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**Datasheet for the decision
of 15 September 2023**

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Language of the proceedings: EN

Title of invention:

POLYETHYLENE COMPOSITION WITH IMPROVED BALANCE OF SLOW CRACK
GROWTH RESISTANCE, IMPACT PERFORMANCE AND PIPE PRESSURE
RESISTANCE FOR PIPE APPLICATIONS

Patent Proprietor:

Borealis AG

Opponents:

Basell Polyolefine GmbH
The Dow Chemical Company

Relevant legal provisions:

EPC Art. 100 (b)

Keyword:

Sufficiency of disclosure - Main request and auxiliary
requests 1-17 (no)



Beschwerdekammern

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Case Number: T 2425/19 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 15 September 2023

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Decision under appeal:

**Interlocutory decision of the Opposition
Division of the European Patent Office posted on
2 July 2019 concerning maintenance of the
European Patent No. 2740761 in amended form.**

Composition of the Board:

Chairman D. Semino
Members: D. Marquis
 R. Cramer

Summary of Facts and Submissions

- I. The appeals lie against the decision of the opposition division concerning maintenance of European patent No. 2 740 761 on the basis of the claims of auxiliary request 2 filed at the oral proceedings before the opposition division on 23 May 2019 and a description adapted thereto.
- II. Independent claims 1 and 12 of the patent as granted read as follows:
- "1. A multimodal polyethylene composition comprising a base resin which comprises a low molecular weight ethylene homo- or copolymer fraction (A) and a high molecular weight ethylene homo- or copolymer fraction (B), wherein fraction (A) has a lower average molecular weight as fraction (B), **characterized in that** the base resin has a weight average molecular weight (Mw) of from 190,000 g/mol to 300,000 g/mol, determined by GPC according to ISO 16014-4:2003 and ASTM D 6474-99, a complex viscosity at 0.05 rad/s ($\eta^*_{0.05 \text{ rad/s}}$) of 75 to 500 kPa.s and a shear thinning index, being the ratio of the complex viscosities at a shear stress 2.7 kPa and at a shear stress of 210 kPa, ($\text{SHI}_{2.7/210}$) of 10 to 60, $\eta^*_{0.05 \text{ rad/s}}$ and $\text{SHI}_{2.7/210}$ being determined by dynamic shear measurements according to ISO 6721-1 and ISO 6721-10, and the composition has a melt flow rate at a load of 21.6 kg (MFR_{21}) of equal to or less than 7.0 g/10 min, determined according to ISO 1133 at a temperature of 190°C and a load of 21.6 kg".
- "12. A process for preparing the polyethylene

composition according to any of the preceding claims comprising the steps of polymerizing the base resin in a multi-stage process, wherein the low molecular weight fraction (A) and the high molecular weight fraction (B) are polymerized in subsequent polymerization stages, and separating the base resin in at least two fractions with different average particle size in a sieving step".

- III. The decision under appeal was based, *inter alia*, on D1 (WO-A-00/22040).

- IV. In its decision the opposition division concluded *inter alia* that claim 1 as granted was sufficiently disclosed. D1 disclosed the preparation of the same multimodal resin as the base resin prepared in the examples of the patent in suit. The example of the patent in suit provided sufficient guidance for a sieving step of that base resin and the recovery of a multimodal polyethylene composition having the properties defined in claim 1 of the main request. The subject-matter of claims 14 and 15 as granted, however, lacked novelty over the disclosure of document D1. The same conclusion applied to claims 13 and 14 of auxiliary request 1. The patent in suit as amended according to auxiliary request 2 met instead the requirements of the EPC.

- V. The patent proprietor (appellant I) and opponents 1 and 2 (appellants II and III respectively) lodged an appeal against the decision of the opposition division.

- VI. The patent proprietor filed auxiliary requests 1-14 with the statement of grounds of appeal, new auxiliary requests 6 and 7 with letter of 17 April 2020 and

auxiliary request 17 with letter of 8 December 2021.

- VII. The parties were summoned to oral proceedings and a communication pursuant to Article 15(1) RPBA 2020 indicating specific issues to be discussed at the oral proceedings was then sent to the parties.
- VIII. Oral proceedings took place on 15 September 2023 in the presence of the parties by videoconference.
- IX. The final requests of the parties were as follows:
- The patent proprietor requested that the decision under appeal be set aside and that the patent be maintained as granted (main request), or on the basis of one of auxiliary requests 1-5 filed with the statement setting out the grounds of appeal, auxiliary requests 6 or 7 corresponding to new auxiliary requests 6 and 7 filed with letter of 17 April 2020, auxiliary requests 8-16 corresponding to auxiliary requests 6-14 filed with the statement setting out the grounds of appeal, or auxiliary request 17 filed with letter of 8 December 2021.
 - The opponents requested that the decision under appeal be set aside and that the patent be revoked.
- X. Claim 1 of auxiliary request 1 corresponded to granted claim 1 in which claim 1 was further defined by "at least one of the following properties: a Charpy notched impact strength at 0°C of at least 30 kJ/m², a Charpy notched impact strength at -30°C of at least 15 kJ/m², and/or a Charpy notched impact strength at -40°C of at least 13 kJ/m², determined according to ISO 179/1eA: 2000 on compression moulded specimens prepared according to ISO 293:2004". Process claim 11 of

auxiliary request 1 corresponded to granted claim 12.

Auxiliary request 2 corresponded to auxiliary request 1 in which claims 13 and 14 were deleted.

Claim 1 of auxiliary request 3 corresponded to claim 1 of auxiliary request 1. Process claim 11 of auxiliary request 3 corresponded to granted claim 12 further modified in that "after the sieving step a fraction having a particle size of 200 μm to less than 500 μm is selected and preferably is compounded to form the polyethylene composition".

Claim 1 of auxiliary request 4 corresponded to claim 1 of auxiliary request 1 further modified in that the alternative limitations of the Charpy notched impact strength at -30°C and -40°C were deleted. Process claim 12 of auxiliary request 4 corresponded to granted claim 12.

Claim 1 of auxiliary request 5 corresponded to claim 1 of auxiliary request 4. Claim 12 of auxiliary request 5 corresponded to claim 11 of auxiliary request 3.

Claim 1 of auxiliary request 6 corresponded to claim 1 of auxiliary request 4 further limited in that the base resin had "a density of 935 to 945 kg/m^3 , determined according to ISO 1183-1:2004 Method A on compression moulded specimen according to EN ISO 1987-2" and the range of melt flow rate at a load of 21.6 kg (MFR_{21}) was limited to "equal to or less than 5.0 g/10 min". Process claim 11 of auxiliary request 6 corresponded to granted claim 12.

Claim 1 of auxiliary request 7 corresponded to claim 1 of auxiliary request 6. Process claim 11 of auxiliary

request 7 corresponded to claim 11 of auxiliary request 3.

Claim 1 of auxiliary request 8 corresponded to claim 1 of auxiliary request 4 further limited in that the composition had a "pressure resistance determined at 5.6 MPa and a temperature of 80°C of at least 1000 h, and/or a pressure resistance determined at 5.7 MPa and a temperature of 80°C of at least 1000 h, determined according to ISO 1167-1:2006 on 32 mm SDR 11 pipes". Process claim 11 of auxiliary request 8 corresponded to granted claim 12.

Claim 1 of auxiliary request 9 corresponded to claim 1 of auxiliary request 8. Process claim 11 of auxiliary request 9 corresponded to claim 11 of auxiliary request 3.

Claim 1 of auxiliary request 10 corresponded to claim 1 of auxiliary request 8 with a further limitation of the ranges of weight average molecular weight (Mw) to 220,000 g/mol to 280,000 g/mol, of complex viscosity to 175 to 400 kPa·s, of shear thinning index to 17 to 45 and of density to 935 to 947 kg/m³. Process claim 10 of auxiliary request 10 corresponded to granted claim 12.

Claim 1 of auxiliary request 11 corresponded to claim 1 of auxiliary request 10. Process claim 10 of auxiliary request 11 corresponded to claim 11 of auxiliary request 3.

Claim 1 of auxiliary request 12 corresponded to claim 1 as granted further modified in that the base resin had "a particle size of equal to or higher than 200 µm and less than 500 µm". Process claim 12 of auxiliary request 12 read:

"12. A process for preparing a multimodal polyethylene composition comprising a base resin which comprises a low molecular weight ethylene homo- or copolymer fraction (A) and a high molecular weight ethylene homo- or copolymer fraction (B), wherein fraction (A) has a lower average molecular weight as fraction (B), characterized in that the base resin has a weight average molecular weight (Mw) of from 190,000 g/mol to 300,000 g/mol, determined by GPC according to ISO 16014-4:2003 and ASTM D 6474-99, a complex viscosity at 0.05 rad/s ($\eta^*_{0.05 \text{ rad/s}}$) of 75 to 500 kPa·s and a shear thinning index, being the ratio of the complex viscosities at a shear stress 2.7 kPa and at a shear stress of 210 kPa, ($\text{SHI}_{2.7/210}$) of 10 to 60, $\eta^*_{0.05 \text{ rad/s}}$ and $\text{SHI}_{2.7/210}$ being determined by dynamic shear measurements according to ISO 6721-1 and ISO 6721-10, and the composition has a melt flow rate at a load of 21.6 kg (MFR_{21}) of equal to or less than 7.0 g/10 min, determined according to ISO 1133 at a temperature of 190°C and a load of 21.6 kg, the process comprising the steps of polymerizing the base resin in a multi-stage process, wherein the low molecular weight fraction (A) and the high molecular weight fraction (B) are polymerized in subsequent polymerization stages, and separating the base resin in at least two fractions with different average particle size in a sieving step".

Claim 1 of auxiliary request 13 corresponded to claim 1 of auxiliary request 12. Process claim 12 of auxiliary request 13 corresponded to claim 11 of auxiliary request 3.

Process claim 1 of auxiliary request 14 corresponded to

claim 12 of auxiliary request 12. Claim 13 of auxiliary request 14 read:

"13. A multimodal polyethylene composition obtained in a process according to any of the preceding claims".

Process claim 1 of auxiliary request 15 corresponded to claim 1 of auxiliary request 12.

Process claim 1 of auxiliary request 16 corresponded to claim 1 of auxiliary request 14 further limited in that "after the sieving step a fraction having a particle size of 200 μm to less than 500 μm is selected and preferably is compounded to form the polyethylene composition".

Claim 1 of auxiliary request 17 corresponded to granted claim 1 with the addition of the density feature of claim 1 of auxiliary request 6 and the further limitation of the ranges of weight average molecular weight (M_w) to 250,000 g/mol to 270,000 g/mol, of complex viscosity to 250 to 350 kPa·s, of shear thinning index to 22 to 35, and of melt flow rate (MFR_{21}) to equal to or less than 5.0 g/10 min. Process claim 11 of auxiliary request 17 corresponded to claim 1 of auxiliary request 12.

XI. The patent proprietor's arguments, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. They are essentially as follows:

- Claims 1 and 12 as granted were sufficiently disclosed. The same arguments applied to the corresponding claims of auxiliary requests 1-5, 8

and 9.

- The limitation of the multimodal polyethylene composition by its density range further delimited the operative claims from the corresponding unsieved resin. Claims 1 and 11 of auxiliary requests 6 and 7 were sufficiently disclosed.
- The limitation of the multimodal polyethylene compositions by their density range and by narrower ranges of molecular weight, complex viscosity and shear thinning index was relevant to the question of sufficiency. Claims 1 and 10 of auxiliary requests 10 and 11 were sufficiently disclosed.
- The multimodal polyethylene compositions of claim 1 of auxiliary requests 12 and 13 were further limited by their particle size range and with that limitation claims 1 and 12 of auxiliary requests 12 and 13 were sufficiently disclosed.
- Claim 1 of auxiliary request 14 pertained to the process for preparing a multimodal polyethylene composition and was defined by the presence of a sieving step. Claim 1 of auxiliary request 14 was sufficiently disclosed. The same arguments applied to auxiliary requests 15 and 16.
- The arguments pertaining to sufficiency of disclosure for claim 1 of auxiliary request 17 relied on the arguments given for auxiliary requests 10 and 11. The further limitations of the ranges of molecular weight, complex viscosity and shear thinning index brought operative claim 1 of auxiliary request 17 closer to the example of the patent in suit. Claim 1 of auxiliary request 17 was

sufficiently disclosed.

XII. The opponents' arguments, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. They are essentially as follows:

- Claims 1 and 12 as granted were not sufficiently disclosed. The same arguments applied to the corresponding claims of auxiliary requests 1-5, 8 and 9.
- The limitation of the multimodal polyethylene composition by its density range was not relevant to the question of sufficiency. Claims 1 and 11 of auxiliary requests 6 and 7 were not sufficiently disclosed.
- The limitation of the multimodal polyethylene compositions by their density range and by narrower ranges of molecular weight, complex viscosity and shear thinning index made the lack of guidance in the patent in suit even more pronounced. Claims 1 and 10 of auxiliary requests 10 and 11 were not sufficiently disclosed.
- The limitation of the multimodal polyethylene compositions of claim 1 of auxiliary requests 12 and 13 by their particle size range was not relevant to the lack of sufficient guidance in the patent in suit. Claims 1 and 12 of auxiliary requests 12 and 13 were not sufficiently disclosed.
- Claim 1 of auxiliary requests 14 to 17 lacked sufficiency of disclosure for the same reasons as those outlined for the previous requests.

Reasons for the Decision

Main request (claims as granted)

1. Sufficiency of disclosure

1.1 According to the established jurisprudence of the Boards of Appeal, a European patent complies with the requirements of sufficiency of disclosure, if a skilled person, on the basis of the information provided in the patent specification and, if necessary, using common general knowledge, is able to carry out the invention as claimed in its whole extent without undue burden, i.e. with reasonable effort. This means in the present case that the skilled person must be able to prepare multimodal polyethylene compositions having a melt flow rate at a load of 21.6 kg (MFR₂₁) of equal to or less than 7.0 g/10 min, determined according to ISO 1133 at a temperature of 190°C and a load of 21.6 kg and comprising a base resin that comprises a low molecular weight ethylene homo- or copolymer fraction (A) and a high molecular weight ethylene homo-or copolymer fraction (B), wherein fraction (A) has a lower average molecular weight as fraction (B), the base resin having to fulfil the following set of conditions:

- (a) a weight average molecular weight (M_w) of from 190,000 g/mol to 300,000 g/mol, determined by GPC according to ISO 16014-4:2003 and ASTM D 6474-99,
- (b) a complex viscosity at 0.05 rad/s ($\eta^*_{0.05 \text{ rad/s}}$) of 75 to 500 kPa.s and
- (c) a shear thinning index, being the ratio of the complex viscosities at a shear stress 2.7 kPa and

at a shear stress of 210 kPa, ($SHI_{2.7/210}$) of 10 to 60, $\eta^*_{0.05}$ rad/s and $SHI_{2.7/210}$ being determined by dynamic shear measurements according to ISO 6721-1 and ISO 6721-10.

- 1.2 The opponents maintained their objection of lack of sufficient disclosure against claims 1 and 12 as granted in the appeal proceedings. In particular, it was argued that the skilled person, contrary to the findings of the impugned decision, did not find sufficient guidance as to the preparation of multimodal polyethylene compositions fulfilling the conditions set out for the base resin in granted claim 1.
- 1.3 The arguments of the patent proprietor were that the patent in suit provided guidance for the process, conditions and starting materials in the description and contained an example showing how a composition according to granted claim 1 was obtained. On that basis, it was argued, the skilled person could perform the invention as set out in granted claim 1.
- 1.4 The question that the Board has to address is therefore whether the patent in suit contains sufficient guidance as to the preparation of the multimodal polyethylene compositions meeting the combination of parameters defined in granted claim 1 throughout the whole area claimed, taking into account the information given in the patent in suit, using common general knowledge and routine experimentation.
- 1.5 The patent in suit contains a general definition of the multimodal polyethylene compositions corresponding to the definition of granted claim 1 (paragraph 13) followed by a section addressing the base resin which forms part of the compositions (paragraphs 18-49). That

section discloses the two fractions (A) and (B) of the base resin and contains passages discussing individual features of the base resin. In these passages, the description discloses the comonomer content (paragraph 33), complex viscosity (paragraph 35), weight average molecular weight (paragraph 36), shear thinning index SHI_(2.7/210) (paragraph 42), density (paragraph 43), melt flow rates and flow rate ratio (paragraphs 44-46) and melting and crystallization temperatures (paragraphs 48 and 49) of the base resin only in terms of preferred ranges. There is in the part dedicated to the definition of the base resin in the description no teaching as to how a base resin having simultaneously a weight average molecular weight (Mw) of from 190,000 g/mol to 300,000 g/mol, a complex viscosity at 0.05 rad/s ($\eta^*_{0.05 \text{ rad/s}}$) of 75 to 500 kPa.s and a shear thinning index (SHI_{2.7/210}) of 10 to 60 (conditions (a) to (c) as defined above) can be obtained.

- 1.6 A process for the production of the multimodal polyethylene compositions is also disclosed in the patent in suit (paragraph 70). From that passage the skilled reader learns that the base resin is produced in a multi-stage process and that after polymerization the base resin is separated in at least two fractions with a different particle size in a sieving step.
- 1.6.1 The multi-stage process is further disclosed in the description in paragraphs 75-114 but only in very general terms and by way of optional and preferred features or ranges (slurry or gas phase polymerization, reactor, monomer concentration, polymerization temperature and residence time). There is no teaching as to how a skilled person could specifically implement that process to obtain a base resin fulfilling the

conditions (a) to (c) of granted claim 1.

- 1.6.2 The sieving step applied to the base resin after the multi-stage polymerization is disclosed in paragraphs 70 and 132 of the description. It is said to lead to the separation of the polyethylene resin in at least two fractions of different particle size (preferred ranges are given in paragraph 135) but there is no further teaching as to how the sieving step, if need be in conjunction with the parameters of the multi-stage process, could lead to a base resin fulfilling the conditions (a) to (c) of granted claim 1.
- 1.6.3 While from that general teaching the skilled person can derive the information that a multi-stage polymerisation followed by a sieving step is necessary, no guidance is available as to how the operating conditions of the former and of the latter should be selected in order to obtain a base resin fulfilling the conditions (a) to (c) and in particular as to how these operating conditions should be modified in order to change a failure into success when the desired result is not obtained.
- 1.6.4 At the oral proceedings before the Board the patent proprietor considered that the definition of the catalyst in the patent in suit was relevant to the sufficiency of disclosure of granted claim 1. The disclosure of the catalyst in the description (paragraphs 115 to 124) is, however, completely unspecific and starts by stating: "As catalyst system any system of catalyst and optionally cocatalyst can be used suitable for polymerising polyethylene resins". The catalyst in the patent in suit is in particular not linked to any teaching relating to the preparation of a base resin fulfilling the conditions (a) to (c) of

granted claim 1. The Board therefore does not find that the catalyst is in itself relevant to the question of sufficiency of disclosure of granted claim 1.

- 1.7 The patent proprietor also relied on the single example of the patent in suit in order to show how a multimodal polyethylene composition and a base resin according to granted claim 1 could be obtained. The example of the patent in suit, also by reference to the example of document D1 (preparation of inventive material A) indeed shows the disclosure of one specific multi-stage polymerization process followed by a sieving step resulting in a base resin (fraction 3) according to granted claim 1. The question to be answered, however, is whether a single example gives sufficient guidance to the skilled person as to how to obtain the base resin of the multimodal polyethylene compositions over the whole scope of granted claim 1.
- 1.8 Fraction 3 of the example of the patent in suit, which corresponds to polyethylene particles of a size of 250 to less than 400 μm , happens to fulfil conditions (a) to (c) (M_w of 265 000 g/mol, $\eta^*_{0.05 \text{ rad/s}}$ of 301.3 kPa.s and $\text{SHI}_{2.7/210}$ of 29) but it is apparent that neither the multi-stage polymerization process of the example of D1, nor the sieving step disclosed in the example of the patent in suit contain a direct teaching of how the process features and the sieving step should be chosen in order to prepare a base resin meeting the conditions (a) to (c) over the whole breadth of claim 1.
- 1.9 Table 1 in the patent in suit shows marked trends in the variation of the weight average molecular weight, complex viscosity and shear thinning index across the fractions of different particle sizes. The skilled reader further derives from Table 1 that with

increasing particle size ranges of the polyethylene fractions (less than 125 μm in fraction 1, between 125 and less than 250 μm in fraction 2, between 250 and less than 400 μm in fraction 3 and 400 μm or more in fraction 4) the weight average molecular weight and the complex viscosity increase steeply (131 0000 g/mol and 24.6 kPa.s for fraction 1, 159 0000 g/mol and 71.2 kPa.s for fraction 2, 265 0000 g/mol and 301.3 kPa.s for fraction 3 and 273 0000 g/mol and 513.8 kPa.s for fraction 4) whereas the shear thinning index sharply decreases (181 for fraction 1, 130 for fraction 2, 29 for fraction 3 and 18 for fraction 4).

1.10 In order to obtain a base resin having a complex viscosity $\eta^*_{0.05 \text{ rad/s}}$ over the whole range of 75 to 500 kPa.s according to claim 1, for instance close to the minimum value of 75 kPa.s, the skilled reader would have derived from Table 1 that fractions of lower particle sizes should be considered, close to the particle size of fraction 2. Table 1 however suggests that for low values of the complex viscosity the weight average molecular weight and the shear thinning index of the fractions will be largely outside the ranges defined in granted claim 1. There is in the patent in suit no further guidance as to how the sieving step should be adapted so as to obtain base resins over the whole scope of granted claim 1 and there is also no guidance as to whether the parameters of the multi-stage process should be modified and if so, how they should be modified so that such base resins could be obtained.

1.11 The Board therefore concludes that the patent in suit does not provide the necessary guidance for the preparation of the multimodal polyethylene compositions defined in granted claim 1 over its whole scope and

with a reasonable effort. The same conclusion is valid for the process claim 12 as granted which refers to the compositions of granted claim 1 and does not provide any process limitation in addition to the ones discussed above. Granted claims 1 and 12 therefore lack sufficiency of disclosure.

Auxiliary requests 1 to 5

2. Sufficiency of disclosure

2.1 Sufficiency of disclosure of auxiliary requests 1 to 5 was in dispute between the parties which relied on their arguments provided for the main request and did not provide specific arguments for these auxiliary requests.

2.2 Claim 1 of auxiliary request 1 differed from granted claim 1 in that the multimodal polyethylene composition was further limited in that it has at least one of the following properties: a Charpy notched impact strength at 0°C of at least 30 kJ/m², a Charpy notched impact strength at -30°C of at least 15 kJ/m², and/or a Charpy notched impact strength at -40°C of at least 13 kJ/m², determined according to ISO 179/1eA:2000 on compression moulded specimens prepared according to ISO 293:2004. Claim 1 of auxiliary request 1 therefore differed from granted claim 1 in that a further condition had to be fulfilled by the multimodal polyethylene composition in addition to those set out in granted claim 1.

2.3 The Charpy notched impact strength of the polyethylene composition at 0°C, -30°C and -40°C is disclosed in paragraphs 62-64 of the patent in suit only by way of preferred ranges. As for the other features of claim 1, there is no teaching in the patent in suit as to how

the ranges of Charpy notched impact strength of the polyethylene composition at 0°C, -30°C and -40°C could be obtained by adjusting any of the features of claim 1 or any step of the multi-stage polymerization process or the sieving step. It has also not been shown that the limitation of the Charpy notched impact strength of the polyethylene composition was in any way relevant to the definition of the base resin by way of the conditions (a) to (c). It follows that the reasoning and conclusion of lack of sufficiency reached for granted claim 1 equally apply to claim 1 of auxiliary request 1. Since claims 1 of auxiliary requests 2 and 3 were identical to claim 1 of auxiliary request 1, the conclusion of lack of sufficiency also applies to auxiliary requests 2 and 3.

- 2.4 Claim 1 of auxiliary requests 4 and 5 corresponded to claim 1 of auxiliary request 1 in which two of the three additional limitations applying to the Charpy notched impact strength of the polyethylene composition (Charpy notched impact strength at -30°C and -40°C) were deleted. The limitation regarding the Charpy notched impact strength of the polyethylene composition at 0°C remains in claim 1 of auxiliary requests 4 and 5. The reasoning and conclusion of lack of sufficient disclosure applying to claim 1 of auxiliary request 1 therefore equally applies to claim 1 of auxiliary requests 4 and 5.

Auxiliary requests 6 and 7

3. Sufficiency of disclosure

- 3.1 Claim 1 of auxiliary requests 6 corresponded to claim 1 of auxiliary request 4 further limited in that the base resin had a density of 935 to 945 kg/m³ and the range

of melt flow rate at a load of 21.6 kg (MFR₂₁) was limited to "equal to or less than 5.0 g/10 min". By comparison with granted claim 1, the multimodal polyethylene compositions must fulfill an additional condition relating to their Charpy notched impact strength at 0°C (at least 30 kJ/m²) at a more limited range of melt flow rate (MFR₂₁) (from at equal to or less than 5.0 g/10 min) and the base resin must also fulfill an additional condition relating to its density (935 to 945 kg/m³).

3.2 The density of the base resin is addressed in paragraph 43 of the patent in suit and is defined by way of preferred ranges. The density of a base resin is a parameter that is in itself known in the field but its addition in claim 1, in combination with the other conditions (a)-(c) set out for the base resin, renders its preparation even more complex than it was in the case of granted claim 1. There is also no teaching in the patent in suit the skilled person could rely upon in order to prepare base resins according to claim 1 of auxiliary request 6.

3.3 The example of the patent in suit would not provide the skilled person with additional guidance either. Table 1 shows that the density of the base resin varies with the particle size's fraction and only fraction 3 (941 kg/m³) has a density within the the range of operative claim 1. A variation of the range of particle sizes of the fractions separated by sieving after the multi-stage process therefore leads to opposite variations of the four conditions the base resin has to fulfill, and the patent proprietor did not show how these variations could be adjusted in order to arrive at a composition according to claim 1 of auxiliary request 6 over the whole scope of the claim. The Board therefore concludes

that claim 1 of auxiliary request 6 lacks sufficiency of disclosure. The same conclusion applies to claim 1 of auxiliary request 7 which is identical to claim 1 of auxiliary request 6.

Auxiliary requests 8 and 9

4. Sufficiency of disclosure

- 4.1 Claim 1 of auxiliary request 8 corresponded to claim 1 of auxiliary request 4 further modified in that the multimodal composition has "pressure resistance determined at 5.6 MPa and a temperature of 80°C of at least 1000 h, and/or a pressure resistance determined at 5.7 MPa and a temperature of 80°C of at least 1000 h, determined according to ISO 1167-1:2006 on 32 mm SDR 11 pipes".
- 4.2 All parties relied on their arguments provided for the main request for the objection of lack of sufficiency of disclosure of auxiliary requests 8 and 9.
- 4.3 The pressure resistance of the multimodal polyethylene composition is disclosed in paragraphs 67 and 68 of the patent in suit. It is again disclosed by way of preferred ranges for which there is no teaching in the patent in suit as to how these ranges could be met alone or in combination with the other requirements set out in claim 1 of auxiliary request 8. The reasoning and conclusion concerning the lack of sufficiency of claim 1 of the auxiliary request 4 upon which claim 1 of auxiliary request 8 is based, also apply. The same conclusion also applies to claim 1 of auxiliary request 9 which is identical to claim 1 of auxiliary request 8.

- 4.4 Claim 1 according to auxiliary requests 8 and 9 therefore lacks sufficiency of disclosure.

Auxiliary requests 10 and 11

5. Sufficiency of disclosure

- 5.1 Claim 1 of auxiliary request 10 corresponds to claim 1 of auxiliary request 8 with a further limitation of the ranges of weight average molecular weight (Mw) to 220,000 g/mol to 280,000 g/mol, of complex viscosity to 175 to 400 kPa·s, of shear thinning index to 17 to 45 and of density to 935 to 947 kg/m³.

- 5.2 In addition to the requirements set out in granted claim 1, claim 1 of auxiliary request 10 requires the multimodal polyethylene composition to fulfill a set of additional conditions pertaining to its Charpy notched impact strength at 0°C and its pressure resistance, and the base resin to additionally have a density in a defined range as well as fulfilling more restricted ranges of weight average molecular weight, complex viscosity and shear thinning index.

- 5.3 The patent proprietor argued that the limitations performed in claim 1 of auxiliary request 10 brought the scope of claim 1 closer to the example for which a preparation was disclosed in the patent in suit. There is, however, no teaching in the patent in suit on how a base resin can be obtained that fulfils a set of four conditions (density, weight average molecular weight, complex viscosity and shear thinning index) as part of a composition that must simultaneously fulfill three additional conditions (melt flow rate (MFR₂₁), Charpy notched impact strength at 0°C and pressure resistance). The number of conditions present in claim

1 of auxiliary request 10 in fact aggravates the lack of guidance as to the preparation of the composition as it adds further parameters to the claim for which there is no specific teaching in the patent in suit. The conclusion of the Board is that claim 1 of auxiliary request 10 also lacks sufficiency of disclosure.

- 5.4 Claim 1 of auxiliary request 11 is identical to claim 1 of auxiliary request 10. The conclusion of on the lack of sufficient disclosure reached for auxiliary request 10 also applies to auxiliary request 11.

Auxiliary requests 12 and 13

6. Sufficiency of disclosure

- 6.1 Claim 1 of auxiliary request 12 corresponded to granted claim 1 with the further limitation that the particle size of the base resin to a range of "equal to or higher than 200 μm and less than 500 μm ". Claim 1 of auxiliary request 13 is identical to claim 1 of auxiliary request 12.

- 6.2 The particle size of the resin obtained by the multi-stage polymerization process disclosed in the patent in suit is discussed in paragraph 135 in which the particle size is again defined in broad terms by way of preferred ranges. It can be understood from the passage in paragraphs 132 to 134 that the selection of any range of particle size can be achieved by sieving the resin. There is, however, nowhere in the description nor in the example of the patent in suit a teaching from which it could be derived that by sieving the resin so that only particles of a size of equal to or higher than 200 μm and less than 500 μm are retained, a resin also fulfilling the conditions relating to the

weight average molecular weight, complex viscosity and shear thinning index defined in operative claim 1 would be obtained. On the contrary, the example shows that in order to obtain one or more of the conditions of the base resin over the whole scope of the claim, the specific particle size would not be suitable (see analysis of the example in points 1.7-1.10 above). The Board therefore concludes that claim 1 according to auxiliary requests 12 and 13 also lacks sufficiency of disclosure.

Auxiliary requests 14 to 16

7. Sufficiency of disclosure

7.1 Claim 1 of auxiliary request 14 pertains to a process for preparing a multimodal polyethylene composition. Its formulation corresponds to that of granted claim 12 in which the wording "polyethylene composition according to any of the preceding claims" was replaced by the wording pertaining to the multimodal polyethylene composition defined in granted claim 1. Claim 1 of auxiliary request 14 therefore corresponds to the scope of granted claim 12 when dependant on granted claim 1.

7.2 The Board already came to the conclusion that both granted claims 1 and 12 lacked sufficiency of disclosure. The same reasoning and conclusion of lack of sufficiency of disclosure apply therefore to claim 1 of auxiliary request 14.

7.3 Claim 1 of auxiliary request 15 is identical to claim 1 of auxiliary request 14. The conclusion of lack of sufficiency of disclosure reached for claim 1 of auxiliary request 14 therefore also applies to claim 1

of auxiliary request 15.

- 7.4 Claim 1 of auxiliary request 16 corresponds to claim 1 of auxiliary request 14 further limited in that "after the sieving step a fraction having a particle size of 200 μm to less than 500 μm is selected and preferably is compounded to form the polyethylene composition".
- 7.5 All parties relied for claim 1 of auxiliary request 16 on their arguments of sufficiency of disclosure provided for claim 1 of auxiliary request 14. No further arguments specific to auxiliary request 16 were provided.
- 7.6 The separation of the base resin obtained by the multi-stage polymerization process in a fraction of particle size of from 200 μm to less than 500 μm is discussed in paragraph 135 of the patent in suit. It has already been established above (section 6.3 of the present decision) that there was nowhere in the description, nor in the example of the patent in suit a teaching from which it could be derived that by sieving the resin so as to obtain particles of a size of from 200 μm to less than 500 μm a resin fulfilling the conditions relating to the weight average molecular weight, complex viscosity and shear thinning index defined in operative claim 1 would be obtained. The Board therefore also concludes that claim 1 of auxiliary request 16 lacks sufficiency of disclosure.

Auxiliary requests 17

8. Sufficiency of disclosure

8.1 Claim 1 of auxiliary request 17 corresponded to granted claim 1 with the addition of the density feature of claim 1 of auxiliary request 6 and the further limitation of the ranges of weight average molecular weight (Mw) to 250,000 g/mol to 270,000 g/mol, of complex viscosity to 250 to 350 kPa·s, of shear thinning index to 22 to 35, and of melt flow rate (MFR₂₁) to equal to or less than 5.0 g/10 min.

8.2 In order to prepare a multimodal polyethylene composition according to claim 1 of auxiliary request 17 the skilled person must therefore provide a base resin having to fulfill a set of conditions relating to its density, weight average molecular weight, complex viscosity and shear thinning index within even more limited ranges. The patent in suit, however, discloses these features and ranges independently from one another and does not provide a teaching showing how these ranges could be achieved in combination as required in operative claim 1, and there is no indication in the patent in suit that the recovery of a base resin having a specific range of particle sizes after sieving would ultimately lead to a composition fulfilling the set of conditions defined in claim 1.

8.3 Table 1 of the patent in suit shows the preparation of a base resin among which only that of fraction 3 is according to the definition of operative claim 1. The table also shows that the parameters of the base resin underlie opposite variations with increasing particle sizes (the density and the shear thinning index decreases while the weight average molecular weight and

the complex viscosity increases). In how far the skilled person could have adjusted the parameters of the preparation process in order to be able to obtain a base resin and a multimodal polyethylene composition over the whole scope of claim 1 of auxiliary request 17 is not disclosed in the patent in suit nor was shown to be part of the common general knowledge of the skilled person. The Board therefore concludes that claim 1 of auxiliary request 17 lacks sufficiency of disclosure.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



D. Hampe

D. Semino

Decision electronically authenticated