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Datasheet for the decision of 24 November 2021

Case Number: T 2425/17 - 3.3.03

Application Number: 99954979.3

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Language of the proceedings: EN

Title of invention:
PROCESS FOR THE POLYMERIZATION OF OLEFINS; POLYETHYLENES, AND FILMS AND ARTICLES PRODUCED THEREFROM

Patent Proprietor:
EASTMAN CHEMICAL COMPANY

Opponent:
THE DOW CHEMICAL COMPANY

Relevant legal provisions:
RPBA Art. 12(4)
RPBA 2020 Art. 13(1)
EPC Art. 54, 56

Keyword:
Amendment to appeal case - exercise of discretion
Novelty - (yes)
Inventive step - (yes)

Beschwerdekammern

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Case Number: T 2425/17 - 3.3.03

DECISION
of Technical Board of Appeal 3.3.03
of 24 November 2021

Respondent: (Patent Proprietor)	EASTMAN CHEMICAL COMPANY 100 North Eastman Road Kingsport TN 37660 (US)
Representative:	Lederer & Keller Patentanwälte Partnerschaft mbB Unsöldstraße 2 80538 München (DE)
Appellant: (Opponent)	THE DOW CHEMICAL COMPANY 2030 Dow Center Midland, Michigan 48674 (US)
Representative:	V.O. P.O. Box 87930 2508 DH Den Haag (NL)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 17 August 2017 concerning maintenance of the European Patent No. 1047717 in amended form.**

Composition of the Board:

Chairman	D. Semino
Members:	D. Marquis
	R. Cramer
	F. Rousseau
	C. Brandt

Summary of Facts and Submissions

I. The appeal lies from the interlocutory decision of the opposition division posted on 17 August 2017 concerning maintenance of European patent No. 1 047 717 in amended form according to the claims of auxiliary request 6 filed by letter of 18 January 2017 and an amended description.

II. An opposition was filed against the patent on the grounds of Article 100(a) EPC (lack of novelty and lack of inventive step of claims 17-22) and Article 100(b) EPC (insufficient disclosure of claims 17-22). The contested decision was based on the claims as granted as the main request and auxiliary requests 1, 2, 2a, 3, 3a, 4, 4a, 5, 5a and 6 filed with letter of 18 January 2017.

III. Claim 17 as granted read:

"17. A copolymer of ethylene and 1-hexene, wherein ethylene comprises at least about 50% by weight of the copolymer, characterized by having a DSC melt transition temperature of 116°C to 123°C, a density of from about 0.880 g/cc to about 0.930 g/cc, a n-hexane extractable of from 0 to 6 weight percent, and a melt flow ratio of from 26 to 34".

The patent as granted included two further independent product claims related to a copolymer (claims 19 and claim 20) which were also present unamended or with further limitations in auxiliary requests 1, 2, 2a, 3 and 3a (both claims) and 4, 4a, 5 and 5a (only the latter product claim).

IV. Auxiliary request 6 contained a single independent product claim related to a copolymer (claim 17) which corresponded to claim 17 as granted. Claim 17 of auxiliary request 4 was also identical to claim 17 as granted.

V. The decision of the opposition division was based *inter alia* on the following documents:

D2: WO-A-0024789
D3: US-A-5139986
D4: US-A-4363904
D9: WO-A-9823500
D10: US-A-4302566
D12: US FDA 21 CFR177.1520, 1997, pages 261-273
D16: US-A-4597920
D19: US-A-5191052
D24: EP-A-0435557
D25: EP-A-0435627
D37: Experimental Report by Dr. L. J. Effler, dated 18 January 2017

VI. The contested decision, as far as it is relevant to the present appeal, can be summarized as follows:

- Claim 19 of the main request lacked novelty over a public prior use. That conclusion also applied to the corresponding claim of auxiliary requests 1, 2, 2a, 3 and 3a (section 5 of the minutes of the of the oral proceedings before the opposition division).

- D3 disclosed ethylene/hexene copolymers but that document did not disclose their DSC melt transition temperatures. D24 disclosed DSC melt transition temperatures of ethylene/hexene copolymers but that document did not show that the DSC melt transition temperatures of the copolymers according to D3 were in the range of 116 to 123°C as defined in claim 17 of auxiliary request 4. Claim 17 of auxiliary request 4 was therefore novel over D3.

- D4 disclosed terpolymers of ethylene, butene-1 and hexene-1. Claim 17 of auxiliary request 4 was novel over D4 as that claim did not encompass terpolymers.

- Examples 1 to 6 of D24 disclosed copolymers with DSC melt transition temperatures of from 123.6 to 126.0°C. However, it could not be concluded from D25 and D37 that these copolymers had a melt transition temperature of from 116 to 123°C when measured according to ASTM D3418-97 used in the patent in suit. It was also not shown that the n-hexane extractables of the copolymers of examples 1 to 6 were below 6 wt.-% as required in operative claim 17. Such a low amount of n-hexane extractables was only disclosed for the copolymers of examples 7 to 9 but these copolymers were obtained by a different polymerization process to the one of copolymers of examples 1-6. Claim 17 of auxiliary request 4 was thus novel over D24.

- Claim 19 of auxiliary request 4 however lacked novelty over a second prior use. That conclusion also applied to the corresponding claim of auxiliary requests 4a, 5 and 5a.

- Claim 17 of auxiliary request 6 was novel over the prior art for the reasons detailed for claim 17 of auxiliary request 4.

- D3 represented the closest prior art for claim 17 of auxiliary request 6. Example 4 of that document disclosed ethylene/hexene copolymers with a density of 0.9180 g/cm^3, a melt flow ratio of 26.2 and n-hexane extractables of less than 5.5 wt.-%. Claim 17 differed from example 4 of D3 in the DSC melt transition temperature of the copolymer. The problem was to provide an ethylene copolymer which could be used for the preparation of films having an improved Dart impact strength. The solution to that problem was an ethylene copolymer characterized by a combination of a narrow molecular weight distribution which lead to a low melt flow ratio, a low content of n-hexane extractables and a DSC melt transition point of 116 to 123°C as shown by the examples of the patent in suit. D3 was silent about the influence of the DSC melt transition temperature on the Dart impact strength. There was no teaching in D24 in that respect either. Auxiliary request 6 involved therefore an inventive step.

VII. The opponent (appellant) lodged an appeal against the above decision and filed *inter alia* document D39 (referred to as D40 in the present decision) which is an experimental report by Dr. L. J. Effler, dated 1 December 2017, with the statement of grounds of appeal and document D42 (a further experimental report by Dr. L. J. Effler, dated 26 October 2018) with letter of 2 November 2018.

VIII. The patent proprietor also lodged an appeal against the decision of the opposition division which was withdrawn at the end of the oral proceedings before the Board.

IX. In preparation of oral proceedings, the Board issued a communication dated 30 July 2020 including a preliminary opinion on the case.

X. Oral proceedings before the Board were held by videoconference on 24 November 2021.

XI. The appellant's submissions, in so far as they are relevant for the present decision, are essentially as follows:

Admittance of documents

- D40 was filed as a reaction to an argument of the proprietor during the oral proceedings before the opposition division. D40 was therefore not filed late and should be admitted into the proceedings.

- D42 addressed an objection of the respondent made in their rejoinder concerning D40 and dealt with the holding times applied during the measurements of the DSC melt transition temperatures of the copolymers reported in Table 3. D42 was filed therefore in reaction to a new argument of the respondent filed with their rejoinder and should be admitted into the proceedings.

Auxiliary request 6 as maintained by the opposition division

Novelty over example 4 of D3

- The DSC melt transition temperature of the copolymer according to example 4 of D3 was not explicitly disclosed in that document. However, based on the values of density and melt flow rate of that copolymer and considering that its preparation involved DMAC (dimethylaluminium chloride) as activator, the DSC melt transition temperature of the copolymer according to example 4 had to be implicitly in the range of 116-123°C as defined in operative claim 17. The use of DMAC to prepare ethylene copolymers was discussed in D24 and D25 wherein it was taught that the activator resulted in a more uniform distribution of the side branching of the copolymers with a lower melting temperature and that DMAC led to melting temperatures that were lower than those obtained with TMA (trimethylaluminium) as activator. Operative claim 17 therefore lacked novelty in view of example 4 of D3.

Novelty over D4

- D4 disclosed terpolymers fulfilling all requirements of operative claim 1. A copolymer defined by the presence of two comonomers as in operative claim 17 was not restricted to those two monomers only. That was part of the common general knowledge and was taught in paragraphs 20, 22 and 36-40 of the patent in suit. D2, D9, D10, D12, D16, D19, D24 and D25 also confirmed that copolymers could contain more than two comonomers. Therefore the copolymers of operative claim 17 encompassed the terpolymers of D4 and claim 17 lacked novelty over D4.

Novelty over example 5 of D24

- The copolymer of example 5 of D24 was prepared in the presence of DMAC as activator and had a density and melt flow rate according to operative claim 17. The DSC melt transition temperature of the copolymer of example 5 was disclosed in Table 1 as being 123.6°C. That value could not be distinguished from the range defined in operative claim 17. Operative claim 17 did not define which measurement method had to be used for the DSC melt transition temperature. D40 and D42 showed that depending on the method and the measurement conditions used during the determination of the DSC melt transition temperature (annealed or unannealed copolymer), the measured values of DSC melt transition temperature could differ by up to 1.7 to 2.9°C. That increase reported for the annealed copolymers was so significant that the value of 123.6°C measured for the copolymer of example 5 of D24 could not be distinguished from the range of 116-123°C defined in operative claim 17.

- With regard to the second feature not explicitly disclosed in example 5 of D24, namely the amount of n-hexane extractables, D24 referred to a FDA test disclosed in D12 that had to be satisfied for the copolymers to be used in food applications. That test required the copolymer to contain less than 2.6 pct (corresponding to less than 5.5 wt.-%) of n-hexane extractables at 50°C. D24 also taught that the copolymers had a narrow short chain branching distribution which meant that the copolymers met the requirements of the FDA test of D12. It could also be derived from D24 that the amount of n-hexane extractables of the copolymer resulting from a polymerization in the slurry in the presence of hexane at 80°C according to example 5 had to be lower than the amount of n-hexane extractables of the copolymers produced in the gas phase according to examples 8 and 9 (2.47 wt.-% and 2.57 wt.-% respectively). The amount of n-hexane extractables in the case of example 5 of D24 was thus according to operative claim 17 (from 0 to 6 wt.-%) and operative claim 17 lacked therefore novelty over that example 5.

Inventive step in view of example 4 of D3 or examples 5 and 8 of D24

- Starting from example 4 of D3 the copolymer of operative claim 17 differed therefrom in the DSC melt transition temperature. No effect was shown with respect to that feature in the patent in suit. The problem was therefore the provision of an alternative to the composition of example 4 of D3. It was taught in D24 and D25 that the use of DMAC as activator lead to a more homogeneous repartition of the branching distribution resulting in a depression of the DSC melt transition temperature. Since D3 used DMAC, the skilled person would have arrived to the subject-matter of operative claim 17 by routine experimentation, for instance by varying the amount of DMAC, hydrogen and the temperature applied during the polymerization process. In that regard, D24 showed that by using DMAC as activator in the preparation of ethylene copolymers a narrower distribution of comonomer branches was obtained. That led to a decrease of the amount of n-hexane extractables together with a decrease of the DSC melt transition temperatures. Operative claim 17 therefore lacked an inventive step over D3. The same reasoning applied when starting from example 8 of D24 from which operative claim 17 was also distinguished by the DSC melt transition temperature.

- Starting from example 5 of D24 the copolymer of operative claim 17 differed therefrom in the amount of n-hexane extractables. The patent in suit did not contain evidence of an effect resulting from the amount of n-hexane extractables being in the range defined in operative claim 17 and the problem was again the provision of an alternative copolymer. The amount of n-hexane extractables was the result of the narrow distribution of branching comonomers in the copolymer produced in the presence of DMAC as an activator. The skilled person expected a low amount of n-hexane extractables in the copolymer of example 5 since its DSC melt transition temperature was also low. Arriving at the range of n-hexane extractables as defined in operative claim 17 resulted therefore from routine experimentations performed within the teachings of D24. On that basis operative claim 17 lacked an inventive step in view of example 5 of D24.

XII. The respondent's submissions, in so far as they are relevant for the present decision, are essentially as follows:

Admittance of documents

- There was no objection to the admittance of D40 into the appeal proceedings.

- D42 was filed after the statement setting out the grounds of appeal in order to introduce data into the proceedings that should have been provided with the corresponding experimental report D40. D42 therefore should not be admitted into the appeal proceedings.

Auxiliary request 6 as maintained by the opposition division

Novelty over example 4 of D3

- There was no evidence that the value of the DSC melt transition temperature of an ethylene copolymer could be derived from the use of DMAC as catalyst activator only, as other factors of the polymerization process such as the amount of ethylene, the polymerization temperature and the type of catalyst had an impact on that parameter as well. That was in particular visible by considering the melting temperatures of the different copolymers made with DMAC activator disclosed in the Figure on page 12 of D24. Operative claim 17 was therefore novel over example 4 of D3 for which the value of the DSC melt transition temperature was not known.

Novelty over D4

- Operative claim 17 was directed to copolymers of ethylene and 1-hexene which were not terpolymers but copolymers of only two monomers. The claim language "A polymer of ethylene and 1-hexene" was clear in that the claimed copolymers were "made of" or, in other words, "consisted" of ethylene and 1-hexene. Operative claim 17 was therefore novel over D4 which disclosed terpolymers.

Novelty over example 5 of D24

- The DSC melt transition temperature of the annealed copolymer according to example 5 of D24 was 123.6°C, above the range of 116-123°C defined in operative claim 17. The appellant had not repeated example 5 of D24 in order to show that the resulting copolymer had a DSC melt transition temperature in the claimed range. While it could be acknowledged that annealing a copolymer raised its melting point, the extent of that increase could not been established. In that regard, Table 3 of D40 showed that the increase depended on the copolymer measured. It could thus not be concluded that the copolymer of example 5, unannealed, would have had a DSC melt transition temperature in the range of 116-123°C according to operative claim 17.

- The amount of n-hexane extractables of the copolymer of example 5 was not disclosed in D24. The general reference to the FDA requirements for the use of copolymers in food applications in D24 did not mean that all copolymers of that document implicitly met these requirements. In particular, it was not shown that all the copolymers of D24 were suitable for food products. The comparison with the copolymers according to examples 8 and 9 was not conclusive as there was no evidence that the polymerization in the slurry in example 5 would necessarily lead to a lower amount of n-hexane extractables, in particular since the influence of other factors such as the different catalyst system and the lack of disclosure as to the handling of the hexane present as a solvent in the process of example 5 could not be neglected. On that basis novelty over the copolymer of example 5 of D24 should be acknowledged.

Inventive step in view of example 4 of D3 or examples 5 and 8 of D24

- Operative claim 17 differed from example 4 of D3 and example 8 of D24 in the DSC melt transition temperature of the copolymer and from example 5 of D24 in the amount of n-hexane extractables of the copolymer. Starting from any of these examples as closest prior art, the problem was the provision of alternative copolymers. There was no teaching in the prior art on how to achieve the copolymers according to operative claim 17 wherein the combination of features as claimed was obtained. It was in particular not shown by the appellant which changes in the process had to be performed in order to obtain a copolymer with a DSC melt transition temperature of 116-123°C in the case of example 4 of D3 and example 8 of D24 or an amount of n-hexane extractables of from 0 to 6 wt.-% in the case of example 5 of D24, these copolymers also fulfilling all the other requirements set out in operative claim 17. The patent in suit achieved that result by incorporating N_2O in the polymerization process. The appellant did not show which measures had to be taken starting from D3 or D24 to arrive at a copolymer according to operative claim 17. Operative claim 17 was therefore inventive over D3 or D24.

XIII. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

XIV. The respondent (patent proprietor) requested that the appeal of the opponent be dismissed.

Reasons for the Decision

1. Admittance of documents

1.1 D40 is an experimental report filed as D39 with the statement setting out the grounds of appeal of the opponent. D40 was filed in reply to an argument made by the patent proprietor at the oral proceedings before the opposition division rejecting D37 as not being an accurate rework of D24. The respondent acknowledged at the oral proceedings before the Board that they had no objection as to the admittance of D40 into the appeal proceedings. Since the filing of D40 is a legitimate reaction to an argument made by the respondent during the oral proceedings before the opposition division and there is no objection with regard to its admission the Board does not see a reason not to admit D40 into the proceedings (Article 12(4) RPBA 2007 which applies in view of Article 25(2) RPBA).

1.2 D42 is an experimental report filed by the appellant in appeal with their letter of 2 November 2018. It was submitted at the oral proceedings before the Board that the data in D42 which complemented those already present in D40 had been filed in reaction to an objection of the respondent against the validity of D40, that objection having been filed with the rejoinder of the respondent. It was not contested that that was effectively the reason why D42 had been filed at this stage of the appeal proceedings. The admittance of D42 into the proceedings underlies the disposition of Article 13(1) RPBA 2020, which in view of Article 25 RPBA 2020 applies to the present situation. According to these dispositions, D42 can be admitted into the proceedings at the discretion of the Board. Since D42 was filed in reaction to an argument of the respondent made during the written appeal proceedings at the first opportunity for the appellant and without delay, and the admittance of D42 is not detrimental to the procedural economy since the conclusions drawn from D42 were essentially contained in D40, the Board finds it appropriate to exercise its discretion by admitting D42 into the appeal proceedings.

Auxiliary request 6 as maintained by the opposition division

2. Novelty over example 4 of D3

2.1 The objection of lack of novelty against operative claim 17 in view of example 4 of D3 was pursued in appeal. The contested decision concluded that operative claim 17 was novel since it had not been shown that the DSC melt transition temperature of the copolymer composition of example 4 was inherently in the range of 116-123°C.

2.2 Example 4 of D3 discloses the preparation of a copolymer of ethylene and hexene (Table 1). The polymerization process is one that is carried out in the gas phase (section 3.3.4 of the rejoinder of the respondent from 18 May 2018) as is also derivable from the description of the process disclosed in D3 (column 5, line 45 to column 6, line 55). In the general disclosure of the process, D3 teaches the use of DMAC, TMA or a mixture thereof as catalyst activator (column

2, lines 11-13). The catalyst activator used in example 4 of D3 is a mixture of DMAC and TMA (Table 1).

2.3 The presence of DMAC is taught in D3 to lower the extractables and raise the dart impact resistance and MD tear strength (column 9, lines 64-66). There is no indication in D3 that the use of DMAC or, as in the case of example 4, a mixture of DMAC and TMA, would provide a DSC melt transition temperature in any specific range. The appellant relied in that respect on D24 and D25, two prior art documents relating to the use of DMAC as activator in olefin polymerization. The question with respect to D24 and D25 was whether these documents showed that the use of an activator as disclosed in the process of example 4 of D3 would result in a copolymer having necessarily a DSC melt transition temperature in the range of 116-123°C.

2.4 D24 and D25 teach that the use of DMAC as activator results in linear low density polyethylene polymer resins having substantially more uniform distribution of side chain branches among the polymer molecules than similar resins produced with triethylaluminum (TEAL) as activator (D24, page 2, lines 29-36), and having a crystalline melting point of about 1-2°C lower than polymers made with the same precursor but activated with TMA (D25, page 6, line 56 to page 7, line 11). It has however not been shown how it could be concluded from that general teaching made in D24 and D25 that the DSC melt transition temperature of the copolymer according to example 4 of D3 was in the range of 116-123°C.

2.5 The teaching of D24 and D25 refers to the branching properties and melting temperatures of copolymers produced with DMAC activators in broad terms only and that teaching does not allow a specific determination of the DSC melt transition temperatures of these copolymers. D24 (page 2, lines 35-37) mentions that LLDPEs produced in the presence of DMAC as activator have melt flow rates of 26-28, a range which encompasses the value of melt flow rate of the copolymer of example 4 of D3 (26.2 in Table 1). Even if the melt flow rates of the copolymer of example 4 of D3 and those of D24 are close, it is not derivable from D24 that such a range of melt flow rates would necessarily correspond to a DSC melt transition temperature in the range of 116-123°C. The contested decision established (page 10, penultimate paragraph) that the examples 2-6 of D24 were not relevant to D3 since the polymerization process of the copolymers of examples 2-6 of D24 (slurry polymerization) was different from the polymerization process in D3 (gas phase polymerization). It has not been shown in appeal that that conclusion was incorrect nor was it shown that the DSC melt transition temperature of the copolymer of example 4 of D3 could be extrapolated on the basis of the DSC melt transition temperatures measured on the copolymers of D24 prepared by slurry polymerization.

2.6 It has therefore not been shown by the appellant that the DSC melt transition temperature of the copolymer according to example 4 of D3 was implicitly in the range of 116-123°C since none of the evidence cited in that regard makes it apparent to the skilled person how the DSC melt transition temperature for the composition of example 4 of D3 could be derived from the evidence cited.

2.7 The Board does therefore not find a reason to reverse the decision of the opposition division on novelty of operative claim 17 in view of example 4 of D3.

3. Novelty over D4

3.1 The opposition division established in the contested decision that claim 17 of auxiliary request 4 (corresponding to operative claim 17) was novel over D4 because claim 17 did not encompass copolymers of ethylene/butene/hexene as were disclosed in D4. The objection of lack of novelty against operative claim 17 in view of D4 was pursued in appeal. The appellant held that examples 1, 4 and 5 disclosed ethylene/butene/hexene terpolymers and example 6 an ethylene/propene/hexene terpolymer that were according to operative claim 17.

3.2 Operative claim 17 concerns copolymers of ethylene and 1-hexene. The argument of the appellant in that regard was that operative claim 17 might encompass further comonomers in addition to ethylene and 1-hexene. However, while it is part of the common general knowledge that copolymers encompass terpolymers, the specific formulation of claim 17 "A copolymer of ethylene and 1-hexene" cannot be seen as open to the presence of any number of comonomers just because the term copolymer is used. In fact, the specific reference to two comonomers only in operative claim 17 and the wording used, a "copolymer <u>of</u> ethylene and 1-hexene" (emphasis by the Board), limits the scope of that claim to copolymers made of ethylene and 1-hexene only.

3.3 The appellant referred to paragraphs 20, 22 and 36-40 of the patent in suit as being passages in which terpolymers were mentioned as being part of the invention. The description indeed contains passages concerning terpolymers explicitly (paragraph 22) or concerning "copolymers of ethylene and at least one or more alpha-olefin(s)" (paragraphs 36 and 40). It is however apparent that these copolymers are not those defined in operative claim 17. The copolymers of ethylene and hexene are addressed in paragraph 37 of the description and the definition provided therein is consistent with that of operative claim 17 in that the presence of other comonomers is not foreseen.

3.4 The appellant cited passages of prior art documents D2 (page 6, lines 14-17), D9 (page 8, lines 18-22), D10 (column 3, lines 20-30), D12 (right-hand column at page 261), D16 (abstract), D19 (column 4, lines 33-35 and claim 2), D24 (page 5, lines 30-31), and D25 (page 7, lines 50-51) mentioning copolymers of one or more comonomers. The passages cited in these documents are however consistent with the wording used in the patent in suit in that when a terpolymer is described or meant to be encompassed, the wording used to define the copolymer unambiguously allows for the presence of more than two comonomers in the copolymer, either by explicit reference to terpolymers (D2 and D19), by a reference to the presence of olefins in general or at least one olefin in the copolymer (D9, D16, D24 and D25) or referring to ethylene or olefin copolymers as a generic term (D10 and D12), all allowing for the presence of more than two comonomers. This is, however, not the wording chosen in operative claim 17. In view of that, these documents cannot support the conclusion of the appellant that a copolymer of ethylene and 1-hexene as defined in operative claim 17 encompasses terpolymers.

3.5 Operative claim 17 is therefore novel over D4.

4. Novelty over example 5 of D24

4.1 The objection of lack of novelty against operative claim 17 in view of example 5 of D24 was pursued in appeal. The contested decision concluded that operative claim 17 was novel since it had not been shown that the amount of n-hexane extractables of the copolymer of example 5 of D24 was in the range of from 0 to 6 wt.-%. In addition, it was disputed by the respondent that the DSC melt transition temperature was in the range 116-123°C.

4.2 The copolymer disclosed in example 5, Table 1 of D24 was produced in the presence of DMAC as activator. The copolymer has a melt flow rate of 28.2 (page 7, line 36) and a DSC melt transition temperature of 123.6°C (Table 1) measured by a method disclosed on page 6 lines 8-12 on an annealed sample of the copolymer (see note in Table 1). The amount of n-hexane extractables of the copolymer of example 5 is not disclosed in D24.

4.3 Operative claim 17 defines the copolymer of ethylene and 1-hexene in that it possesses a DSC melt transition temperature in the range of 116-123°C. While paragraph 45 of the patent in suit indicates that the DSC melt transition temperature provided for the examples was determined according to ASTM D-3418-97 (the transition T_M being measured on the second heat cycle), operative claim 17 by contrast does not require that the DSC melt transition temperature be measured by any specific method. The appellant compared in D40 (page 4 and Table 3 on page 5) and D42 (Table 3 on page 4) values of DSC melt transition temperatures measured on several copolymers of ethylene and 1-hexene with five different measurement methods and measurement conditions defined on pages 2/3 and summarized in Table 2 on page 4 of

D40.

4.4 The results reported in Tables 3 of D40 and D42 show that the value of the DSC melt transition temperature of a given ethylene hexene copolymer (Dowlex™ 2645 and gas phase LLDPE) depends on its measurement method/ measurement conditions. Table 3 of D42 for instance shows that the DSC melt transition temperature (Tm1) for a gas phase LLDPE can vary by up to 2°C depending on whether the sample was unannealed (123.15°C) or had been annealed (cases 3 to 7: 125.14°C to 125.20°C). The annealing steps (Cases 3-7) in D42 (see Table 2 for the description of the conditions) are an attempt to reproduce the annealing step that was performed in D24 (page 6, lines 7-11) as part of the measurement of the DSC melt transition temperature (Table 1). D42 credibly shows that an annealing step leads to a copolymer having a DSC melt transition temperature of about 2°C higher than the corresponding unannealed copolymer.

4.5 Even if D40 and D42 do not contain a measurement of the DSC melt transition temperature of a reworked sample of the copolymer according to example 5 of D24, they show convincingly, in view of the coherent variations of DSC melt transition temperature shown in D42, that the value of 123.6°C disclosed in example 5 of D24 for an annealed sample cannot be distinguished from the range of 116-123°C defined in operative claim 17.

4.6 With regard to the amount of n-hexane extractables in the copolymer the appellant referred to the passage on page 6, lines 22-31 of D24. That passage discloses a general procedure (FDA test used for polyethylene film intended for food contact applications) to follow in order to determine the amount of n-hexane extractables. There is however in D24 no indication that that test was performed on the copolymer of example 5, nor on any of the copolymers of examples 2-6 produced in slurry polymerisation that are reported in Table 1. It can also not be concluded from the passage on page 6 that the copolymer of example 5 would have shown an amount of n-hexane extractables as disclosed in the FDA test described on page 265 of D12.

4.7 The passage on page 8, lines 15-18 of D24 discloses that the copolymers of Table 1 obtained with DMAC as activator showed a better compositional homogeneity as compared to copolymers obtained with a TEAL activated catalyst. The appellant contended that, as the use of DMAC as an activator resulted in a copolymer with better compositional homogeneity, it also led to a decrease of the amount of n-hexane extractables in the copolymer. That assertion was however not supported by any verifiable fact showing how it could be ascertained that the amount of n-hexane extractables for the copolymers of Table 1 was in the range of from 0 to 6 wt.-% as defined in operative claim 17.

4.8 It was also not established that the amount of n-hexane extractables of copolymers obtained by a slurry polymerization as in example 5 could be derived from the amount of n-hexane extractables of copolymers 8 and 9 obtained in the gas phase. Some properties of the copolymer of example 5 obtained in the slurry (density of 0.918 g/cc and melt flow rate of 28.2) are indeed comparable to those of copolymers of examples 8 and 9 obtained in the gas phase (densities of 0.917 and 0.918 g/cc and melt flow rates of 28.1 and 27.2 respectively), but it has not been established that that was sufficient to extrapolate the amount of n-hexane extractables of the copolymer according to example 5 from the amount of n-hexane extractables of the copolymers of examples 8 and 9, especially since the amount of n-hexane extractables in the copolymer results from the specific polymerization of ethylene with hexene. The presence of n-hexane as a solvent in example 5 cannot change this conclusion, as no information is available as to how the solvent (including possibly part of the extractables) is separated from the produced copolymer. In that regard the Board finds that on the basis of the evidence provided in appeal no definitive conclusion can be reached as to the amount of n-hexane extractables in the copolymer of example 5.

4.9 Operative claim 17 is therefore novel over example 5 of D24.

5. Inventive step

5.1 Inventive step was addressed starting from example 4 of D3 and examples 5 and 8 of D24 as the closest prior art disclosures.

5.2 The patent in suit concerns a process for the polymerization of olefins having narrowed molecular weight distribution (MWD) values resulting in polyethylenes having a reduced n-hexane soluble polymeric fraction (paragraph 1), the combination of these properties leading to films generally characterized as having improved optical properties and improved strength properties which are shown by the values of Dart impact in Table 2 (paragraph 68).

5.3 D3 concerns films from linear low density polyethylene of narrow molecular weight distributions and that possess improved Dart impact resistance and reduced n-hexane extractable contents (column 1, lines 14-20).

D24 also concerns the polymerization of olefins and in particular ethylene and a-olefins to provide films with higher Dart impact strength (page 2, lines 1-4 and 11-15). Both D3 and D24 are therefore reasonable starting points in the assessment of inventive step of operative claim 17.

5.4 Operative claim 17 differs from example 4 of D3 in that the DSC melt transition temperature is in the range of 116-123°C and from example 5 of D24 in that the amount of n-hexane extractables is from 0 to 6 wt.-% (see points 3 and 4, above). With regard to example 8 of D24, both parties acknowledged that operative claim 17 differed from that example in that the DSC melt transition temperature was in the range of 116-123°C.

5.5 It was not disputed that the patent in suit did not contain true comparative examples showing an effect of the copolymer according to operative claim 17 over the copolymers of example 4 of D3 and of examples 5 and 8 of D24. In that regard the problem solved is in all instances the provision of alternative copolymers, as agreed by both parties.

5.6 It remains to be determined whether the subject-matter according to operative claim 17 was obvious to a person skilled in the art starting from the copolymer of either example 4 of D3, example 5 of D24 or example 8 of D24. In that regard, the arguments provided by the parties with respect to example 8 of D24 referred to those made in view of example 4 of D3. It was indeed established that operative claim 17 differed from example 4 of D3 and example 8 of D24 in the same feature, namely the value of the DSC melt transition temperature. In the following the question of obviousness in view of example 4 of D3 and in view of example 8 of D24 will therefore be dealt with together.

5.7 Obviousness in view of example 4 of D3 or example 8 of D24

5.7.1 The object of D3 was to provide olefin copolymers having a relatively narrow molecular weight distribution and a high bulk density for the production of films with improved tear strength, FDA extractables and dart impact resistance (D3, column 1, lines 49-56). This object was achieved in D3 with a polymerization involving a catalyst (column 6, lines 60-66) produced by forming a precursor composition from a magnesium compound, and a compound of a transition metal; partially activating the precursor with DMAC, TMA or admixtures thereof and activating the diluted precursor composition with at least one organoaluminum compound, the organoaluminum compound being provided as triethylaluminum (TEAL) and/or trimethylaluminum (TMA) (column 2, lines 5-18). The catalyst is taught in D3 as being essential for the relatively low values of melt flow rate (column 6, lines 60-66) and reduced hexane extractables (column 7, lines 21-23 and column 9, lines 64-66), evidencing a relatively narrow molecular weight distribution of the produced copolymers. In that context, D3 discloses values of melt flow rates of 24 to 29 (column 7, lines 3-15).

5.7.2 That teaching of D3 is consistent with that available in D24 and D25 in that these documents also teach that the use of DMAC as activator of the catalyst for polyolefin polymerization leads to a more uniform distribution of the side chain branches in the copolymer (D24: page 2, lines 29-37; D25: page 6, line 56 to page 7, line 7). D24 also mentions in that regard a melt flow rate of 26-28 for these copolymers (page 5, lines 18-20), a range which is consistent with that given in D3. D24 (page 8, lines 15-18) and D25 (page 7, lines 2-7 and page 10, lines 2-3) also teach that the copolymers obtained with a DMAC activator display lower DSC melt transition temperatures.

5.7.3 Starting from the copolymer according to example 4 of D3 which was prepared in the presence of DMAC and TMA, it cannot, however, be derived from the combined teachings of D3, D24 and D25 how the DSC melt transition temperature of a copolymer of ethylene could be adjusted. Varying the amount of DMAC is linked to the variation of the catalyst activity in D24 (page 4, lines 53-57 and page 5, lines 5/6) and D25 (page 7, lines 12-15) but nowhere is it taught that the amount of DMAC would have an influence on the DSC melt transition temperature of the resulting copolymer.

5.7.4 The appellant also submitted that by routine experimentation, for instance by varying the hydrogen content, the temperature and possibly using slurry polymerization, a skilled person would have arrived at a copolymer according to operative claim 17. There is however no evidence on file indicating that the variation of these process parameters could have been performed with the result of changing the DSC melt transition temperature within the range in operative claim 17 while still obtaining a copolymer having a melt flow rate and an amount of extractables in the ranges defined in that claim. It is indeed suggested in D3 and in D24 that the melt flow rate of the copolymers is dependent on the use of DMAC in the catalyst system (D3: column 7, lines 3-15 and D24: page 5, lines 18-20) as well as on the use of hydrogen during polymerization (D24: page 5, lines 13-17). Since the melt flow rate of the copolymer according to example 4 of D3 (26.2) is already at the edge of the range defined in operative claim 17 (26-34), a change in any of the process conditions and in particular concerning DMAC or the hydrogen content could be reasonably expected to affect the melt flow rate to such an extent that its value was outside the range of 26-34. There is also no teaching in the cited prior art showing how a copolymer according to operative claim 17 with, in addition to the melt flow ratio, a DSC melt transition temperature and an amount of extractables in the ranges defined in operative claim 17 could be obtained. In that regard, the examples of the patent in suit show that copolymers of ethylene and 1-hexene satisfying both conditions of DSC melt transition temperature and amount of extractables were obtained when dinitrogen monoxide was added as a gas to the line for recycling the gaseous reaction mixture (patent in suit, page 6, lines 45-49 and examples 3-7). There is thus no evidence on file of how the modification of the polymerization process disclosed in example 4 of D3 could have resulted in a copolymer according to operative claim 17. It has as a result not been established that a skilled person would have been in the position to obtain a copolymer according to operative claim 17. The Board therefore concludes that operative claim 17 is inventive over example 4 of D3.

5.7.5 The same arguments have been made when starting from example 8 of D24. While the influence of the variation of the polymerization parameters on the melt flow rate (28.1) of the copolymer according to example 8 of D24 appears to be less critical than in the case of example 4 of D3, the Board nevertheless reaches the same conclusion since the evidence provided does not show how the DSC melt transition temperature can be varied and adjusted in the range of 116-123°C while maintaining all other properties according to operative claim 17. In that regard, operative claim 17 is also inventive in view of example 8 of D24.

5.8 Obviousness in view of example 5 of D24

5.8.1 The object of D24 was to provide olefin copolymers having improved, narrower branching distributions (page 2, lines 1-4 and lines 11-19). This object was achieved in D24 with a polymerization involving a catalyst system involving the use of DMAC as the activator for the precursor composition instead of TEAL (page 2, lines 29-33). D24 further discloses that the polymers prepared with these catalysts systems are especially suitable for the production of films and injection moulding products (page 2, lines 38-39).

5.8.2 The copolymer of example 5 of D24 chosen as starting point for the assessment of inventive step was produced in the presence of DMAC by a slurry polymerization process (page 7, lines 20-36), and the properties of the copolymer prepared by that process are reported in Table 1 of D24. The amount of n-hexane extractables of the copolymers produced in example 5 is however not disclosed in D24. The amount of n-hexane extractables is mentioned in the introductory part of D24 in the broad context of LLDPEs having a more uniform distribution of branches among individual molecules of copolymer (page 2, lines 11-15), allowing films from these copolymers to meet FDA requirements for extractables in films used for food packaging. While it is the object of D24 to produce olefin copolymers with improved distribution of branches among the polymer molecules, D24 does not require all its copolymers to be suitable for food packaging, nor does it require the copolymers produced to meet the FDA standard for these applications, nor any limitation of the amount of n-hexane extractables.

5.8.3 A method for the determination of the amount of n-hexane extractables of copolymers which is based on the FDA test described in D12 is disclosed on page 6, lines 22-31. It is however apparent that that method was only used for the copolymers of examples 7-9 in table 2 of D24, all produced by a gas phase polymerization which is the preferred process of D24 (page 5, lines 11-12). Even if the copolymers of examples 2-6 in Table 1 were found to have some compositional homogeneity, there is no specific teaching in D24 regarding the amount of n-hexane extractables of the copolymers produced by slurry polymerization, as in examples 2-6 of D24, and therefore no reason to conclude that the amount of n-hexane extractables of these copolymers was particularly limited.

5.8.4 There is also no teaching in D24 of whether the amount of n-hexane extractables of these copolymers could be adjusted and how it could be adjusted. In that regard, the appellant referred to routine experimentation involving the amount of hydrogen, amount of activator and temperature, but since no evidence of that was provided in that regard, the Board sees no reason to conclude that a skilled person knew how to perform these variations in order to obtain, starting from example 5 of D24, a copolymer with an amount of n-hexane extractables according to operative claim 17 while maintaining all other properties according to that claim (in particular the melt flow rate and the DSC melt transition temperature).

5.8.5 The preparation of the copolymers according to examples 7-9 in D24 provides some teaching with regard to the amount of n-hexane extractables since Table 3 reports that parameter for each of the copolymers. It is apparent from examples 8 and 9 in Tables 2 and 3 of D24 that the amount of n-hexane extractables of these copolymers varies with the amounts of activator and hydrogen in the process. It is however unclear if these two parameters, which are disclosed in the context of a gas phase polymerization, could also be successfully applied to a slurry polymerization process as that used to prepare the copolymer according to example 5. It is also unclear from examples 8 and 9 in Tables 2 and 3 if the teaching derived for the amount of n-hexane extractables would have been considered to be relevant at all since for none of these examples the DSC melt transition temperature is provided. It is thus unclear from the teaching of D24 whether a copolymer of ethylene and 1-hexene having the combination of DSC melt transition temperatures, melt flow ratio and n-hexane extractables in combination could be obtained. In that regard, the examples of the patent in suit show that copolymers of ethylene and 1-hexene satisfying both conditions of DSC melt transition temperature and amount of extractables were obtained when dinitrogen monoxide was added as a gas to the line for recycling the gaseous reaction mixture (patent in suit, page 6, lines 45-49 and examples 3-7). The appellant mentioned that the melt flow rates of the copolymers of examples 8/9 were comparable to those of example 5, but it was not established that a similarity in melt flow rates was sufficient to draw any conclusion as to the DSC melt transition temperatures of the copolymers of examples 8/9.

5.8.6 It is therefore not apparent from the teachings of D24 that a modification of the process of example 5 of D24 with respect to the amount of n-hexane extractables would have led to a copolymer according to operative claim 17, that is a copolymer for which not only the amount of n-hexane extractables was in the claimed range but also the melt flow rate and the DSC melt transition temperature. In summary, starting from example 5 of D24 it has not been shown that a skilled person was in a position to prepare the copolymers according to operative claim 17. The Board therefore concludes that operative claim 17 is inventive over example 5 of D24.

6. As none of the objections is successful, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

Beschwerdekammern des Europäischen Patentamts ✦ Boards of Appeal of the European Patent Office ✦ Chambres de recours de l'Office européen des brevets ✦

B. ter Heijden D. Semino

Decision electronically authenticated