It represented an alternative starting point for assessing inventive step, reference being made to example 1 of that document. For the same reasons as submitted in the light of D9 taken as the closest prior art, the subject-matter of operative claim 1 lacked an inventive step over D8.

XII. As far as relevant to the present decision, the submissions of the respondent can be summarized as follows:

Novelty

(a) D9 neither described the downwards movement of the polymer gel at the end of the polymerisation reactor, nor the regulation of the consistency of the polymer gel by means of the radiation intensity. The wording "controlled by adjusting" which had to be interpreted in a sensible manner meant that the consistency had to be regularly checked during the polymerisation, not necessarily automatically or semi-automatically, but for example by a worker who using its experience would adjust the intensity of the UV lamps during the polymerisation in order to obtain a polymer gel whose consistency allowed the polymer gel to follow the continuous belt downward at the end of the continuous belt reactor. D9 did not concern a process in which a cooling step and a polymerisation/irradiation step took place simultaneously and the cooling belt in D9 could not be seen as an additional polymerisation reactor. Moreover, compared to Example 8 of D9, Example 12 used a monomer solution comprising an increased concentration of monomer and sodium persulfate, whereas the concentration of hydroxycyclohexyl-phenylketone was kept constant. In Example 12 of D9, the intensity of the radiation used in Example 8 had been changed having regard to the change of formulation of the solution undergoing polymerisation, but not adjusted in response to a change of the consistency of the obtained polymer gel. Accordingly, Examples 8 and 12 of D9 related

to two different processes. For these reasons, claim 1 was novel over D9.

Inventive step

- (b) The closest prior art was represented by the polymerisation process disclosed in Example 12 of D9. The monomer conversion had to be high enough and the polymer produced at the end of the belt reactor had to be sufficiently elastic, i.e. the gel should not be rigid in order for the polymer to follow the continuous belt downward at the end of the continuous belt reactor. The inventors had found that the consistency of the polymer gel was a suitable parameter for controlling drying and monomer conversion, which could be adjusted with the intensity of the UV-radiation. This was shown with test report D11. Having regard to the disclosure of D9, the technical problem successfully solved by the subject-matter of granted claim 1 was the provision of a simple process for the production of superabsorbent polymers on a continuous belt by which the monomer conversion and drying could be kept constant during the continuous production. The features distinguishing the claimed process from that described in Example 12 of D9 related to one another, as the consistency of the gel and its ability to move downwards at the end of the belt reactor depended on the intensity of the energy-rich radiation. None of the documents submitted dealt with that problem. As already indicated Examples 8 and 12 of D9 did not show any adjustment of the UV-radiation as a function of the consistency of the gel, but the preparation of different polymers resulting from the use of two

different formulations. D3 taught an interruption of the polymerisation for providing a shaping step of the viscous partially polymerized monomer solution prior to complete polymerization. D3 did not suggest or contain any information on an adjustment of the consistency of the completely polymerized gel. D1 taught that too little free space above the polymer gel led to attachment of the polymer to the ceiling, but that too much free space lead to an inefficient use of the polymerisation heat (page 9, lines 14-21). D1 therefore taught to optimize the free space above the polymer gel, but did not teach or suggest to adjust the consistency of the polymer gel during the production of the polymer. D2 taught a two step polymerisation using two different UV-initiators. In the second step using the second type of UV-initiator the intensity of the UV-light was higher. However, D2 did not teach or suggest to regulate the consistency of the polymer gel in the course of the production of said gel. The process according to claim 1 of the granted patent was therefore based on an inventive step.

- (c) The appellant had not submitted any argument for the late submission of D8. The opposition division had not attached any importance to the use of a cooling belt in D8 and therefore had correctly exercised its discretionary power in not admitting D8 into the proceedings. The arguments submitted in support of an inventive step starting from D9 as the closest prior art were also valid when D8 was taken as an alternative starting point for assessing inventive step.

- XIII. The appellant requested that the decision under appeal be set aside and that the patent be revoked. It also requested that documents D8 and D10 be admitted into the proceedings.
- XIV. The respondent requested that the appeal be dismissed. It further requested that document D8 not be admitted into the proceedings.

Reasons for the Decision

1. The indication by the Board in its communication of 8 April 2019 that the submissions made by the respondent with letter of 23 August 2016, i.e. pages 1 to 4 and experimental report D11, shall retain their original date of receipt (see above point IX of the Summary of Facts and Submissions) was not disputed by the appellant. The submissions made by the respondent with letter of 23 August 2016 are therefore deemed to have been made within four months of notification of the grounds of appeal and are to be taken into account in the appeal proceedings (Rule 12(1)(b) and (4) RPBA).

Novelty

2. The general principle consistently applied by the Boards of Appeal for concluding lack of novelty is that there must be a direct and unambiguous disclosure in the state of the art which inevitably leads the skilled person to subject-matter falling within the scope of what is claimed. It is also established case law that novelty of what is claimed has to be assessed on the basis of the wording of the claim, according to its broadest technical sensible meaning, and in order to ensure legal certainty, independently from any alleged intention derivable from the description that the claim

should be read in a more restrictive way (Case Law of the Boards of Appeal of the EPO, 8th Edition, 2016, II.A.6.3.4).

3. The appellant is of the opinion that Example 12 of D9 (paragraphs [0313] to [0322]) discloses a process in accordance with claim 1 of the patent in suit. The process disclosed in that example is described among others by a reference in paragraph [0313] to the process of Example 8 of that document, which Example 8 is described in paragraphs [0290] to [0301]. The parties are in dispute whether Example 12 of D9 concerns a process wherein (i) the consistency of the formed polymer gel at the end of the continuous belt reactor is controlled by adjusting the intensity of energy-rich radiation and (ii) the polymer gel moves downward at the end of the continuous belt reactor. It is however not disputed that the other features defining the process for production of superabsorbent polymers in accordance with operative claim 1 are described in Example 12 of D9. Before assessing the presence of features (i) and (ii) in the process of Example 12 of D9, it is necessary to analyse the meaning of the relevant features of claim 1.
 - 3.1 According to its broadest technical sensible meaning the wording "the consistency of the formed polymer gel at the end of the continuous belt reactor is controlled by adjusting the intensity of energy-rich radiation" means that the consistency of the polymer gel formed at the end of the continuous belt reactor is determined, compared with a reference consistency sought to be obtained, and the intensity of the energy-rich radiation is adjusted to obtain the sought consistency, should the consistency measured be different from the reference consistency. This meaning of "controlled" is

confirmed by paragraphs [0016] of the specification, according to which the consistency of the formed gel at the end of the continuous belt reactor is held in a specific range by varying the intensity of the used energy-rich radiation.

- 3.1.1 The feature of claim 1 that "the polymer gel moves downward at the end of the continuous belt reactor" implies a consistency of the polymer gel being within a range which allows such movement. It implies in particular that the polymer gel is not rigid, as confirmed in paragraph [0014], since if the polymer gel is rigid, it cannot follow the continuous belt downward at the end of the continuous belt reactor.
- 3.1.2 Claim 1 does not contain any limitation concerning the manner of appreciating the consistency and the frequency at which it is determined, in line with paragraph [0017] of the specification according to which the consistency of the formed polymer gel at the end of the continuous belt reactor can be detected by periodical visual inspection, a continuous or semi-continuous measurement of the elasticity of the formed polymer gel being also possible.
- 3.1.3 Finally, due to the open formulation of the process of claim 1 ("comprising") the steps recited are defined to be part of the process of claim 1 meaning that a process in accordance with the patent in suit must contain a step of adjusting the intensity of the energy-rich radiation, which step necessarily follows an assessment of the consistency of the formed polymer gel at the end of the continuous belt, the adjustment of the intensity of the energy-rich radiation allowing to control the consistency of the polymer gel at the end of the continuous belt reactor. This means in line

with the reasons for the contested decision that operative claim 1 requires during the production of the superabsorbent polymer an assessment of the consistency of the gel at the end of the continuous belt reactor and an adjustment of intensity of the energy-rich radiation in response to a formed polymer gel which does not follow the continuous belt reactor.

3.2 *Adjustment of the intensity of energy-rich radiation for controlling the consistency of the polymer gel formed at the end of the continuous belt reactor*

3.2.1 Example 12 of D9 when read in the light of Example 8 to which it refers to does not contain any disclosure, even implicit, that the intensity of the energy-rich radiation is adjusted at some point of the process described with said example, let alone that the variation of intensity follows a verification of the consistency of the gel at the end of the polymerization belt, be it in the process of Example 12 or in the process of Example 8.

3.2.2 A comparison of Examples 12 and 8 of D9 shows that besides an increase of the light intensity between these two examples of about 59% (paragraphs [0313] and [0293] of Examples 12 and 8, respectively), other parameters of the process were changed. The speed of the various belts (belt polymerizer and cooling belt) is 50% higher in Example 12 (paragraphs [0313] and [0314], respectively) than in Example 8 (paragraphs [0292] and [0294], respectively). The speed of addition of the monomer solution and of sodium persulfate (a thermal decomposition initiator; paragraph [0044]) like the speed of the various belts was also increased by 50% (paragraphs [0313] and [0292] of Examples 12 and 8, respectively), while the speed of addition of

hydroxycyclohexylphenylketone (a photodecomposition initiator) was kept constant (paragraphs [0313] and [0292] of Examples 12 and 8, respectively). It is also to be noted that the cooling system used after the belt polymerizer is not described to be the same between Examples 8 and 12. While Example 8 describes that air at 25°C is applied on the upper part of the roller conveyor to cool the hydrogel sheet (paragraph [0295]), Example 12 discloses that the cooling belt was chilled by cold water with a temperature of 13°C applied from the bottom (paragraph [0316]).

3.2.3 Consequently, it cannot be concluded that Examples 12 and 8 of D9 belong to the same process for the production of a superabsorbent polymer in which a modification of the energy-rich radiation used in Example 8 resulted from an appreciation of the consistency of the polymer gel formed at the end of the continuous belt reactor, which was found to be outside of a specific range taken as a reference. It is rather concluded that Examples 8 and 12 of D9 concern two subsequent processes using different settings, the reference to Example 8 in Example 12 being only made for the purpose of shortening the description of the process used in Example 12.

3.2.4 As to the argument that the polymerisation process used in Example 12 of D9 would necessarily require an adjustment of the energy-rich radiation, it is reminded that an "implicit disclosure" relates solely to matter which is not explicitly mentioned, but is a direct consequence of what is explicitly mentioned. An explicit disclosure in D9 from which the alleged implicit disclosure for an adjustment of the energy-rich radiation during the process would be inferred unequivocally or any evidence showing that an

adjustment of the energy-rich radiation would always take place during such type of process was not indicated by the appellant and is not apparent to the Board.

3.3 *Downward movement of the polymer gel at the end of the continuous belt reactor*

3.3.1 It follows from the description of Example 12 (paragraph [0314]) that the hydrous gel sheet is supplied from the polymerizer to the cutting device via a cooling belt horizontally placed. It is undisputed that the polymer gel sheet in Example 12 of D9 is moved downward while entering the cutting device, resulting in the rotating knife cutting the downward moving polymer gel. Reference is made not only to Figure 3 mentioned in Example 12, paragraph [0026] providing a description of Figure 3, but also to paragraph [0017] providing a description of the cutting device used in D9. There is however no disclosure in that example that the polymer gel moves downward at the end of the polymerizer since the hydrous gel sheet leaving the polymerizer is immediately supplied to the cooling belt horizontally placed.

3.3.2 There is also no reason to consider that a continuous belt reactor within the meaning of claim 1 of the patent in suit could designate an apparatus comprising a belt polymerizer and a cooling belt, which according to the appellant would mean that the horizontal cooling belt described in Example 12 of D9 should be considered to be part of the continuous belt reactor used in that example. There is no apparent reason to attribute to the terms "continuous belt reactor" used in claim 1 of the patent in suit in the context of the formation of a polymer gel, and "belt polymerizer" used in Example 12

of D9 in the context of a continuous process using a moving belt reactor (paragraph [0039]) a different meaning.

3.3.3 By contrast, the appellant assessed the meaning of the term "belt reactor" in claim 1 of the patent in suit by referring to the belt dryer mentioned in paragraph [0055] of the specification, which would show that the wording "belt reactor" did not exclude the presence of an additional belt within that apparatus. There is however no explicit indication in the specification that a drying step within the meaning of paragraph [0055] would be carried out before the cutting step, let alone in the apparatus used for the polymerization. It is also rather questionable whether the skilled person would understand that the drying step performed to obtain a residual moisture content preferably below 15% by weight (paragraph [0055]) refers to a step to be carried out before cutting the polymer gel. Reference is made to the passages of the patent in suit showing the necessity to have a polymer gel which does not have a reduced water content to perform the cutting step (paragraph [0014]) and the indication in paragraph [0057] that the dried polymer gel is then ground and classified, a cutting step being not mentioned for such dried polymer. Accordingly, there is no reason to construe in the light of paragraph [0055] the wording "continuous belt reactor" used in claim 1 of the patent in suit as to comprise a further belt, let alone a cooling belt.

3.3.4 The appellant also referred to D10, the admissibility of which was not contested by the respondent. D10 submitted with the statement setting out the grounds of appeal is therefore taken into account in these appeal proceedings. D10 however does not show that the skilled

person would understand, contrary to the opinion of the appellant, that the term "belt reactor" designates an apparatus which would comprise a further belt in addition to the polymerisation belt. D10 is a patent document which alone does not constitute evidence that a wording used therein would have a meaning generally accepted in the art. Moreover, D10 does not give any definition of the term "belt reactor", in particular whether such reactor would also include a conveyor belt. D10 merely shows in Figure 1 that a conveyor belt can be used immediately after the polymerization belt.

- 3.4 Accordingly, the appellant's objection that the subject-matter of claim 1 of the granted patent lacks novelty over Example 12 of D9 fails to convince and novelty is therefore acknowledged.

Inventive step

D9 as closest prior art

4. In line with the reasons for the contested decision, the appellant and the respondent agreed that the disclosure of D9, in particular its Example 12 represents a suitable starting point for assessing inventive step. The Board has no reason to take a different view. As indicated in the above analysis of novelty of the claimed process over the disclosure of Example 12 of D9, the method of operative claim 1 differs from that disclosed with Example 12 of D9 in that (i) the consistency of the formed polymer gel at the end of the continuous belt reactor is controlled by adjusting the intensity of energy-rich radiation and (ii) the polymer gel moves downward at the end of the continuous belt reactor.

Problem successfully solved

- 4.1 Relying on comparative test D11, the respondent regarded the problem solved over the closest prior art as the provision of a simple process for the production of superabsorbent polymers on a continuous belt by which the monomer conversion and drying can be kept constant during the continuous production.
- 4.1.1 The problem to be determined is that solved over or in comparison with the closest prior art, meaning that the formulation of a problem submitted by the respondent which is defined in absolute terms to be simple or by which the monomer conversion and drying can be kept constant during the continuous production without any comparison with the closest prior art cannot be accepted. There is no indication that the process of Example 12 of D9 is a process by which the monomer conversion and drying cannot be kept constant during the continuous production or that the process in accordance with the present claim is more simple than that of the closest prior art.
- 4.1.2 D11, the sole experimental evidence relied upon by the respondent, does not relate to a polymerisation taking place on a continuous belt reactor, but on a Petri dish. Accordingly, this experiment does not reproduce the conditions encountered on a polymerization belt reactor, in particular those relating to heat dissipation, which have an influence on vaporization of water or monomers and the solid content of the gel (D1, page 9, lines 14-21). In addition D11 compares two polymerisation processes in which not only the intensity of the UV-radiation, but also the exposure time to UV-radiation was varied, and the respondent did not provide any argument as to why the results shown in

D11 concerning a different context and the use of a further distinguishing feature, namely exposure time to UV-radiation, would nevertheless demonstrate any advantage of the process of operative claim 1 over the process of Example 12 of D9.

- 4.1.3 Consequently, the problem successfully solved by the subject-matter of claim 1 over the closest prior art can only be formulated, in line with the arguments presented by the appellant, as the provision of a further method for the production of superabsorbent polymers.

Obviousness of the solution

- 4.2 It remains to be decided whether or not the proposed solution to the above problem, i.e. a process as defined in operative claim 1 characterized in that (i) the consistency of the formed polymer gel at the end of the continuous belt reactor is controlled by adjusting the intensity of energy-rich radiation and (ii) the polymer gel is moved downward at the end of the continuous belt reactor (see point 4 above) is obvious in view of the state of the art. The appellant referred in this respect to documents D9 and D1 to D3.
- 4.3 Paragraph [0170] of D9 teaches that the use of a cooling belt is optional. This constitutes for the skilled person merely seeking to provide a further method for the production of superabsorbent polymers an unambiguous suggestion that the polymer gel obtained at the end of the polymerisation belt reactor can be for this purpose directly supplied from the belt reactor to the cutting device. This suggests taking account the teaching of D9 that the polymer gel is moved downward while entering the cutting device that the polymer gel

would also be able to move downward at the end of the continuous belt reactor. Accordingly, the use of feature (ii) identified in above point 4 to solve the problem defined in above point 4.1.3 was obvious to the skilled person.

4.4 However, as indicated in the following sections a control of the consistency of the polymer gel at the end of a continuous belt reactor by means of an adjustment of the intensity of the energy-rich radiation (feature (i) identified in above point 4) is neither described, nor suggested by prior art documents D1 to D3, contrary to the arguments of the appellant. There is no disclosure or suggestion in any of these documents of a step of adjusting the intensity of the energy-rich radiation in the course of the polymerization in response to a polymer becoming too rigid to follow the continuous belt downward at the end of said continuous belt reactor. It was also not explained why the skilled person faced with a polymer gel which does not follow the continuous belt downward at the end of the continuous belt reactor would suspect for example based on phenomena known to occur during such polymerization reaction on a continuous belt reactor that one could remedy this problem by reducing the intensity of the energy-rich radiation.

4.4.1 D3 relates to a method of manufacturing a water-absorbing shaped body that is produced by polymerizing an aqueous solution including a photo polymerization initiator and a water-soluble ethylenically unsaturated monomer. The aqueous solution is thickened in a first polymerization step using light radiation until a desired viscosity is attained for performing a shaping step after radiation of the light is stopped. In a second step radiation of the light is resumed for

completing polymerization (abstract, claim 3, paragraph [0027]). The purpose of this first polymerization step before the shaping step is performed is to avoid the use of a thickening agent, the aqueous solution being thickened due to the partial polymerization operated during the first polymerization step (abstract, paragraphs [0006], [0032], [0033]). The maximum viscosity obtained after the first polymerization step is such that a shaping step is still possible as indicated in paragraphs [0033] and [0034]).

- 4.4.2 There is no indication in D3 that a viscosity or consistency value corresponding to that of a rigid polymer gel within the meaning of the patent in suit, i.e. a consistency which would not allow the polymer gel to move downward at the end of the continuous belt reactor, would be obtained as a result of too high exposure to the energy-rich radiation. Above the preferred maximum value of the viscosity recommended for the first step, the thickened monomer cannot be shaped easily (paragraph [0034]). It was not shown that such values of viscosity at which the thickened monomer solution cannot be shaped easily is one similar to the viscosity of the polymer gel resulting in a polymer gel which would not move downward at the end of the continuous belt reactor or even to viscosity values typically obtained for a superabsorbent polymer at the end of a continuous belt reactor. It was also not shown that a level of polymerization typically obtained for a superabsorbent polymer at the end of a continuous belt reactor is similar to that leading to the maximum value of the viscosity taught in D3 for the first polymerization step, so that the skilled person concerned with the consistency of the polymer gel at the end of the continuous belt reactor would have no

reason to consider to measures taught in D3 in relation to that first polymerization step.

4.4.3 It was pointed out by the appellant that polymerization of the polymer gel in D3 can take place on a continuous belt as mentioned in paragraph [0046] of that document. An example of such process is described in Example 6 of this document (paragraphs [0071] and [0072]). According to paragraph [0046], when a continuous belt is used, the aqueous solution is continuously injected onto the continuous belt, so that the aqueous solution is thickened and shaped while being conveyed. In this case, in order to prevent the aqueous solution from spilling out of the continuous belt, it is preferable that the first polymerization step is performed simultaneously while the aqueous solution is injected. It follows that the viscosity or consistency of the injected partially polymerized solution is in such process far below the viscosity of a rigid material within the meaning of the patent in suit. The control of the viscosity by adjusting the light intensity in D3 concerns therefore a range of viscosity which is far below the value obtained when the polymer gel becomes too rigid to not follow the continuous belt.

4.4.4 There is furthermore no suggestion in D3 that a control of the viscosity by adjusting the light intensity would be possible also in a range of viscosity near to values corresponding to a rigid polymer which represents a context different from that of the first step operated in D3. As indicated in paragraphs [0014] and [0015] of the patent in suit the rigidity of the polymer gel is not only due to a higher monomer conversion, but also to a reduced water content. It was not shown that the skilled person based on the phenomena known in the art to underlie such polymerization process and the various

parameters known to influence the consistency of the polymer gel would understand that a reduction of the intensity of the energy-rich radiation would not only reduce the monomer conversion, but also lead to polymer gel having a higher water content, both factors having an influence on the consistence of the polymer gel.

4.4.5 Accordingly, D3 does not suggest to adjust during the polymerization the intensity of the energy-rich radiation as a means to control the consistency of a polymer gel so that it does not become too rigid to not follow the continuous belt at the end of the belt reactor.

4.4.6 D1 also concerns the continuous synthesis of water absorbent polymers on an endless belt using UV radiation (claim 1; Figure 1; Example 1; paragraphs [0011], [0013] and [0072]). The height of the ceiling of the polymerizing device on which the UV irradiation unit is installed (page 10, lines 43-53) is preferably changeable (paragraph [0075]). It is stated in this paragraph (page 11, lines 10-11) that depending on a polymer produced, the expansion ratio of the hydropolymer or the suitable intensity of ultraviolet ray differs. By making the ceiling height changeable attachment of the polymer to the ceiling can be avoided and the intensity of ultraviolet ray can be adjusted (paragraph [0075]). It follows, contrary to the argument of the appellant, that D1 does not teach to adjust the intensity of the UV-radiation (resulting from an adjustment of the height of the ceiling) in response to variations of the polymer properties, let alone its consistency, occurring during a given polymerization process, but rather as a function of the type of polymer to be produced, i.e. to vary the settings of the polymerization device as a function of

the polymer to be produced. This is confirmed by the screw type lift mechanism used to change the height of a ceiling of the polymerizing device described in paragraph [0076], Figure 7 and paragraph [0013]. The argument that in Example 1 of D1 (paragraph [0089]) the polymerisation was carried out while changing the intensity of the UV-radiation in response to the contraction of the polymer gel also fails to convince. Example 1 and Figure 8 showing the continuous polymerization device used in Example 1 merely disclose the use of two fixed light intensities provided by two sources of light in two separate parts of the polymerizing device, which light intensities are not described to be varied in response to variations of the properties of the polymer gel at some point of the polymerizing device.

4.4.7 Accordingly, an adjustment of the intensity of the light radiation during the polymerization process resulting in a control of the properties of the polymer gel obtained at some point of the polymerizing device, let alone its consistency at the end of the continuous belt reactor, as required by operative claim 1, is not suggested by D1 either.

4.4.8 D2 also concerns the synthesis of water absorbent polymers using UV radiation, preferably on an continuous belt (claim 16, whole page 18 and paragraph bridging pages 18 and 19). As noted by the appellant, D2 concerns a two step polymerization procedure using two different light intensities. It was also not disputed that D2 teaches that different profiles of light intensities may be used during the polymerization, i.e. that the light intensity may be varied with the advancement of the reaction (page 7, lines 14-22). These measures represent as noted by the

appellant an adjustment of the intensity of the UV-radiation during the polymerisation time. They lead to a profile of the intensity of the UV-radiation as a function of the polymerization time or as a function of the position of the solution/gel on the moving belt. However, they do not represent a variation or an adjustment of said profile in response to a measurement or evaluation of some properties at the end of the polymerisation belt, let alone of the consistency of the polymer gel as required by operative claim 1. Hence, D2 does not describe or suggest the use of feature (i) either.

4.4.9 Consequently, it was not demonstrated that the use of feature (i) as identified in above point 4 to solve the problem defined in above point 4.1.3 was obvious to the skilled person.

4.5 Accordingly, the skilled person starting from the process of Example 12 of D9 would not arrive in an obvious way to the subject-matter of operative claim 1.

Objection of inventive step in the light of D8

5. The appellant submitted an additional objection for lack of inventive step starting from D8 as the closest prior art which document had not been admitted into the proceedings by the opposition division. The admissibility to the proceedings of this document is in dispute.

5.1 According to the established case law, in particular decision G 7/93 (OJ EPO 1994, 775), point 2.6 of the reasons, Boards of Appeal should only overturn discretionary decisions under Article 114(2) EPC of the first instance if it is concluded that the first

instance exercised its discretion according to the wrong principles, or without taking into account the right principles or in an unreasonable way. D8 and D9 were both submitted after the period for opposition. The reasons for not admitting D8 into the opposition proceedings was that D8 was not more relevant than D9, which prior art D9 was admitted into the proceeding, as it constituted a prior art closer to the claimed method than the documents cited in the notice of opposition.

5.2 While D8 and D9 concern both the same kind of process, it is undisputed that the process of claim 1 differs from that disclosed in D8 solely by the control of the consistency of the gel at the end of the polymerisation belt by an adjustment of the intensity of the energy-rich radiation. It is undisputed that in the process of D8 the polymer gel falls downward at the end of the continuous belt reactor. Accordingly, there was no reason to consider that D9 represented a prior art closer to the subject-matter of operative claim 1 than D8. Moreover, concerning the relevance of D8 and D9, a criterion which was used by the opposition division to decide on their admissibility was which of these documents was the most relevant. However, the criterion to be considered is not a comparison of the relevance of the documents whose admittance had to be decided, but whether these documents submitted outside of the opposition period are more relevant than the prior art documents already on file. Based on the assessment of technical features of D8 and D9 made by the opposition division, it follows that both D8 and D9 relate to a similar process and that D8 in fact comes structurally even closer to the process of operative claim 1 than D9, meaning that using the appropriate criterion for assessing the relevance of D8 should have led the opposition division to also admit that prior art

document into the proceedings. For the above reasons, and in view of its own discretion pursuant to Article 12(4) RPBA, the Board decided not to hold document D8 inadmissible.

- 5.3 The parties did not dispute that the polymer gel moving downward at the end of the continuous belt reactor did not constitute a feature distinguishing the process of operative claim 1 from that disclosed in D8. Apart from that aspect, their submissions on inventive step starting from D8 as the closest prior art were made for both parties by reference to the submissions made in relation to D9 as the closest prior art. Under these conditions, the reasoning provided above for inventive step of the method of operative claim 1 in the light of D9 as the closest prior art and the conclusion based on it also apply when D8 is taken as an alternative starting point for assessing inventive step. Accordingly, the subject-matter of claim 1 as granted is also deemed to involve an inventive step over D8.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



B. ter Heijden

D. Marquis

Decision electronically authenticated