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**Datasheet for the decision
of 22 March 2023**

Case Number: T 0351/20 - 3.3.03

Application Number: 09790180.5

Publication Number: 2227505

IPC: C08L23/04, D01F6/04, D01F6/46,
D04H1/00, D04H1/56, D04H3/16,
C08L23/08, D01D5/12, D01D10/02,
D01F6/30

Language of the proceedings: EN

Title of invention:
FIBERS MADE FROM POLYETHYLENE COMPOSITIONS AND METHOD OF
MAKING THE SAME

Patent Proprietor:
Dow Global Technologies LLC

Opponent:
TotalEnergies OneTech Belgium

Relevant legal provisions:
RPBA 2020 Art. 12(1), 12(4), 12(6), 13(2)
EPC Art. 56, 84, 123(2)

Keyword:

Admittance of documents

Inventive step - Main request and auxiliary request 1 (no)

Admittance - Auxiliary requests 2A, 2B, 3A, 3B, 9 (yes)

Clarity - Auxiliary requests 2A, 2B, 3A, 3B, 4A, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 10A, 10B, 11A, 11B (no)

Amendment - Auxiliary requests 9, 10A, 10B, 11A, 11B (no)



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Case Number: T 0351/20 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 22 March 2023

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
2 December 2019 concerning maintenance of the
European Patent No. 2227505 in amended form.**

Composition of the Board:

Chairman O. Dury
Members: D. Marquis
R. Cramer
M. Barrère
A. Bacchin

Summary of Facts and Submissions

I. The appeal lies against the decision of the opposition division concerning maintenance of European patent No. 2 227 505 in amended form on the basis of the claims of auxiliary request 2A filed with letter of 10 October 2019 and an adapted description.

II. Claim 1 as granted read as follows:

"1. A fiber comprising
a polyethylene composition comprising:
less than or equal to 100 percent by weight of the
units derived from ethylene;
less than 20 percent by weight of units derived from
one or more α -olefin comonomers;
wherein said polyethylene composition has a density in
the range of 0.920 to 0.970 g/cm³, a molecular weight
distribution (M_w/M_n) in the range of 1.70 to 3.5, a
melt index (I_2) in the range of 0.2 to 1000 g/10
minutes, a molecular weight distribution (M_z/M_w) in the
range of less than 2.5, vinyl unsaturation of less than
0.1 vinyls per one thousand carbon atoms present in the
backbone of said composition".

III. The contested decision is based on the main request filed with letter of 28 April 2016, auxiliary request 1 filed with letter of 24 January 2018 and auxiliary request 2A filed with letter of 10 October 2019. Claim 1 of the main request differed from granted claim 1 in that the range of density of the polyethylene composition is 0.930 to 0.960 g/cm³. Claim 1 of auxiliary request 1 corresponded to claim 1 of the main request. Claim 1 of auxiliary request 2A corresponded

to claim 1 of the main request further limited in that "the polyethylene composition is free of any long chain branching".

- IV. The decision of the opposition division was based, inter alia, on the following documents:
- D1: WO 2004/092459 A1
 - D10: EP 1 972 704 A1
 - D18: WO 2008/064112 A1
 - D19: Declaration of Mr. Jacques Michel, dated 21 August 2019
 - D19a: Analysis dated 26 April 2006
 - D22: Technical Data sheet of resin Aspun™ 6834 fiber grade resin
 - D23: Fina Research GPC curve concerning Polymer Type PE 231531-1 from 21 November 2008
 - D24: Screenshot retrieved from the website from Dow listing Aspun™ 6834 fiber grade resins.
- V. The opposition division decided that claims 1-3, 6, 8 and 9 of the main request found a basis in the application as filed. Claim 1 of the main request was novel over the prior use of "M3410 EP", over D1 and over D10 but lacked novelty over D18. The same conclusion applied to claim 1 of auxiliary request 1. Claims 1 and 3 of auxiliary request 2A found a basis in the application as filed. Claim 1 of auxiliary request 2A was clear in the sense of Article 84 EPC. Claim 1 of auxiliary request 2A was novel over D18 and the disclosure of Aspun™ 6834 in view of D22 to D24. Claim 1 of auxiliary request 2A was also inventive over D18 or D22 as documents representing the closest prior art. Auxiliary request 2A was also sufficiently disclosed. For these reasons, the patent as amended on the basis of auxiliary request 2A was held to meet the requirements of the EPC.

- VI. Both the patent proprietor and the opponent lodged an appeal against that decision.
- VII. The patent proprietor submitted auxiliary requests 2A, 2B, 3A, 3B and 4A with the statement setting out the grounds of appeal and auxiliary requests 1C, 2C, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 6C, 7A, 7B, 7C, 8A, 8B, 8C, 9, 9C, 10A, 10B, 10C, 11A, 11B and 11C as well as D30 with their rejoinder to the opponent's statement of grounds of appeal. The patent proprietor also submitted D32, D33, D34 and D35 by letter of 16 December 2022.
- D30: Declaration of Mr. Baugh regarding vinyl unsaturation of AspunTM 6834 dated 3 September 2020
- D32: Declaration of Mr. Fontaine dated 14 November 2022
- D33: D. Yan, W.-J. Wang, S. Zhu, Effect of long chain branching on rheological properties of metallocene polyethylene, *Polymer*, Volume 40, Issue 7, 1999, pages 1737-1744
- D34: Florian J. Stadler, Burçak Arikan-Conley, Joachim Kaschta, Walter Kaminsky, and Helmut Münstedt, Synthesis and Characterization of Novel Ethylene-graft-Ethylene/Propylene Copolymers, *Macromolecules*, 2011, 44 (12), pages 5053-5063
- D35: Inmaculada Suárez, Baudilio Coto, Determination of long chain branching in PE samples by GPC-MALS and GPC-VIS: Comparison and uncertainties, *European Polymer Journal*, Volume 49, Issue 2, 2013, pages 492-498
- VIII. The opponent submitted documents D26, D27 and D28 with their statement setting out the grounds of appeal, D29 with their rejoinder to the patent proprietor's statement of grounds of appeal and D31 with letter of 11 August 2022.

D26: Liu, P., Liu, W., Wang, W.-J., Li, B.-G., Zhu, S., A Comprehensive Review on Controlled Synthesis of Long-Chain Branched Polyolefins: Part 3, Characterization of Long-Chain Branched Polymers, *Macromol. React. Eng.*, 2017, 11, 1600012

D27: Claus Gabriel, Esa Kokko, Barbro Löfgren, Jukka Seppälä, Helmut Münstedt, Analytical and rheological characterization of long-chain branched metallocene-catalyzed ethylene homopolymers, *Polymer*, Volume 43, Issue 24, 2002, pages 6383-6390

D28: Data Sample 231531 mPE Aspun 6834

D29: Introduction to Industrial Polyethylene: Properties, Catalysts, and Processes, Malpass D., 2010, Ed. Scrivener Publishing LLC, Chapter 1 (Introduction to polymers of ethylene), page 10

D31: R. N. Shroff and H. Mavridis, Long-Chain-Branching Index for Essentially Linear Polyethylenes, *Macromolecules* 1999 32 (25), pages 8454-8464

- IX. With letter of 8 June 2022, 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.
- X. During the oral proceedings, which were held on 22 March 2023 by videoconference, the opponent withdrew their request not to admit into the proceedings any of auxiliary requests 4A, 5A, 5B, 6A, 6B, 7A, 7B, 8A and 8B (minutes: page 2, last paragraph; page 3, third paragraph). They also - conditionally - withdrew their request not to admit into the proceedings auxiliary requests 11A and 11B in the event the Board would conclude that their Article 84 EPC objections were also valid for these requests (minutes: page 4, first paragraph). The patent proprietor withdrew all

auxiliary requests of their C series at the oral proceedings before the Board.

XI. The final requests of the parties were as follows:

The opponent requested that the decision of the opposition division be set aside and that the patent be revoked.

The patent proprietor requested that the decision under appeal be set aside and the patent be maintained on the basis of the claims of the main request or of any of auxiliary requests 1, 2A, 2B, 3A, 3B and 4A filed with their statement setting out the grounds of appeal, or of any of auxiliary requests 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9, 10A, 10B, 11A and 11B filed with their rejoinder to the opponent's statement of grounds of appeal.

The main request and auxiliary request 1 corresponded to the main request and auxiliary request 1, respectively, addressed in the contested decision.

Claim 1 of auxiliary request 2A corresponded to claim 1 of the main request further limited by the sentence "wherein the polyethylene composition is substituted with less than 0.1 long chain branching per 1000 total carbons".

Claim 1 of auxiliary request 3A corresponded to claim 1 of auxiliary request 2A wherein the range of long chain branching was "less than 0.01 long chain branching per 1000 total carbons".

Claims 1 of auxiliary requests 2B and 3B corresponded to claims 1 of auxiliary requests 2A and 3A

respectively, further limited by the following sentence "wherein long chain branching is determined according to gel permeation chromatography coupled with low angle laser light scattering detector (GPC-LALLS) or gel permeation chromatography coupled with a differential viscometer detector (GPC-DV)".

Claim 1 of auxiliary request 4A corresponded to claim 1 of the main request further limited by the sentence "wherein the polyethylene composition is free of any long chain branching". It was identical to claim 1 of auxiliary request 2A dealt with in the contested decision and allowed by the opposition division.

Claim 1 of auxiliary request 5A corresponded to claim 1 of auxiliary request 4A in which the range of melt index (I_2) is limited to "2 to 1000 g/10 minutes".

Claim 1 of auxiliary request 6A corresponded to claim 1 of auxiliary request 4A in which the range of melt index (I_2) is limited to "10 to 1000 g/10 minutes".

Claim 1 of auxiliary request 7A corresponded to claim 1 of auxiliary request 4A in which the range of molecular weight distribution (M_z/M_w) is limited to less than 2.3.

Claim 1 of auxiliary request 8A corresponded to claim 1 of auxiliary request 4A in which the range of molecular weight distribution (M_z/M_w) is limited to less than 2.2.

Claim 1 of auxiliary request 9 corresponded to claim 1 of the main request in which the range defining the density of the polyethylene composition is limited to

0.936-0.960 g/cm³.

Claim 1 of auxiliary request 10A corresponded to claim 1 of auxiliary request 5A in which the range defining the density of the polyethylene composition is limited to 0.936-0.960 g/cm³.

Claim 1 of auxiliary request 11A was directed to a melt spun fiber comprising a polyethylene composition defined according to claim 1 of auxiliary request 4A.

Claims 1 of auxiliary request 4B, 5B, 6B, 7B, 8B, 10B and 11B corresponded to claims 1 of auxiliary requests 4A, 5A, 6A, 7A, 8A, 10A and 11A respectively, further limited by the following sentence "wherein long chain branching is determined according to gel permeation chromatography coupled with low angle laser light scattering detector (GPC-LALLS) or gel permeation chromatography coupled with a differential viscometer detector (GPC-DV)".

Claims 2 of auxiliary requests 4A, 9, 10A, 10B, read "2. The fiber according to Claim 1, wherein said fiber exhibits one or more of the following properties:
(i) has a denier per filament in the range of less than 50 g/9000 m,
(ii) has a tenacity in the range of 0.1 to 5 g/denier,
(iii) has an elongation measured in percent of less than 1000,
(iv) has a boiling water shrink measured in percent after being annealed at 120°C in the range of less than 30, or
(v) is a staple fiber or a continuous fiber".

Claim 2 of auxiliary requests 11A and 11B read "The melt spun fiber according to Claim 1, wherein said melt

spun fiber exhibits one or more of the following properties" (i) to (v) whereby said properties (i) to (v) were identical to the ones defined for claims 2 of auxiliary requests 4A, 9, 10A and 10B.

XII. 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:

- D26, D27, D28 and D31 should not be admitted into the proceedings. D30, D34 and D35 should be admitted into the proceedings.
- Claims 1 of the main request and auxiliary request 1 involved an inventive step over D18 as the closest prior art.
- Auxiliary requests 2A, 2B, 3A, 3B should be admitted into the proceedings.
- Claims 1 of auxiliary requests 2A, 2B, 3A, 3B satisfied the requirements of Article 84 EPC.
- Claims 1 of auxiliary requests 4A, 5A, 6A, 7A, 8A satisfied the requirements of Article 84 EPC.
- Claims 1 of auxiliary requests 4B, 5B, 6B, 7B and 8B satisfied the requirements of Article 84 EPC.
- Auxiliary requests 9, 10A and 10B should be admitted into the proceedings.
- Claims 2 of auxiliary requests 9, 10A, 10B, 11A, 11B satisfied the requirements of Article 123(2) EPC. Claims 1 of auxiliary requests 10A, 10B, 11A and 11B satisfied the requirements of Article 84 EPC.

XIII. The opponent'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:

- D26, D27, D28 and D31 should be admitted into the proceedings. D30, D34 and D35 should not be admitted into the proceedings.
- Claims 1 of the main request and auxiliary request 1 lacked an inventive step over D18 as the closest prior art.
- Auxiliary requests 2A, 2B, 3A, 3B should not be admitted into the proceedings.
- Claims 1 of auxiliary requests 2A, 2B, 3A, 3B did not satisfy the requirements of Article 84 EPC.
- Claims 1 of auxiliary requests 4A, 5A, 6A, 7A, 8A did not satisfy the requirements of Article 84 EPC.
- Claims 1 of auxiliary requests 4B, 5B, 6B, 7B and 8B did not satisfy the requirements of Article 84 EPC.
- Auxiliary requests 9, 10A and 10B should not be admitted into the proceedings (conditional request for auxiliary requests 11A and 11B: see section X above).
- Claims 2 of auxiliary requests 9, 10A, 10B, 11A, 11B did not satisfy the requirements of Article 123(2) EPC. Claims 1 of auxiliary requests 10A, 10B, 11A and 11B did not satisfy the requirements of Article 84 EPC.

Reasons for the Decision

1. Documents D26 to D35 - Admittance
 - 1.1 D26 is a review on the preparation of polyolefins and their characterization through long chain branching. D26 was cited by the opponent in their statement of grounds of appeal as a document representing the knowledge on long chain branching. D26 was published in

2017, after the priority date of the patent, but it was not disputed that D26 represented the common general knowledge on long chain branching at the priority date of the patent in suit. The argumentation of both the opponent and the patent proprietor in appeal referred to D26. The patent proprietor, in section 6.5 of their rejoinder also argued that the equations of D26 were known and understood long before the patent in suit's filing date, which in view of the publication dates of almost all the references in D26 is credible for the Board. The Board also finds that D26 can be seen as representing the common general knowledge on long chain branching for the patent in suit.

- 1.2 D27 is a publication from 2002 on the analytical and rheological characterization of long-chain branched metallocene-catalyzed ethylene homopolymers. The opponent put forward that D27 was filed in reaction to the reasoning of the opposition division on long chain branching in the contested decision (sections 6.3, 7.2, 8.2 and 9.3; statement of grounds of appeal of the opponent: page 3, paragraph preceding section 3).
- 1.3 The admittance of D26 and D27 into the appeal proceedings is subject to the provisions of Article 12(4) and (6) RPBA 2020. Both D26 and D27 were filed with the opponent's statement of grounds of appeal to pursue lines of argumentations in appeal that had already been raised in opposition but which did not succeed.
- 1.4 D26 and D27 address the characterization, in claim 1 of auxiliary request 2A, of the polyethylene composition by its long chain branching, a feature that was introduced at a late stage of the opposition proceedings, i.e. at the end of the time limit under

Rule 116 EPC and two months prior (on 22 August 2019) to the oral proceedings before the opposition division (on 23 October 2019). In that regard, the Board considers that the short period of time available to the opponent before the oral proceedings before the opposition division can be seen as justifying the filing of D26 and D27 with their statement setting out the grounds of appeal. The Board therefore finds that the circumstances of the case justify the admittance of D26 and D27 into the proceedings (Article 12(6) RPBA 2020, second sentence).

- 1.5 D28 was filed with the grounds of appeal of the opponent. D28 is cited in support of an attack of lack of novelty based on D22 against claim 1 of the main request, an attack raised in opposition on 22 August 2019. According to Article 12(6) RPBA 2020, the Board shall not admit requests, facts, objections or evidence which should have been submitted, or which were no longer maintained, in the proceedings leading to the decision under appeal, unless the circumstances of the appeal case justify their admittance. It is apparent from the facts of the present case that the main request was filed on 28 April 2016 before the opposition division, so that when the opponent raised their novelty attack based on D22 against claim 1 of the main request on 22 August 2019, they already should have provided their full case including evidence concerning D22, and not first in appeal. Under the present circumstances, the Board does not find reasons that would justify the admission of D28 into the proceedings according to Article 12(6) RPBA 2020.
- 1.6 D30 is a declaration provided by the patent proprietor to address the content of D28 pertaining to the determination of the vinyl unsaturation. There is

however no reason to admit D30 into the proceedings since D28 is not admitted.

1.7 Documents D31, D34 and D35 were submitted after the notification of the summons to oral proceedings by the Board. The admittance of these documents into the appeal proceedings is subject to the provisions of Article 13(2) RPBA 2020 according to which any amendment to a party's appeal case made after notification of a summons to oral proceedings shall, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.

1.8 D31 was submitted by the opponent in support of arguments made with their letter of 11 August 2022 (sections 2.1 and 2.4). D31 addresses the determination of the long chain branching index in polyethylenes. It also discusses the validity of known methods of determination of long chain branching including methods discussed between the parties in appeal (rejoinder of the patent proprietor, sections 4.2-4.6 and 6.6-6.11). The admittance of D31 was contested on the grounds that it could have been filed earlier, during the opposition proceedings. The opponent submitted that D31 was in fact filed to address the question of the validity of the method for the determination of long chain branching by combining size exclusion chromatography and intrinsic viscosity due to limitations linked to its sensitivity (letter of the opponent of 11 August 2022, section 2.4). The discussion of the sensitivity of the method for the determination of long chain branching is a question that was addressed by the patent proprietor in their rejoinder (sections 4.2, 4.4, 4.6) with regard to the objection of lack of clarity. This can be considered as an exceptional

circumstance that can justify the admittance of D31 filed by the opponent at this stage of the appeal proceedings (Article 13(2) RPBA 2020).

1.9 D34 and D35 are publications that were cited by the patent proprietor to reflect the common general knowledge about the determination of long chain branching in polyethylene samples. These documents also concern the use of GPC-based methods and were submitted by the patent proprietor to address the objection of lack of clarity discussed in appeal. The patent proprietor argued that these documents were filed in response to the argument made by the opponent in section 4.1 of their letter of 11 August 2022 concerning the sensitivity of the methods of determination of long chain branching based on D26 and D27. This can be considered as an exceptional circumstance that justifies the admittance of D34 and D35 at this stage of the appeal proceedings (Article 13(2) RPBA 2020).

1.10 Further documents were submitted by the parties in appeal (D29, D32 and D33) whose admittance was also disputed, but since these documents were only cited in writing in support of objections that are not relevant to the present decision, there is no need to decide on the admittance of these documents.

Main request and auxiliary request 1

2. Inventive step over D18

2.1 The patent in suit concerns the production of fibers from polyethylenes (paragraph 1). D18 concerns the use of single site catalyzed polyethylene resins in processes where an article was formed through melt

extrusion, injection molding, injection blow molding or casting, then cooled, and then oriented or stretched (page 3, lines 4-7). The articles produced by these processes were films and sheets, tapes or fibers (claims 5, 19, 20; page 1, lines 13-14; page 4, line 22; page 5, line 8 and line 22; page 10, line 19 to page 11, line 2). Therefore, D18 discloses the production of fibers from polyethylene as does the patent in suit.

- 2.2 Suitable polyethylene resins of D18 are polyethylene homopolymers or copolymers of ethylene and C₃ to C₁₀ alpha-olefin monomers (page 3, lines 9/10) which are alpha-olefins in the sense of claim 1 of the main request. A polyethylene resin highlighted as having particularly useful properties in D18 is the commercially available polyethylene resin "grade M3410" (page 6, lines 1-9).
- 2.3 Inventive step was addressed in particular in view of D18 as closest prior art in the contested decision (section 8.1, in respect of the then pending auxiliary request 2A) and was also discussed by the parties in appeal (statement of grounds of appeal of the patent proprietor, section 4.15; rejoinder of the opponent, section F and rejoinder of the patent proprietor, section 8), whereby it was common ground that D18 was a suitable document to be taken as closest prior art for claim 1 of the present main request. The Board does also not find a reason to deviate from D18 as closest prior art.
- 2.4 The patent proprietor however argued that D18 would not contain enough information on the resin M3410 to allow its reproduction (statement of grounds of appeal, sections 4.6 and 4.10). The resin M3410 is however

disclosed in D18 as being a commercially available product and its availability was not disputed by the patent proprietor. In that regard, the fiber produced according to the method of claim 20 of D18 can be seen as a valid starting point within D18 to assess inventive step.

2.5 In the contested decision, the opposition division held that the subject-matter of claim 1 of the main request was anticipated by the disclosure of D18 in its entirety, in particular because it was disclosed therein that the polyethylene resins of D18 could be made into fibers and that an example of the polyethylene according to the teaching of D18 was resin M3410 as disclosed therein. That conclusion of the opposition division was - still - in dispute between the parties in appeal.

2.6 D18 discloses some of the properties of the commercially available resin M3410 and further indicates that it is a polyethylene-hexene copolymer (page 6, line 12). It also identifies the specific lot D51222401 in Tables 1A, 3 and 4 as having been used in the example of D18. Tables 1A, 3 and 4 of D18 show that the polyethylene in lot D51222401 had a melt index (I_2) of 0.91 g/10 min, a M_w/M_n of 2.8 and a M_z/M_w of 2.0 which are all properties according to claim 1 of the main request. Also, while the density of the product in that lot is not disclosed in D18 explicitly, it can be concluded from Table 1A that the density should be close to 0.934 g/cm^3 and therefore also within the range of density specified in claim 1 of the main request. That was not contested in appeal.

2.7 D18 does not directly disclose the amount of comonomer in the polyethylene copolymer, nor the amount of vinyl

unsaturation in the M3410 resin of lot D51222401. D19/D19a however establishes that the amount of hexene in that specific lot was 2.2 wt.-% and the vinyl unsaturation was 0.079, both being in the ranges of claim 1 of the main request. That also was not in dispute in appeal.

2.8 There is in D18 no explicit disclosure of the resin M3410 being used in the production of fibers. Fibers are however mentioned as a possible application of polyethylenes in D18 (page 1, line 13; page 5, line 22 and claim 20). The position of the opponent was that the method for preparing fibers disclosed in claim 20 of D18 applied to the polyethylene resin M3410 that was discussed in the description of D18. The patent proprietor contested that argument. Even if the position of the patent proprietor was followed and it was assumed that formally, claim 1 of the main request at most differed from D18 in that fibers were produced with a resin satisfying the specific combination of structural and physical features defined in claim 1 of the main request, the Board would nevertheless come to the conclusion that claim 1 lacked an inventive step over D18 for the following reasons.

2.9 The use of M3410 resins is disclosed in example 1 and mentioned on pages 6/7 of D18. D18 further teaches that the wide thermal processing window of the M3410 resin is a property that is beneficial to the production of articles by the process of D18, in particular films but also other articles such as oriented tape, monofilament, fully oriented yarn and fibers (passage bridging pages 10 and 11). D18 therefore is not only directed to the production of films but concerns also fibers as a relevant application (page 5, lines 22/23,

claim 20).

- 2.10 While the resin M3410 is said to be used in films in example 1 of D18, it is apparent from the discussion on page 8, lines 7-15, page 10, line 13 to page 11, line 15 of D18 that the resin M3410, because of its broader thermal processing window than resin D350, is a resin of choice in D18.
- 2.11 No effect was associated with the choice of resins according to claim 1 of the main request over D18. The problem solved over D18 was therefore to provide alternative fibers. Under these circumstances, the skilled person confronted with that problem would have considered the resin M3410 for the production of fibers and would have arrived in an obvious manner to the subject-matter of claim 1 of the main request.
- 2.12 Claim 1 of the main request therefore lacks an inventive step over D18.
- 2.13 Claim 1 of auxiliary request 1 corresponds to claim 1 of the main request and therefore the conclusion of lack of inventive step reached for the main request also applies to claim 1 of auxiliary request 1.

Auxiliary requests 2A, 2B, 3A, 3B

3. Admittance

- 3.1 Auxiliary requests 2A, 2B, 3A, 3B were first filed by the patent proprietor with their statement setting out the grounds of appeal (see sections 6.1, 7.1 and 9.1 of the statement setting out the grounds of appeal of the patent proprietor). The admittance of these requests into the appeal proceedings was contested by the

opponent.

- 3.2 Since auxiliary requests 2A, 2B, 3A, 3B were first filed in appeal they are not according to Article 12(2) RPBA 2020 and are considered as amendments to the party's case (Article 12(4) RPBA 2020) that can be admitted into the proceedings at the discretion of the Board. The Board exercises its discretion in view of, inter alia, the complexity of the amendment, the suitability of the amendment to address the issues which led to the decision under appeal, and the need for procedural economy.
- 3.3 The patent proprietor argued that auxiliary requests 2A, 2B, 3A, 3B were filed in reaction to the filing of D18 and D22 by the opponent on 22 August 2019, two months before the oral proceedings before the opposition division, on 23 October 2019.
- 3.4 The patent proprietor made it credible that the filing of D18 and D22 supporting entirely new objections of lack of novelty and inventive step by the opponent essentially constituted a new case raised against the patent at a very late stage of the opposition proceedings and for which the patent proprietor had a limited amount of time to properly address it.
- 3.5 While the patent proprietor provided on 10 October 2019 a written reply - including some auxiliary requests different from present auxiliary requests 2A, 2B, 3A and 3B - to the filing of D18 and D22, the short amount of time between the filing of D18 and D22 supporting the new objections based on these documents, is a valid justification for the filing of further auxiliary requests at the outset of the appeal proceedings, namely with the patent proprietor's statement setting

out the grounds of appeal.

3.6 Furthermore, the amendment made in claim 1 of auxiliary requests 2A and 3A relies on the same feature, namely the content of long chain branching in the composition, as the amendment made in claim 1 of auxiliary request 4A, which was discussed as auxiliary request 2A in the contested decision. It can therefore be accepted that the amendment in claim 1 of auxiliary requests 2A and 3A is neither complex nor detrimental to the procedural economy of the case. The suitability of the amendment to address the issues which led to the decision under appeal, in particular the conclusion of lack of novelty of claim 1 of the main request over D18 (section 3.2.3), is already apparent from the conclusion reached by the opposition division on novelty and inventive step of claim 1 of auxiliary request 2A over D18, which relies on the content of long chain branching in the composition (reasons: sections 7.1 and 8.1).

3.7 In auxiliary requests 2B and 3B methods for the measurement of the content in long chain branching were added to claim 1. Auxiliary requests 2B and 3B are largely based on auxiliary requests 2A and 3A and the additional amendment they contain addresses the objection of lack of clarity considered in section 6 of the decision of the opposition division.

3.8 Under these circumstances, the Board found it appropriate to exercise its discretion under Article 12(4) RPBA 2020 by admitting auxiliary requests 2A, 2B, 3A and 3B into the appeal proceedings.

Auxiliary requests 2A and 3A

4. Clarity

4.1 Claim 1 of auxiliary request 2A differs from claim 1 of the main request in that "the polyethylene composition is substituted with less than 0.1 long chain branching per 1000 total carbons". The opponent argued in opposition that the term "long chain branching", which was not defined in claim 1 of the then pending auxiliary request 2A, lacked clarity. The opposition division however concluded in section 6.3 of the contested decision that the skilled person knew what long chain branching was. The opponent contested that conclusion in appeal.

4.2 Since the term "long chain branching" is neither defined in operative claim 1 nor in the description of the patent in suit the first question raised in appeal was whether the term "long chain branching" had an accepted definition in the art (statement of grounds of appeal of the opponent, section 4.1).

4.3 The patent proprietor mentioned paragraphs 112 and 198 of the patent in suit as providing relevant information about long chain branching (rejoinder, section 4.2). Paragraph 112 however only concerns the definition of different ranges of long chain branching of the polyethylene composition and not the definition of long chain branching as such. As to paragraph 198, it discloses that long chain branching was determined by "methods known in the art, such as gel permeation chromatography coupled with low angle laser light scattering detector (GPC-LALLS) and gel permeation chromatography coupled with a differential viscometer detector (GPC-DV)". That paragraph only refers to "known methods in the art" and gives an example of a method that was apparently used, but it does not

indicate how long chain branching is to be understood in the patent in suit. In fact, paragraph 198 seems to indicate that there was no method of choice as to the measurement of long chain branching in the patent in suit. In any case, no evidence was provided by the patent proprietor to show that the term "long chain branching" had an unambiguous meaning for the skilled person. In particular, no evidence in that regard was provided although that issue was raised by the opponent in their statement of grounds of appeal (page 6, section 4.1, first three paragraphs) and was further mentioned in the Board's communication (section 17.2).

- 4.4 The opponent referred to D26, which is a review of the characterization of long chain branched polymers. D26 was cited as a document representing the knowledge on long chain branching. D26 addresses the question of what long chain branching represents for polymers in its section 1, in particular the presence of a "chain length sufficiently longer than the entanglement molecular weight (M_e) or the critical molecular weight (M_c)" which "are beneficial in facilitating chain entanglements". This definition, which essentially corresponds to the definition provided by the patent proprietor in section 4.2 of their rejoinder, is firstly ambiguous in itself since it sets out, for the chain length representing the long chain branching, two reference points (M_e or M_c) which are not further explained. Furthermore, it does not set out how the length of the chain shall generally be determined for a given polymer in order to allow its quantification by way of an experimental measure.
- 4.5 It can further be derived from D26 that depending on the method chosen for its determination long chain branching may imply some restrictions as to the chain

length of the branches that can be measured. D26 sets out that several methods were known to the skilled person to determine long chain branching in polymers such as ^{13}C -NMR (section 2), GPC (section 3) and rheological determination (section 4). It is apparent from the discussion in D26 that these methods are not all based on the same measurement principles and therefore have different sensitivities when it comes to the determination of the chain branches (D26: page 3, first column, last paragraph of section 1).

4.6 Also, the measurement of long chain branching by ^{13}C -NMR in solution is said to only reliably discern branch lengths that are up to six carbons long (D26: page 4, first column, second to fourth paragraph). It follows that the choice of ^{13}C -NMR as a method of determination of long chain branching implies that chains having more than 6 carbon atoms will be seen as long chain branching. That may obviously have a significant impact on the long chain branching obtained for a given composition, especially on polyethylene compositions comprising a comonomer that can have a number of carbon atoms below or above 6 as the patent in suit allows it (paragraph 9 mentions preferably 3 to 10 carbon atoms for the comonomer).

4.7 This definition of the chain branches by their number of carbon atoms is not mentioned in the context of methods that are not based on ^{13}C -NMR, such as the GPC methods discussed in D26. It is derivable from D26 that GPC methods could be able to measure chain branches of a different length that would otherwise not be detected by ^{13}C -NMR. The opponent further argued that D27 disclosed a sample (sample 272), for which a value of long chain branching determined by ^{13}C -NMR of 0.04 / 1000C was reported in Table 2 (for Hexyl+ which means

branches having more than 6 carbon atoms, as taught in D26) and a value of 0.12 /1000C was reported when measured by GPC (Table 4). That example in D27 shows that depending on the method used for the determination of long chain branching, a sample may (with ¹³C-NMR measurement) or may not (with GPC measurement) fall under the scope of claim 1 of auxiliary request 2A.

- 4.8 For the reasons addressed in sections 4.3 to 4.7 above, it can be concluded that the feature long chain branching defining claim 1 of auxiliary request 2A lacks clarity.
- 4.9 Claim 1 of auxiliary request 3A differs from claim 1 of the main request in that "the polyethylene composition is substituted with less than 0.01 long chain branching per 1000 total carbons". By comparison to claim 1 of auxiliary request 2A, claim 1 of auxiliary request 3A was amended only in the threshold value defining the maximum amount of long chain branching. Both parties in appeal referred to their arguments given for claim 1 of auxiliary request 2A, which would equally apply to claim 1 of auxiliary request 3A.
- 4.10 The modification of the maximum amount of long chain branching from 0.1/1000C to 0.01/1000C does not change the reasoning of lack of clarity of the feature "long chain branching" as such. Under these circumstances, the conclusion of lack of clarity reached for auxiliary request 2A also applies to auxiliary request 3A.

Auxiliary requests 2B and 3B

5. Clarity

- 5.1 Claim 1 of auxiliary request 2B corresponds to claim 1 of auxiliary request 2A further modified in that the "long chain branching is determined according to gel permeation chromatography coupled with low angle laser light scattering detector (GPC-LALLS) or gel permeation chromatography coupled with a differential viscometer detector (GPC-DV)". The amendment made in claim 1 of auxiliary request 2B defines two alternative methods for the determination of long chain branching, (GPC-LALLS) and (GPC-DV).
- 5.2 The question relating to the objection of lack of clarity of claim 1 of auxiliary request 2B as submitted by the opponent was whether both methods (GPC-LALLS) and (GPC-DV) would lead to the same results when used on a same polyethylene composition. Should that not be the case, it was argued, claim 1 of auxiliary request 2B lacked clarity because, depending on the method chosen to measure the long chain branching of one given polyethylene composition, one could obtain a value below 0.1/1000C and therefore according to claim 1 or above 0.1/1000C that would not be according to claim 1.
- 5.3 The patent proprietor argued that both methods (GPC-LALLS) and (GPC-DV) were based on the same overall principles (letter of 16 December 2022, section 2.18 and letter of 22 February 2023, sections 4.10-4.20). Both methods were shown to rely on the preparation of a Mark Houwink plot from measurements of molecular weights and viscosity of a given polymer from which it was possible to calculate long chain branching by comparison with a reference polymer.
- 5.4 These methods however differ from one another in a significant way for the determination of the molecular weight of the polymer measured, the (GPC-LALLS)

technique was said to involve using a concentration detector and a low angle light scattering (LALLS) detector to produce absolute molecular weights whereas the (GPC-DV) technique involved using a concentration detector to produce conventional molecular weight values only.

- 5.5 The different detectors used for the determination of the molecular weight in the two techniques imply that there is a difference in sensitivity of the molecular weight measurement which would then be reflected in the Mark Houwink plot and ultimately lead to doubts as to whether the two methods would lead to the same values of long chain branching.
- 5.6 It is also apparent from the description of the (GPC-LALLS) and (GPC-DV) methods made by the patent proprietor in their letter of 22 February 2023 (sections 4.16 to 4.19) that the presence of long chain branching in a given polyethylene composition is determined by comparison with a reference polymer only identified as a linear homopolymer, but for which there is no further means of identification in the method.
- 5.7 The choice of the reference polymer used in the Mark Houwink plot was also credibly argued by the opponent to have an impact on the determination of the long chain branching of the measured polyethylene composition, which was not disputed by the patent proprietor. The absence of information on how to choose the reference polymer in the method of determination of the long chain branching also leaves strong doubts as to whether it can be concluded that a reliable value of long chain branching can be obtained for any given polyethylene composition even when the same method

(GPC-LALLS) is used.

- 5.8 The patent proprietor submitted that the methods (GPC-LALLS) and (GPC-DV) were known methods in the art and that a skilled person knew how to reliably calibrate the methods. The patent proprietor however did not provide any evidence in support of that argument and did not show how these arguments would solve the lack of clarity pertaining to the ambiguous definition of the term "long chain branching" in operative claim 1 (points 4.3/4.4 above).
- 5.9 Under these circumstances, the Board comes to the conclusion that claim 1 of auxiliary request 2B does not fulfil the requirements of Article 84 EPC.
- 5.10 Claim 1 of auxiliary request 3B differs from claim 1 of auxiliary request 3A in the same feature as claim 1 of auxiliary request 2B differs from claim 1 of auxiliary request 2A. Therefore, claim 1 of auxiliary request 3B lacks clarity for the same reason as outlined above for claim 1 of auxiliary request 2B.

Auxiliary requests 4A, 5A, 5B, 6A, 6B, 7A, 7B, 8A and 8B

6. Admittance

- 6.1 Since the requests not to admit any of auxiliary requests 4A, 5A, 5B, 6A, 6B, 7A, 7B, 8A and 8B were withdrawn by the opponent during the oral proceedings before the Board (see section X above), there is no need for the Board to deal with that issue in the present decision. Also, in view of the conclusion reached below that auxiliary request 4B is not allowable pursuant to Article 84 EPC, there is no need for the Board to decide on its admittance, which was

disputed by the opponent (letter of 11 August 2022: section 1.4).

Auxiliary requests 4A, 5A, 6A, 7A, 8A

7. Clarity

7.1 Claim 1 of auxiliary request 4A corresponds to claim 1 of the main request in which it is set out that "the polyethylene composition is free of any long chain branching".

7.2 Both parties submitted at the oral proceedings before the Board that they relied on their arguments provided for auxiliary request 2A with regard to the objection of lack of clarity of claim 1 of that request. The same arguments would also apply in view of clarity of claim 1 of auxiliary requests 5A, 6A, 7A and 8A which contained the same feature relating to long chain branching.

7.3 The definition of claim 1 by the feature that the polyethylene composition is "free of any long chain branching" does not change the reasoning of lack of clarity of the Board given for claim 1 of auxiliary request 2A. Also, the values of long chain branching reported for sample 277 in tables 2 and 4 of D27 show that the same sample can be considered as being free of long chain branching when measured by ^{13}C -NMR (0.00 branching /1000C in column Hexyl+ of Table 2) or not when measured by GPC (0.06 branching /1000C in Table 4).

7.4 The patent proprietor submitted that the requirement in claim 1 that the polyethylene composition should be free of any long chain branching as measured by (GPC-

LALLS) or (GPC-DV) meant that the long chain branching was below the detection limit of the chosen method (rejoinder, section 4.3). It is however not apparent how the skilled person would ascertain that the detection limit has been achieved and if that point would have been considered as being a reliable method for the determination of long chain branching.

- 7.5 D26 also suggests that the detection limit for the determination of long chain branching by GPC may depend on further factors that would need to be known in order to reliably compare several measurements made for a given composition. D26 for instance teaches that the sensitivity of the GPC method may depend significantly on the background noise of the measurement (page 7, second column, first paragraph) or the range of molecular weight of the polyethylene composition measured (page 7, first column, last paragraph). It is therefore highly doubtful that, in the absence of a reliable teaching about these factors and conditions, a skilled person could conclude with reasonable reliability that a measured polyethylene composition is "free of any long chain branching". The Board finds therefore that claim 1 of auxiliary request 4A lacks clarity. The same conclusion applies to claims 1 of auxiliary requests 5A, 6A, 7A and 8A which contain the same feature relating to long chain branching.

Auxiliary requests 4B, 5B, 6B, 7B, 8B

8. Clarity

- 8.1 Claim 1 of auxiliary request 4B corresponds to claim 1 of auxiliary request 4A further modified in that the "long chain branching is determined according to gel permeation chromatography coupled with low angle laser

light scattering detector (GPC-LALLS) or gel permeation chromatography coupled with a differential viscometer detector (GPC-DV)".

8.2 The patent proprietor submitted at the oral proceedings before the Board that the requirement in claim 1 of auxiliary request 4B about the polyethylene composition being free of any long chain branching as measured by (GPC-LALLS) or (GPC-DV) meant that the long chain branching was below the detection limit of the chosen method. However, as in the case of claim 1 of auxiliary request 4A, it is not apparent to the Board how the skilled person would ascertain that the detection limit has been achieved and if that point would have been considered as being a reliable method for the determination of long chain branching.

8.3 D26 suggests that the detection limit for the determination of long chain branching by GPC may depend on further factors that would need to be known in order to reliably compare several measurements made for a given composition. The Board finds therefore that claim 1 of auxiliary request 4B lacks clarity for the same reasons as claim 1 of auxiliary request 4A. The same conclusion applies to claims 1 of auxiliary requests 5B, 6B, 7B and 8B which contain the same feature relating to long chain branching.

Auxiliary request 9

9. Admittance

9.1 Claim 1 of auxiliary request 9 contains, by comparison with claim 1 of the main request, a limitation of the range of density of the polyethylene composition. That request corresponds to auxiliary request 2 filed on 24

January 2018 and was further maintained as auxiliary request 7 with letter of 10 October 2019 (last written submission of the patent proprietor during the opposition proceedings, which was filed in reaction to the submission of D18 and D22 by the opponent). Given that that request was filed early in the opposition proceedings and can be seen as having been filed in reaction to the preliminary opinion of the opposition division dated 14 September 2017, the Board sees no reason not to admit auxiliary request 9 into the proceedings (Article 12(4), first sentence, RPBA 2020).

10. Amendments

10.1 The wording of claim 2 of auxiliary request 9 corresponds to the one of claim 2 of auxiliary request 4A defended in appeal (auxiliary request 2A dealt with in the contested decision) against which an objection of added subject-matter under Article 123(2) EPC was raised (see e.g. statement setting out the grounds of appeal of the opponent, section 5.2, whereby reference is made therein to auxiliary request 2A dealt with in the contested decision). That objection concerned the presence in claim 2 of auxiliary request 4A of a combination of features (i)-(v) which is also part of claim 2 of auxiliary request 9. As a result, the objection under Article 123(2) EPC raised against claim 2 of auxiliary request 4A also applies to claim 2 of auxiliary request 9 which contains the same combination of features.

10.2 Claim 2 of auxiliary request 9 defines a fiber according to Claim 1, wherein said fiber exhibits **one or more** of the following properties (emphasis added):
(i) has a denier per filament in the range of less than 50 g/9000 m,

- (ii) has a tenacity in the range of 0.1 to 5 g/denier,
- (iii) has an elongation measured in percent of less than 1000,
- (iv) has a boiling water shrink measured in percent after being annealed at 120°C in the range of less than 30, or
- (v) is a staple fiber or a continuous fiber.

- 10.3 The question was whether the application as filed provided a support for the features (i) to (v) in any number of combinations as claimed.
- 10.4 According to Article 123(2) EPC the European patent application or the European patent may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed. Any amendment to the parts of a European patent application or of a European patent relating to the disclosure (the description, claims and drawings) is subject to the mandatory prohibition on extension laid down in Article 123(2) EPC and can therefore, irrespective of the context of the amendment made, only be made within the limits of what a skilled person would derive directly and unambiguously, using common general knowledge, and seen objectively and relative to the date of filing, from the whole of these documents as filed (Case Law of the Boards of Appeal, 10th Edition, 2022, II.E.1.3.1).
- 10.5 While the features (i)-(v) find a support individually in claims 11-15 of the application as filed as well as on page 14, lines 3-6 (i), page 15, lines 9-12 (ii), page 16, lines 11-14 (iii), page 17, lines 5-9 (iv) and page 18, lines 3-6 (v) and pages 53-56 of the application as filed, the Board does not find a support

for the combination of these properties.

- 10.6 In particular, claims 11-15 as originally filed containing features (i)-(v) are all dependent on claim 10 only and as such their subject-matter is not disclosed in any kind of combination with one another in these claims.
- 10.7 The features (i) to (v) are also individually disclosed on pages 14-18 and 53-56 of the application as filed. The patent proprietor pointed at the description of each feature (i)-(v) on pages 14-18 containing the wording "in accordance with any of the preceding embodiments" and to the fact that the relevant passages on pages 53-56 were of a general nature (reply to the statement setting out the grounds of appeal of the opponent, section 5.10).
- 10.8 The application as filed however contains many other "preceding" embodiments, starting on page 10 up to page 18, including features that go beyond those chosen to define features (i)-(v) in claim 2 of auxiliary request 9, for instance embodiments relating to the use of an hafnium catalyst or a limited melt index (page 10), relating to the vinyl unsaturation or the presence of specific elution peaks (page 11), limitations of the molecular weight distribution (M_z/M_w) and the amount of monomer (page 12), that could in principle all be considered as the embodiments referred to on pages 14-18. It is however not apparent from the application as filed why the specific combination of embodiments including features (i)-(v) was selected over the other equally relevant embodiments presented on pages 10-18.
- 10.9 The patent proprietor further argued that the combination of features (i)-(v) present in claim 1 of

auxiliary request 9 was supported by the examples in tables III and IV of the application as filed, where the exemplified fibers had a plurality of the specified properties (reply to the statement of grounds of appeal of the opponent: end of section 5.10). However, these examples of the application as filed are limited to certain types of catalysts and monomers and only disclose two or four of features (i) to (iv) in combination and appear to be all directed to a single embodiment for feature (v). In addition, these examples satisfy additional requirements disclosed as "alternative embodiment" in the description of the application as filed (see e.g. tables II and IIA as well as the passages of the application as filed indicated in section 10.8 above related to the hafnium catalyst or melt index). For these reasons, these examples do not provide a direct and unambiguous disclosure for "one or more" of features (i) to (v) at the level of generality of claim 2 of auxiliary request 9.

- 10.10 The specific combination of features (i) to (v) defining claim 2 of auxiliary request 9 therefore is not clearly and unambiguously derivable from the application as filed and contravenes Article 123(2) EPC.

Auxiliary requests 10A and 10B

- 10.11 Claims 1 of auxiliary requests 10A and 10B contain the same feature regarding long chain branching as claims 1 of auxiliary requests 4A and 4B, respectively, which were found not to satisfy the requirements of Article 84 EPC.

10.12 The wording of claims 2 of auxiliary requests 10A and 10B correspond to claim 2 of auxiliary request 9. The conclusion reached for claim 2 of auxiliary request 9 under Article 123(2) EPC therefore applies to claim 2 of auxiliary requests 10A and 10B.

10.13 Auxiliary requests 10A and 10B are not allowable pursuant to Article 123(2) EPC and Article 84 EPC. For these reasons, there is no need for the Board to decide on their admittance, which was in dispute between the parties.

Auxiliary requests 11A and 11B

10.14 Claims 1 of auxiliary requests 11A and 11B contain the same feature regarding long chain branching as claims 1 of auxiliary requests 4A and 4B, respectively, which was found not to satisfy the requirements of Article 84 EPC. Therefore, these requests can only share the same fate as auxiliary requests 4A and 4B in that respect.

10.15 In view of that conclusion and considering the conditional withdrawal of the request regarding non-admittance of auxiliary requests 11A and 11B made by the opponent at the oral proceedings before the Board (section X above), there is no need for the Board to decide on their admittance.

10.16 Claims 2 of auxiliary requests 11A and 11B concern a "melt spun fiber according to Claim 1, wherein said melt spun fiber exhibits one or more of the following properties" (i) to (v) whereby said properties (i) to (v) are identical to the ones defined for claim 2 of auxiliary request 9. It follows that the conclusion reached for claim 2 of auxiliary request 9 under Article 123(2) EPC also applies to claims 2 of

auxiliary requests 11A and 11B (section 10.10 above).

10.17 For these reasons, auxiliary requests 11A and 11B are not allowable pursuant to Article 123(2) EPC and Article 84 EPC.

11. Considering that none of the patent proprietor's pending requests is allowable, the patent is to be revoked.

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

O. Dury

Decision electronically authenticated