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Datasheet for the decision of 16 May 2023

Case Number: T 3201/19 - 3.3.03

Application Number: 12798164.5

Publication Number: 2855537

IPC: C08F2/01, C08F2/38, C08F4/38, C08F110/02

Language of the proceedings: EN

Title of invention:
ETHYLENE POLYMERS FOR EXTRUSION COATING

Patent Proprietor:
Borealis AG

Opponent:
The Dow Chemical Company

Relevant legal provisions:
RPBA Art. 12(4)
EPC Art. 56

Keyword:
Document admitted by the opposition division upon which the decision was based - not to be excluded from appeal proceedings
Inventive step (no) obvious alternative (main request, auxiliary requests 1 and 2)

Decisions cited:
G 0009/92, G 0004/93, G 0001/99, T 1568/12, T 0026/13, T 0487/16, T 2603/18

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Chambres de recours

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

Case Number: T 3201/19 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 16 May 2023

Appellant: (Patent Proprietor)	Borealis AG Trabrennstrasse 6-8 1020 Vienna (AT)
Representative:	Kador & Partner Part mbB Corneliusstraße 15 80469 München (DE)
Respondent: (Opponent)	The Dow Chemical Company 2030 Dow Center Midland, MI 48674 (US)
Representative:	V.O. P.O. Box 87930 Carnegieplein 5 2508 DH Den Haag (NL)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 31 October 2019 concerning maintenance of the European Patent No. 2855537 in amended form.**

Composition of the Board:

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

Summary of Facts and Submissions

I. The appeal lies from the interlocutory decision of the opposition division according to which European patent No. 2 855 537 as amended according to the claims of the sixth auxiliary request filed during the oral proceedings on 18 September 2019 met the requirements of the EPC. The decision was also based among others on the patent as granted as the main request and on a fifth auxiliary request filed as third auxiliary request with letter of 17 July 2019.

II. Claims 1 and 7 of the granted patent read as follows:

"1. A low density polyethylene having a melt flow rate (MFR) according to ISO 1133 (190°C, 2.16 kg) which is at least 4.4 g/10 min, a storage modulus G', measured at a loss modulus G" of 5 kPa, which is above 3000 Pa and a vinylidene content which is at least 24/100k C.

7. A process for production of the low density polyethylene according to any of claim 1, 2, 3 or 4, in a tubular reactor by radical initiated polymerization under high pressure where the polymerization is performed by reacting a reaction mixture, comprising ethylene monomers, under action of one or more radical initiators, such as peroxides, oxygen or combinations thereof, wherein the amount of used radical initiators, i.e. the amount of used active oxygen, is at least 5 times the conventionally used amount, and, optionally, wherein inlet temperature of the reaction mixture into the first reaction zone of the reactor is 135 °C or lower, or, alternatively, from 120 to 135 °C."

III. The decision was taken having regard to the following documentary evidence among others:

D4: Plastic Film - Resin Material Guidebook 2004, Converting Technical Institute 2003, ISBN4-906451-30-6 C3068; pages 272-275 and translation thereof in English (D4a)
D8: Declaration of Teresa Plumley Karjala dated 19 April 2018
D10: D. Kalyon et al., High Pressure Polymerization of Ethylene and Rheological Behavior of Polyethylene Product, Polymer Engineering and Science, May 1994, Vol. 34, No. 10, pages 804-814

IV. According to the reasons for the contested decision which are pertinent for the appeal proceedings:

Admittance of D4a

(a) D4a was a full English translation of document D4 in Japanese language, whereby D4 already contained handwritten translations of selected pieces of information sufficient to establish the relevance of that document. Despite its filing after the final date fixed pursuant to Rule 116(1) EPC, D4a which had been submitted in response to the opposition division's invitation to submit a translation of the Japanese documents, was admitted into the proceedings.

Main request

(b) Claim 1 of the main request lacked novelty over *inter alia* the commercial product NUC-8007 whose public availability was shown by D4 (translated as

D4a). Documents D4 and D8 demonstrated that this product fulfilled the requirements of granted claim 1. Moreover, the proprietor had not shown, or even argued, that the sale of NUC-8007 would not be enabling and that this product could not be reproduced.

Fifth auxiliary request

(c) Claim 1 of the fifth auxiliary request was directed to the process of granted claim 7. Its novelty was acknowledged. Concerning inventive step, D4, taking into account its translation D4a, described that the resin NUC-8007 had all product features defined in claim 1, was prepared in a high pressure tubular reactor and had an improved neck-in. On this basis, the closest prior art for the process of operative claim 1 was the product NUC-8007 with its process of production. The process according to claim 1 differed from the closest prior art in that the amount of active oxygen used was at least 5 times the amount conventionally used.

The patent in suit did not contain appropriate comparative examples showing the effect of using such an amount of active oxygen. Considering that the good balance of neck-in and draw-down in the patent in suit was not a result of the process, but of the product, whose properties did not represent a distinguishing feature over the closest prior art, the objective problem solved was thus to provide provide an alternative process for producing LDPE with a good balance of properties for extrusion coating, and a MFR, a storage modulus and a vinylidene content within the claimed ranges.

Varying the amount of initiator fed to the reactor in order to provide an alternative process was considered to be within the usual practice of the person skilled in the art. Furthermore, the claimed amount was not precise because the "*conventional amount*" was not a fixed amount but had to be a range depending on the operating conditions. Therefore, by varying the amount of initiator, the person skilled in the art would work within a range which could be considered as the claimed range. Furthermore, document D10 confirmed, with the amounts of initiators described in table 9, that it was usual in the art to vary the amount of initiator, even by a factor of 5.

The process of the fifth auxiliary request therefore lacked an inventive step.

V. An appeal against that decision was lodged by the patent proprietor (appellant).

VI. With the statement of grounds of appeal, four sets of claims as main and first to third auxiliary requests were submitted, whereby the third auxiliary request corresponded to the sixth auxiliary request deemed allowable by the opposition division.

VII. A reply to the statement of grounds of appeal was filed by the opponent (respondent). Additional submissions by the appellant and the respondent were made with letter of 5 April 2022 and letter of 18 November 2022, respectively. In response to a communication of the Board sent in preparation for the oral proceedings, the appellant made further submissions with letter of 10 May 2023.

VIII. Oral proceedings before the Board were held on 16 Mai 2023.

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

The appellant 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 one of the first to third auxiliary requests, all filed with the statement of grounds of appeal.

The respondent requested that the appeal be dismissed.

X. The claimed subject-matter which is relevant to the present appeal is that defined in claim 6 of the main request which reads as follows:

"6. A process for production of a low density polyethylene having a melt flow rate (MFR) according to ISO 1133 (190°C, 2.16 kg) which is at least 4.4 g/10 min, a storage modulus G', measured at a loss modulus G" of 5 kPa, which is above 3000 Pa and a vinylidene content which is at least 24/100k C, in a tubular reactor by radical initiated polymerization under high pressure where the polymerization is performed by reacting a reaction mixture, comprising ethylene monomers, under action of one or more radical initiators, such as peroxides, oxygen or combinations thereof, wherein the amount of used radical initiators, i.e. the amount of used active oxygen, is at least 5 times the conventionally used amount, and, optionally, wherein inlet temperature of the reaction mixture into the first reaction zone of the reactor is 135 °C or lower, or, alternatively, from 120 to 135 °C."

The same process is defined in claim 6 of the first auxiliary request and in claim 1 of the second auxiliary request.

XI. The parties' submissions, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. The contentious points essentially concerned the inventive step of the process for producing a low density polyethylene, the meaning to be attributed to the feature of using at least 5 times the conventional amount of active oxygen and the obviousness of that feature for the skilled person, starting from the process of producing the commercial product resin NUC-8007.

Reasons for the Decision

Status of document D4a

1. D4a whose admittance has been disputed by the appellant was admitted into the proceedings by the opposition division (point 2 of the Reasons for the contested decision) and taken into account for deciding on the issues of novelty of claim 1 of the main request (points 3.3 to 3.3.5 of the Reasons) and inventive step of claim 1 of the fifth auxiliary request (points 7.5 to 7.5.8 of the Reasons). There is in such a case no legal basis to reverse the decision of the opposition decision and exclude document D4a from the appeal proceedings (see for example T 0487/16, point 3.1 of the Reasons for the decision, T 0026/13, point 2 of the Reasons for the decision; T 1568/12, point 2.4 of the Reasons for the decision; T 2603/18, points 1.1 to 1.2 of the Reasons for the decision). Accordingly, D4a should be taken into account by the Board (Article

12(4) RPBA 2007 which applies in view of Article 25(2) RPBA 2020). Moreover the Board cannot detect any error in the excercise of discretion by the opposition division to admit this document.

In what follows, any citation of a passage of D4 should be understood to refer to the corresponding passage of D4a.

Main request - inventive step

Meaning of "conventionally used amount"

2. Operative claim 5 defines the use of an amount of active oxygen which is defined to be at least 5 times the "conventionally used amount". What this "conventionally used amount" should be is not defined in claim 1, let alone in numerical terms.

In this respect, the appellant submits in relation to the issue of sufficiency of disclosure in the paragraph bridging pages 4 and 5 of their letter of 10 Mai 2023 that "*The polymerisation chemist is well aware that each and every tubular reactor setup licensed to a commercial user is documented regarding its reactor setup and the limits of its capacities. In radical polymerization in tubular reactors the conventional amount of peroxides or active oxygen is a general parameter connected to a reactor setup and a particular polymer grade. Thus, the skilled person knows said conventional amount depending especially on the type of initiators, pressure and temperature at which the reactor is run. The skilled person would usually employ the least amount of initiators necessary for achieving radical polymerization to obtain a desired product. This is the conventionally used amount of peroxides and*

respective active oxygen" (emphasis added by the Board).

The appellant also adds on page 5 of that letter that "*It is also average knowledge to the skilled person that less initiator is desirably used at a higher reactor pressure. If another reactor setup will be used, the skilled person can modify reactor parameters according to reactor manufacturer's documentation and his/her average knowledge. Still, he would run the reactor, according to conventional techniques, with said conventionally used amounts of active oxygen and, according to present claim 1, raise it to at least the fivefold amounts.*"

In other words a "*conventionally used amount*" is by the appellant's own admission an amount which depends on many variables, such as the polymer grade to be produced, the reactor set up, the type of initiators, the pressure and the temperature at which the reactor is operated, which are not defined in operative claim 1.

This is in agreement with the respondent's position that the skilled person is well aware that the "*conventionally used amount*" for products produced in tubular trains depends, *inter alia*, on reactor pressure, initiation and peak temperatures, initiator composition, initiator dilution, peroxide injector design, conversion, injector fouling, and possibly some interaction between components (rejoinder, page 9, last full paragraph).

The appellant submits that paragraph 183 in the experimental part of the patent in suit describes with the preparation of comparative material I a

"*conventionally used amount*" of active oxygen, namely 0.04 kg per ton of polyethylene (paragraph 183 and table 10, in conjunction with paragraph 180). However, the appellant does not argue that this amount of active oxygen used in the preparation of comparative material I would define the lowest possible "*conventionally used amount*" of active oxygen, for example, if different reaction conditions, a different initiator composition or a different polymer grade than comparative material I were prepared.

Under these circumstances, the expression "*conventionally used amount*" in operative claim 6 refers to a broad range of values which cannot be precisely defined, even implicitly, since it depends on a large number of variables for which claim 6 does not provide any limitation.

Closest state of the art

3. The patent in suit concerns low density polyethylene (LDPE) prepared in a tubular reactor which should be suitable for extrusion coating (claims 1 and 7, paragraphs 2 to 5 of the specification). According to paragraph 5, the two most important variables determining the processability of a polymer used for extrusion coating are its draw-down (DD) and neck-in (NI). The value of DD should be as high as possible in order to obtain a coating layer as thin as possible and to allow a high production speed. At the same time it is desirable to have polymers with a low NI value. In addition, according to paragraph 6, LDPE produced in an autoclave reactor have satisfactory processability for extrusion coating together with satisfactory end product properties. They exhibit a good NI and DD balance.

According to paragraph 7 of the specification there was a need to produce LDPE from tubular reactors which had the same processability as LDPE produced from autoclave reactors. The LDPE produced from tubular reactors should therefore meet the requirements of DD and NI and web stability.

4. D4 is a material guide book that describes LDPE extrusion grade products from Nippon Unicar Co. Ltd (page 3; framed text). These LDPE are all indicated to be made using a high pressure tubular reactor (page 3, second full paragraph), two of which are identified as NUC-8007 and NUC-8008 (page 3, section 2, second paragraph). While NUC-8008 is described as a grade for coating all substrates, which can be used under a wide range of processing conditions, NUC-8007 is described as an NI improved version of 8008 (page 3, same section). The density (0.918 g/cm^3) and the MFR (7.0 g/10 min) of NUC-8007 are given in table 1 on page 3. Parameters related to the extrusion processability of the NUC polyethylenes are given in table 2 on pages 3 and 4, including NI values according to a specific method, as well as DD speed and minimum coating thickness. In the last row of table 2, on page 4, NUC-8007 is indicated to be suitable for high speed processing. This is confirmed in the first line of the text following table 2, in which it is indicated that NUC-8007 has good DD for light packaging and the resin flow is stable at high speed processing.

Accordingly, D4 teaches that the commercial resin NUC-8007 is a LDPE prepared in a high pressure tubular reactor which has satisfactory processability for extrusion coating, in terms of NI, DD and flow stability.

5. The appellant did not dispute at the oral proceedings the public availability of NUC-8007. The Board has no reason to consider that commercial product NUC-8007 was not made available the public, in line with the position of the opposition division in point 3.3.4 of the Reasons for the contested decision. In particular, D4 makes it clear that this product could be purchased before the priority date of the patent in suit. In this respect, reference may be made to the first paragraph on page 3 of D4, beginning with the statement "*Our company is launching NUC-8007*", and to the contact address of the sales division at the bottom of page 10.

Furthermore, D8 is an experimental report in which, among others, the parameters defined in operative claim 6 were measured on a sample of NUC 8007 between 25 April and 10 May 2012. According to this report, resin NUC 8007 meets the parametric requirements of the LDPE obtainable by the method of operative claim 6, i.e. the LDPE defined in granted claim 1. As already indicated in the reasons for the contested decision concerning novelty of claim 1 of the granted patent over the commercial product NUC-8007, the appellant did not dispute that the sale of the commercial product NUC 8007 constituted an enabling disclosure, i.e. that this product could be analysed and reproduced. In this respect, reference may be made to (i) the information provided in D4 according to which NUC 8007 is prepared in a high pressure tubular reactor and (ii) the common general knowledge in the art concerning the polymerisation of ethylene in such reactors invoked by the appellant when arguing in relation to sufficiency of disclosure, that the amount of active oxygen to be used in order to obtain a desired product depends on

the various process parameters influencing the reaction (see point 2 above).

Although this was initially contested in the statement of grounds of appeal, the appellant no longer disputed at the oral proceedings that the method of producing NUC 8007 as described in D4 is a reasonable starting point for assessing inventive step, in line with the decision of the opposition division and the respondent's position. The Board has no reason to have a different view and therefore considers this method to be the closest prior art.

Distinguishing feature(s)

6. Having regard to the agreement between the parties that the sole feature distinguishing the method of operative claim 6 from that of D4 is the amount of active oxygen which is at least 5 times the "*conventionally used amount*", the Board is satisfied that the method of operative claim 6 differs from that of D4 by this amount of active oxygen, whatever that feature is supposed to mean exactly. In this respect, the quantity of active oxygen defined as the "*conventionally used amount*" is not defined as that used for the preparation of NUC 8007. In other words, claim 6 does not require the use of at least 5 times the amount that could be used for the preparation of NUC 8007, but an amount of active oxygen which represents a distinguishing feature in the sense that such an amount is not disclosed in D4.

Problem successfully solved

7. Having regard to the disclosure of the closest prior art the appellant submits that the problem successfully

solved by the method of operative claim 6 is the provision of an alternative process for the preparation of LDPE having a good NI / DD balance and high web stability at high line speed. The appellant relies in this respect on the experimental data shown in table 10 of the patent in suit. However, as the appellant conceded at the oral proceedings, none of the examples shown in table 10 concern a preparation method for the commercial resin NUC 8007. The appellant's assertion that materials D and E prepared in accordance with the method of operative claim 6 and whose properties are indicated in said table would be representative of NUC 8007 cannot be accepted, since NUC 8007 in comparison with materials D and E is a resin having (i) higher Mw and Mn values (appellant's letter of 5 April 2022, page 6, table; D8, table 1, page 3) and (ii) a higher MFR (D8, table 1, page 3 and patent in suit, table 10, paragraph 181).

Moreover, while the appellant accepts on the basis of D8 that NUC 8007 has a polydispersity value of 17, operative claim 6 does not provide any limitation in this respect. The preparation of materials A to F in the experimental part of the specification, which are held by the appellant to be obtained with a method in accordance with claim 6, results in materials having a polydispersity either below (materials D to F) or above (materials A to C) the value obtained for NUC 8007. Accordingly, the experimental results on which the appellant bases its argument cannot provide a suitable comparison with a polymerisation method resulting in resin NUC 8007. Therefore, there is no reason to conclude that a LDPE resin meeting the parametric requirements set out in operative claim 6 would have an improved extrusion processability or better coating properties compared to NUC 8007.

In addition, no comparison has been provided between an amount of active oxygen as in operative claim 6 which is at least 5 times the "*conventionally used amount*", especially when such an amount can be varied within a broad range of values (see point 2 above), and a different amount corresponding to one used to prepare resin NUC 8007. Accordingly, there is no reason to consider that the process feature distinguishing the method of operative claim 6 from the closest prior art results in implicit structural features of the LDPE going beyond the features set out in operative claim 6 by the parameter values recited therein, or in any advantageous property of the LDPE resulting from said distinguishing process feature. An advantage brought about by this different amount of active oxygen with respect to the preparation process of the LDPE was not invoked by the appellant and is not apparent to the Board either.

In view of the above considerations, it is concluded that the problem successfully solved by the subject-matter of claim 6 over the closest prior art can only reside in the provision of a process leading to the preparation of resin NUC 8007 or a further LDPE resin suitable for extrusion coating.

Obviousness of the solution

8. It remains to be decided whether the skilled person desiring to solve the problem identified above would, starting from the method of producing NUC 8007 as described in D4, have modified the method for preparing NUC 8007 in such a way as to arrive at the subject matter of operative claim 6.

As indicated in point 5 above, the skilled person knows how to produce by high pressure polymerization of ethylene in a tubular reactor the LDPE resin NUC 8007, i.e. a resin which satisfies the parametric requirements defined in operative claim 6. This process is undisputedly known to the skilled person to conventionally require the use of one or more radical initiators, such as peroxides (patent in suit, paragraph 0002), i.e. active oxygen. This is *a fortiori* also valid for the production in a tubular reactor of a LDPE resin which is not exactly NUC 8007, but a similar resin also encompassed by the parametric definition of operative claim 6. The only remaining question to be answered is whether the amount of active oxygen the skilled person would find obvious to use to prepare LDPE resin NUC 8007 or a similar resin can be qualified as at least 5 times the "*conventionally used amount*".

As indicated in point 2 above, the expression "*conventionally used amount*" in operative claim 6 refers to a broad range of values which depends on a large number of variables, such as the polymer grade to be produced, the reactor set up, the type of initiators, the pressure and the temperature at which the reactor is operated. Moreover, as outlined in point 6 above, the quantity of active oxygen defined as the "*conventionally used amount*" does not not necessarily refer to one that could be used for the preparation of NUC 8007, since the polymer grade to which that amount refers is not specified in operative claim 6.

D10 already illustrates with the results shown in table 9 (page 810) that initiator amounts can be varied by a factor of at least 5 when preparing LDPE resins. The Board is convinced that the amount of active oxygen can be even more broadly varied when selecting as reference

for the "*conventional used amount*" the preparation of a different LDPE resin, using a different reactor set, different initiators and/or different conditions for operating the reactor.

In these circumstances, and having regard to the vague and therefore broad definition of the feature "*conventional used amount*", it is concluded that the skilled person wishing to provide a method of producing resin NUC 8007 or a further LDPE resin suitable for extrusion coating would find it obvious to use an amount of active oxygen corresponding to at least five times this vaguely defined amount, and would thus arrive in an obvious manner at a method falling within the ambit of operative claim 6.

The main request is therefore not allowable, as the subject-matter of its claim 6 does not involve an inventive step.

Auxiliary requests

9. It is undisputed that the same conclusion applies to the process of claim 6 of the first auxiliary request and the process of claim 1 of the second auxiliary request, whose object is the same as the one of claim 6 of the main request.

10. As indicated by the appellant the claims of the third auxiliary request correspond to those on the basis of which the opposition division decided that the patent in suit could be upheld in amended form. This was not disputed by the respondent. In application of the principle of the prohibition of reformatio in peius (decisions G 9/92 and G 4/93, OJ EPO 1994, 875, confirmed in G 1/99, OJ EPO 2001, 381), as the patent

proprietor is the sole appellant in the present appeal proceedings, neither the Board, nor the non-appealing opponent can challenge the maintenance of the patent as amended in accordance with the interlocutory decision, i.e. in the form of the present third auxiliary request. There is therefore no need to take position on that third auxiliary request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Hampe D. Semino

Decision electronically authenticated