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**Datasheet for the decision  
of 10 November 2016**

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**Application Number:** 05787154.3

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**Title of invention:**  
ELASTOMERIC POLYOLEFIN COMPOSITIONS

**Patent Proprietor:**  
Basell Poliolefine Italia S.r.l.

**Opponent:**  
W.R. Grace & Co.-Conn.

**Relevant legal provisions:**  
EPC Art. 83, 54, 56

**Keyword:**  
Sufficiency of disclosure - (yes)  
Novelty - (yes)  
Inventive step - (yes)



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Case Number: T 0402/13 - 3.3.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.03**  
**of 10 November 2016**

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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
29 November 2012 concerning maintenance of the  
European Patent No. 1797138 in amended form.**

**Composition of the Board:**

**Chairman** M. C. Gordon  
**Members:** D. Marquis  
C. Brandt

## Summary of Facts and Submissions

- I. European Patent No. 1 797 138 was granted on the basis of 5 claims, independent claim 1 reading as follows:
- "1. Olefin polymer composition comprising (by weight):
- A) 60-85% of a crystalline propylene homopolymer or a crystalline copolymer of propylene containing 3% or less of ethylene or C<sub>4</sub>-C<sub>10</sub>  $\alpha$ -olefin(s) or of combinations thereof, said homopolymer or copolymer having a Polydispersity Index value of from 4.5-6 and a content of isotactic pentads (mmmm), measured by <sup>13</sup>C NMR on the fraction insoluble in xylene at 25 °C, higher than 96%;
- B) 15-40%, of a partially amorphous copolymer of ethylene containing from 35% to 70% of propylene or C<sub>4</sub>-C<sub>10</sub>  $\alpha$ -olefin(s) or of combinations thereof, and optionally minor proportions of a diene; said olefin polymer composition exhibiting a value of elongation at break ranging from 150 to 600% according to ISO method 527 and an Izod impact resistance are over kJ/m<sup>2</sup> [sic] at 23°C and over 7 kJ/m<sup>2</sup> at 0°C according to ISO method 180/1A."
- II. A notice of opposition was filed in which revocation of the patent on the grounds of Article 100(a) (lack or novelty and lack of inventive step), 100(b) and 100(c) EPC was requested.
- III. During opposition proceedings, the following documents were inter alia cited:
- D2: ISO 180 standard, third edition 15.12.2000  
D3: Experimental report of Mr. Sheard  
D4a: ASTM D638-03, complete 2003 version  
D5: WO 2005/113672

D6: WO 2004/087805  
D7: US 5541260  
D9: WO 2005/044911  
D10: WO 03/051984  
D11: US 2004/0030052  
D12: US 6818690  
D13: US 6313227  
D17: IUPAC, Phase 1: IUPAC SEC/GPC Round Robin Project Report; Repeatability and reproducibility of Sample Preparation and Analysis in High Temperature SEC, 19 May 2010, pp. 2-4, 30, 38, 42 and 45  
D18: G. Cecchin et al. "Polypropene Product Innovation by Reactor Granule Technology", Macromol. Symp., 2001, 173, 195-209  
D21: Extract and translation from JIS K 7110 (1999)  
D22: WO 2004/013193

IV. The interlocutory decision of the opposition division to maintain the patent as amended on the basis of a request filed on 16 September 2011 was announced at the oral proceedings on 8 November 2012. Claim 1 of that request read as follows:

"1. Olefin polymer composition comprising (by weight):

A) 60-85% of a crystalline propylene homopolymer or a crystalline copolymer of propylene containing 3% or less of ethylene or C<sub>4</sub>-C<sub>10</sub>  $\alpha$ -olefin(s) or of combinations thereof, said homopolymer or copolymer having a Polydispersity Index value of from 4.5-6 a content of isotactic pentads (mmmm), measured by <sup>13</sup>C NMR on the fraction insoluble in xylene at 25 °C, higher than 96%; and a molecular weight distribution, expressed by the M<sub>w</sub>/M<sub>n</sub> ratio, measured by GPC, ranging from 6 to 9.

B) 15-40%, of a partially amorphous copolymer of ethylene containing from 35% to 70% of propylene or C<sub>4</sub>-C<sub>10</sub>  $\alpha$ -olefin(s) or of combinations thereof, and optionally minor proportions of a diene; said olefin polymer composition exhibiting a value of elongation at break ranging from 150 to 600% according to ISO method 527 and an Izod impact resistance over 12 kJ/m<sup>2</sup> at 23°C and over 7 kJ/m<sup>2</sup> at 0°C according to ISO method 180/1A."

The decision of the opposition division, as far as relevant to the present decision, can be summarised as follows:

The claims were allowable under Article 123(2) EPC. With respect to sufficiency of disclosure, the patent in suit provided sufficient guidance as to the measurement of the ratio  $M_w/M_n$ , the elongation at break and the Izod impact strength. In particular, it was found that the values of the parameters needed for the Mark-Houwink equation necessary to calculate  $M_w/M_n$  were readily available in the literature. The problem regarding the reliability of the measurement of the elongation at break of the composition affected the boundaries of the scope of the claim; it was consequently a problem of lack of clarity which could not be addressed in opposition rather than a question of sufficiency of disclosure. The effect of the method of preparation of the test specimens on Izod impact strength and the elongation at break was small and not an issue of sufficiency in the present case.

The claims were also novel in view of D5, D6, D7, D9, D10 and D11. The compositions of examples 1 and 1c of D5 had an  $M_w/M_n$  outside the claimed range. The elongation at break of the compositions according to examples 2c and 3c were outside the claimed range. It had not been plausibly shown that the  $M_w/M_n$  of the

composition according to example 1 of D6 was within the claimed range. Doubts existed as to whether the composition of example 3 of D7 had a  $M_w/M_n$  and a P.I. as claimed in the main request. Claim 1 of the main request required the presence of only one copolymer of ethylene as copolymer B). Since two copolymers were present in the composition according to example 5 of D9, it did not anticipate the claimed subject matter. Neither the Polydispersity Index value, the  $M_w/M_n$ , nor the isotactic pentads content of the propylene homopolymer fraction was disclosed for the composition of example 12 of D10. D10 did not anticipate the claimed subject matter. Neither the Polydispersity Index value nor the isotactic pentads content of the propylene homopolymer fraction was disclosed for the composition of example 6 of D11. D11 did not anticipate the claimed subject matter. The claimed subject matter was novel in view of the cited prior art. D7 represented the closest prior art. D7 did not disclose a propylene homopolymer fraction having in combination, a Polydispersity Index value of between 4.5 and 6 and a ratio  $M_w/M_n$  of between 6 and 9. The problem to be solved was to provide further impact polypropylene compositions. There was no hint towards the use of compositions disclosed in D22 in order to solve the problem posed because D22 did not relate to the production of high impact polypropylene blends. The claimed subject matter was inventive in view of the cited prior art.

- V. The opponent (appellant) lodged an appeal against that decision and requested that the decision be set aside and that the patent be revoked.
- The following further documents were cited:
- D17a: IUPAC, Phase 1: IUPAC SEC/GPC Round Robin Project Report; Repeatability and Reproducibility of Sample

Preparation and Analysis in High Temperature SEC, 19 May 2010, pp. 1-45.

D21a: Complete translation of JIS K 7110 (1999) (D21)

D26: WO 2009/068514

D27: ISO 16014-2:2003 & ISO 16014-4:2003

D28: US 6384142

- VI. In its reply to the statement of grounds of appeal, the respondent requested that the appeal be dismissed or that the patent be maintained on the basis of a new first or second auxiliary request.
- VII. With letter of 29 July 2015, the appellant confirmed that the opposition relating to the present case was being transferred to W.R. Grace & Co. Conn.
- VIII. In a communication sent in preparation of the oral proceedings, the Board summarised the points to be dealt with, and provided a preliminary view on the disputed issues.
- IX. Oral proceedings were held on 10 November 2016.
- X. The arguments of the appellant, as far as relevant to the present decision, can be summarised as follows:

Sufficiency of disclosure

Determination of  $M_w/M_n$  of the isotactic polypropylene fraction by GPC

No sufficient guidance about the type and method of calibration and the Mark-Houwink constants ( $\kappa$  and  $\alpha$ ) necessary to determine the  $M_w/M_n$  ratio by gel permeation chromatography was provided. It had not been shown where the skilled person could retrieve the

appropriate set of parameters  $\kappa$  and  $\alpha$  for the measuring conditions of solvent and temperature set out in the patent in suit. Both values of  $\kappa$  and  $\alpha$  depended on the solvent and temperature at which the measurement was performed as shown by D17, D23 and D25. It was not apparent to the skilled person which values of  $\kappa$  and  $\alpha$  were used in the patent in suit and how the skilled person had to select the values of these parameters, as can be derived from D28. Also, D24 and D26 showed that several types and methods of calibration needed for the GPC measurement were available to the skilled person. No information was provided in the patent in suit on how to choose the appropriate calibration. On the basis of the reproducibility of the determination of  $M_w$  and  $M_n$  of polypropylene disclosed in D27, the reproducibility of  $M_w/M_n$  was such that a value of 9 in fact corresponded to a value anywhere in the range of 7.2 to 10.8 or even up to 14. Since the values of  $M_w/M_n$  were subject to large variations as a result of the different calibration methods available, compositions meeting the claimed properties were not reproducible. That uncertainty in the determination of the parameter resulted in a lack of sufficiency of claim 1.

Izod impact strength and elongation at break

No guidance was provided in the patent in suit on how the Izod impact strength was measured. The reference to the ISO 180 standard was not sufficient since a number of additional factors needed to enable the test were not provided, as shown in D2.

In addition, D3 and D4a showed that the elongation at break was a highly variable parameter owing to necking behaviour of the polymer at the centre section of the test bar. As a result, the whole claimed numerical



range of 150% to 600% lacked sufficiency of disclosure. There was also no guidance in the patent in suit and in the ISO 527 standard as to whether the test specimen necessary for the measurement of the elongation at break had to be compression moulded or injection moulded. As shown by D3, the preparation of the test specimen markedly influenced the test results. It resulted from these documents that a value of elongation at break within the claimed range was not - statistically - significantly different from a value outside the claimed range.

The lack of sufficiency of the individual parameters was made even worse by the fact that the claimed subject matter was defined by an amalgamation of the parameters  $M_w/M_n$ , elongation at break and Izod impact strength.

#### Novelty

The upper range value of  $M_w/M_n$  of 9 in claim 1 was, in view of the uncertainty that gave rise to the insufficiency (see above), technically equivalent to a value of up to 14. The value of 10.9 reported in example 1 of D5 therefore fell within the claimed range. Example 1 was novelty destroying for the claimed subject matter.

Examples 2c and 3c of D5 anticipated claim 1 (Article 54(3) EPC). It was deduced from D4a that the reproducibility for the elongation at break was such that the value of 74% reported in these examples was technically equivalent to a value of 158.9%, falling within the claimed range. Alternatively, the elongation at break was so variable in claim 1 that it should be disregarded when assessing novelty.

Example 1 of D6 disclosed a composition according to claim 1 of the patent in suit. The elongation at break was above 660%. The isotactic pentad content was not reported in D6 but since the catalyst system was the same as in the patent in suit, that parameter inherently was above the threshold specified. The feature  $M_w/M_n$  lacked clarity so that it could not distinguish the claimed subject matter from that of D6. Alternatively, the value of  $M_w/M_n$  of the composition of example 1 of D6 had to be within the claimed range as could be deduced from the values of melt flow ratio disclosed in examples 1-4.

Example 3 of D7 also anticipated claim 1. The isotactic pentads, Polydispersity Index value and  $M_w/M_n$  were not disclosed in that document. Since the preparation and the catalyst system used in D7 was similar to that of the patent in suit, the polymer produced in example 3 of D7 would have a level of isotactic pentads, Polydispersity Index value and  $M_w/M_n$  within the claimed range, as supported by D18.

The composition of example 5 of D9 was produced with a catalyst system that was of the same type as that used in the patent in suit. It was inherent that the values of the level of isotactic pentads and  $M_w/M_n$  were within the claimed range. As to the elongation at break and Izod impact resistance, a comparison with the values of the patent in suit showed that they had to be within the claimed range. Also, the composition of example 5 of D9 met the overall compositional requirements for component B of operative claim 1. D9 anticipated claim 1.

Example 12 of D10 disclosed a composition for which the isotactic pentads, Polydispersity Index value and  $M_w/M_n$

were not specified. Since the catalyst system was close to that of comparative example 2 of the patent in suit, these parameters had to fall within claim 1. Although the Izod value at 0°C was not reported, the value of that parameter at 23°C had to be within claim 1 of the patent in suit. D10 anticipated claim 1.

Example 6 of D11 disclosed a composition according to claim 1. The description of D11 indicated that the pentad content, Polydispersity Index value,  $M_w/M_n$ , elongation at break had to be within the claimed range. The equivalence of measurement standards shown by D21 showed that the Izod impact strength had to be according to claim 1.

#### Inventive step

Starting from D7, which represented the closest prior art, the problem solved was the provision of an alternative polymer composition. The solution to that problem was obvious as evidenced by the examples 2c and 3c of D5 or example 3 of D7. Furthermore, the skilled person looking for an alternative crystalline polypropylene with good mechanical resistance and stiffness would find the solution in a combination of D7 and D22, in particular example 3 in Table 2 of D22. D18 did not lead away from the teaching of D7 and D22 - it complemented them and confirmed the obviousness of combining these teachings. D12 and D13 also taught the use of a high content of isotactic pentads to maintain good flexural modulus properties. D13 further taught a  $M_w/M_n$  ratio of 3 to 8.

D10 and D11 could alternatively be invoked as documents representing the closest prior art. The claimed subject matter lacked an inventive step over these documents as well.

XI. The arguments of the respondent, as far as relevant to the present decision, can be summarised as follows:

Sufficiency of disclosure

Determination of  $M_w/M_n$  of the isotactic polypropylene fraction by GPC

The parameters  $\kappa$  and  $\alpha$  of the Mark-Houwink equation for a given solvent and temperature were calculated data that could be retrieved from the literature. Thus, the skilled person, given the solvent and the temperature at which the determination occurs, would not have any doubt about the proper parameter to use. The patent in suit therefore provided sufficient guidance on how to determine the parameter  $M_w/M_n$ .

Izod impact strength and elongation at break

The objection against these parameters was related to the reliability of the measurement and not to the question of whether the skilled person was able to measure them. That was not an objection under Article 83 EPC. The preparation of the test specimen for these measurements was disclosed in the standard ISO 1873-2. The Izod impact strength and elongation at break were therefore sufficiently disclosed in the patent in suit.

Novelty

The value of  $M_w/M_n$  that was disclosed in example 1 of D5 did not fall under the claimed range also taking into account any error margin that might affect the measure. The elongation at break disclosed in examples 2c and 3c was also outside the claimed range. The opponent did not convincingly show whether, and if so

to what extent, the measurement of the elongation lacked reliability. The claimed subject matter was therefore novel over D5.

D6 did not report the value of  $M_w/M_n$  so that it did not anticipate the claimed subject matter.

Neither the Polydispersity Index value nor  $M_w/M_n$  were disclosed in example 3 of D7. The claimed subject matter was therefore novel over D7.

D9 did not report the value of  $M_w/M_n$ . Also, the three component composition of example 5 did not fall under the claimed subject matter since claim 1 did not encompass the presence of two polymers as component b). The claimed subject matter was therefore novel over D9.

Neither the Polydispersity Index value nor  $M_w/M_n$  were disclosed in example 12 of D10. Said example of D10 disclosed also the presence of two polymers as component b). That was however not encompassed by claim 1.

Neither the Polydispersity Index value nor  $M_w/M_n$  were disclosed in example 6 of D11. The methods used to determine the Izod impact resistance and the elongation at break in D11 were different from those disclosed in the patent in suit, so that the results of these measurements could not be compared to one another. The claimed subject matter was novel over D11.

Inventive step

D7 represented the closest prior art. In particular, the claimed subject matter differed from example 3 of D7 in the nature of the component A. The technical

effect of the claimed subject matter over example 3 of D7 was a better balance between elastic properties (elongation at break, Izod) and rigidity (Flexural modulus). The problem was to obtain a composition having an improved rigidity/elastic behaviour balance. The solution to that problem, the specific component (A), was not taught in D7 which instead taught to modify the balance by increasing (not changing the nature) of component A. That resulted in an increase of rigidity and a drop of the impact resistance leading to an insufficient balance. The claimed subject matter was inventive over the cited prior art.

XII. The appellant requested that the decision under appeal be set aside and that the European patent No. 1797138 be revoked.

XIII. The respondent requested that the appeal be dismissed and the patent be maintained as upheld by the decision under appeal (main request), or, alternatively, that the patent be maintained on the basis of either of the first or second auxiliary request filed with the reply to the statement of grounds of appeal.

## Reasons for the Decision

Main request

1. Sufficiency of disclosure
  - 1.1 Determination of  $M_w/M_n$  of the isotactic polypropylene fraction by GPC
    - 1.1.1 Claim 1 of the main request is directed to an olefin polymer composition defined in that it comprises 60-85% of a crystalline propylene homopolymer or a crystalline copolymer of propylene A) containing 3% or less of ethylene or  $C_4-C_{10}$   $\alpha$ -olefin(s) or of combinations thereof, said homopolymer or copolymer having a Polydispersity Index value of from 4.5-6 and a content of isotactic pentads (mmmm), measured by  $^{13}C$  NMR on the fraction insoluble in xylene at 25 °C, higher than 96% and a molecular weight distribution, expressed by the  $M_w/M_n$  ratio, measured by GPC, ranging from 6 to 9.
    - 1.1.2 Thus, the first component of the composition of claim 1 is characterized, *inter alia*, by a molecular weight distribution, expressed by the  $M_w/M_n$  ratio, measured by GPC that must be comprised within a numerical range. Although claim 1 does not provide any further detail regarding the measurement of the molecular weight distribution by GPC, the passage on page 8 lines 3-8 of the description discloses that  $M_n$  (number average molecular weight) and  $M_w$  (weight average molecular weight) needed to obtain the  $M_w/M_n$  ratio were  
  
"Measured by way of gel permeation chromatography (GPC) in 1,2,4-trichlorobenzene; in detail, the samples are prepared at a concentration of 70 mg/50 ml of

stabilized 1,2,4 trichlorobenzene (250µg/ml BHT (CAS REGISTRY NUMBER 128-37-0); the samples are then heated to 170°C for 2.5 hours to solubilize; the measurements are run on a Waters GPCV2000 at 145°C at a flow rate of 1.0 ml/min. using the same stabilized solvent; three Polymer Lab columns are used in series (Plgel, 20µm mixed ALS, 300 X 7.5 mm).".

- 1.1.3 The patent in suit therefore provides some guidance concerning the method and conditions of the measurement of the molecular weights  $M_n$  and  $M_w$  of the component A). However, the patent in suit does not disclose the calibration method needed to obtain the molecular weight of the component A) by comparison with polymers of known molecular weights (standards). Also, the patent in suit does not disclose the values of the parameters  $\kappa$  and  $\alpha$  of the Mark-Houwink equation which were needed to calculate the molecular weights of the polymer.
- 1.1.4 It was argued on the basis of the documents D17 and D23 to D28 that the values of molecular weights that could be determined by the GPC method varied significantly, in particular with the specific calibration method chosen as well as with the values of the parameters  $\kappa$  and  $\alpha$ . Since different calibration methods were available to the skilled person and since the literature provided various values for the parameters  $\kappa$  and  $\alpha$  that depended on the conditions of the measurement, the molecular weights and therefore the  $M_w/M_n$  ratio obtainable with the limited information of the patent in suit lacked the necessary reliability.
- 1.1.5 A lack of reliability does however not necessarily prevent the skilled person from obtaining a claimed composition. To establish the exact limits of a claim



as was done by the appellant in this case is a question of clarity (Article 84 EPC), which is not a ground of opposition. The question that needed to be answered in the present case was rather whether the lack of reliability concerning the  $M_w/M_n$  ratio of component A) in the composition of claim 1 was so severe that it constituted an unsurmountable obstacle for the skilled person set to prepare an olefin polymer composition according to claim 1.

1.1.6 The preparation of the olefin polymer composition is described in paragraphs 17 to 26 of the patent in suit. The two stage polymerization process to form component A) in a first stage followed by component B) in a second stage is generally described in paragraphs 20 to 22. The operating parameters of the process such as reaction time, pressure, temperature as well as catalyst system are disclosed in the subsequent paragraphs 29 to 46. Apart from the general mention of the  $M_w/M_n$  ratio of component A) in paragraph 14 and its method of measurement in paragraph 75, it cannot be derived from the patent in suit that the value of the  $M_w/M_n$  ratio of component A is a necessary prerequisite for the preparation of the composition of claim 1. As shown in the examples of the patent in suit and in particular in example 1, olefin polymer compositions according to claim 1 can be produced. The measured data and properties of the composition are disclosed in Tables 1 to 3 of the patent in suit. Those data show that a composition can be obtained irrespective of whether the  $M_w/M_n$  ratio was within the claimed range.

1.1.7 The question to be answered for sufficiency was not whether one can determine all the parameters on the finished composition, but rather if the skilled person was able to obtain the composition as claimed. Even if

the respondent could show that the  $M_w/M_n$  ratio was subject to significant variation, it did not show that that variation would prevent the skilled person from obtaining a composition according to claim 1. In particular, the documents and arguments put forward by the appellant do not show how a lack of reliability of the determination of the  $M_w/M_n$  ratio would prevent a skilled person from obtaining an olefin polymer composition according to claim 1 exhibiting a value of elongation at break ranging from 150 to 600% according to ISO method 527 and an Izod impact resistance are over  $\text{kJ/m}^2$  [sic] at  $23^\circ\text{C}$  and over  $7 \text{ kJ/m}^2$  at  $0^\circ\text{C}$  according to ISO method 180/1A.

1.1.8 The respondent has therefore merely shown the existence of an ambiguity due to the absence of a definition of the method used to determine the  $M_w/M_n$  ratio of one of the components of the claimed olefin polymer compositions. It was however not shown why that lack of reliability would lead to a lack of sufficiency of disclosure of the claimed subject matter.

1.2 Elongation at break and Izod impact strength

1.2.1 Claim 1 of the main request defines the claimed olefin compositions by their elongation at break as measured by the method ISO 527. It was undisputed that measurements of the elongation at break of the claimed olefin compositions was possible but it was submitted that based on the incomplete information contained in the patent as well as in D4a and D3, the value obtained from the measurement of that parameter would be highly variable. As a result, the claimed subject matter was insufficiently disclosed.

1.2.2 D4a is a document describing the standard test method for tensile properties of plastics ASTM D638-03 which was said to be equivalent to method ISO 527 referred to in the patent in suit (D4a see page 1, note 1 thereof). The test method of D4a covers the determination of the tensile properties of unreinforced and reinforced plastics in the form of standard dumbbell-shaped test specimens when tested under defined conditions of pretreatment, temperature, humidity, and testing machine speed.

1.2.3 D4a discloses that tensile strength and elongation at break values obtained for unreinforced polypropylene plastics are highly variable as a result of inconsistencies in necking or "drawing" of the centre section of the test bar (Note A, under Table 6). That is shown in Table 6 of D4a which reports elongation at break values for a number of polymers including "polypropylene" as measured by the same operator using the same equipment on the same day (Repeatability  $I_r$ ) and different operators using different equipments on different days (Reproducibility  $I_R$ ). The elongation at break reported is characterized by high values of the statistical indexes  $I_r$  and  $I_R$ , indicating that the repeatability and reproducibility of the measurement performed on the polypropylene sample was indeed poor. The polypropylene sample tested in D4a is however not defined any further and there are no other data beyond the reported elongation at break which would permit the type of polypropylene employed to be identified. For example there is no information relating to its preparation or further properties (crystallinity, molecular weight, viscosity, Polydispersity Index value). The question arises therefore whether the results reported in D4a also apply to the olefin polymer composition according to claim 1 of the main

request. The composition of claim 1 comprises A) 60-85% by weight of a crystalline propylene homopolymer or a crystalline copolymer of propylene containing 3% or less of ethylene or C<sub>4</sub>-C<sub>10</sub> α-olefin(s) and B) 15-40% by weight of a partially amorphous copolymer of ethylene containing from 35% to 70% of propylene or C<sub>4</sub>-C<sub>10</sub> α-olefin(s). The claimed composition differs therefore substantially from the "polypropylene" sample disclosed in D4a. As a result, it cannot be established in how far the polypropylene of D4a compares to the specific olefin - heterophasic - polymer compositions according to operative claim 1. Accordingly based on consideration of the constitution of the claimed composition there is no *prima facie* reason to assume that the variabilities reported in D4a for "polypropylene" would also arise in the case of the compositions of the patent in suit. Furthermore, no information was provided to establish that test specimens prepared from compositions according to claim 1 were affected by the same inconsistencies in necking or "drawing" of the centre section of the test bar which, according to D4a, cause poor repeatability and reproducibility in the case of "polypropylene". The Board concludes that it has not been shown in how far the determination of the values of elongation at break of the claimed composition was subject to variations.

- 1.2.4 Experimental report D3 discloses measurements of the Izod impact strength and elongation at break of a polypropylene impact copolymer composition comprising 79.4% by weight of a polypropylene homopolymer and 20.6% by weight of an ethylene/propylene rubber and performed either on a compression or an injection moulded specimen. The data disclosed on page 2 of D3 show that the type of specimen used to perform the measurement, i.e. compression or injection moulded

specimen, has an influence on the values of the Izod impact strength and the elongation at break measured. Insofar as the specimens used to perform the measurement of Izod impact strength and elongation at break are not defined in claim 1 of the main request, it is concluded from the data presented in D3 that both parameters lack reliability in the patent in suit. However, as discussed above under 1.1.5 to 1.1.8, such a lack of reliability does not necessarily prevent the skilled person from obtaining the claimed composition. The respondent has shown the existence of an ambiguity due to the absence of a definition of one aspect of the method used to determine the elongation at break and the Izod impact strength (sample preparation). It has however not been shown how that lack of reliability would prevent the skilled person from obtaining a composition as claimed. The patent in suit shows that compositions according to claim 1 can be obtained and the elongation at break and Izod impact strength can be measured. The lack of reliability of these parameters arising from the absence of a disclosure of the method by which the test samples were obtained is therefore a matter of clarity (Article 84 EPC) and not of sufficiency of disclosure.

- 1.2.5 As far as the method of determination of the Izod impact resistance of the claimed olefin polymer composition is concerned, it was also put forward in the statement of grounds of appeal (page 15, point 2.48) that the patent in suit failed to describe sufficiently how that parameter was measured as it was apparent from D2 that a number of additional factors needed to be described to enable the test to be repeated, notably the type and preparation (including orientation) of the specimen (see D2, paragraphs 6.1.1 and 6.2).

1.2.6 D2 provides some information on how the measurement of the Izod impact resistance can be performed. The patent in suit indicates that a measurement of the Izod impact strength was performed on the basis of the information contained in the ISO method 180/1 A (page 8, line 38), wherein the index A indicates the type of notch as mentioned in paragraph 6.1.1 in D2. As to paragraph 6.2 of D2, it refers to the anisotropy of the sample and only indicates how to deal with - not further defined - "certain types" of samples. The general statement in paragraph 6.2 of D2 does not establish which essential parameters of the measurement could be missing from the disclosure of the patent in suit and how that would amount to a lack of sufficient disclosure of the claimed subject matter. On the contrary, the examples of the patent in suit show that an olefin polymer composition according to claim 1 could be obtained and its Izod impact strength measured. Since it has not been shown which alleged parameters were missing from the patent in suit and how these would prevent the specified property- expressed as the Izod value - being obtained, the Board concludes that the arguments provided by the appellant have not established that the specification of the Izod impact strength in claim 1 resulted in the composition as claimed being insufficiently disclosed.

1.2.7 It was also put forward in the statement of grounds of appeal that the amalgamation of parameters lacking reliability or accuracy in claim 1 constituted an undue burden as such. No arguments were however provided to show how that amalgamation of allegedly unclear parameters could result in undue burden, that is how that would prevent a skilled person from obtaining the claimed compositions. In the absence of any argument

supporting the case made the objection of the appellant must fail.

- 1.2.8 The Board concludes from the above that the claimed subject matter is sufficiently disclosed.
  
2. Since the objection of lack of clarity against claim 1 of the main request submitted by the appellant with his statement of grounds of appeal was withdrawn at the oral proceedings before the Board, the next issue to be addressed is that of lack of novelty of the claims.
  
3. Novelty
  - 3.1 D5 (Article 54(3) EPC)
    - 3.1.1 D5 concerns a heterophasic polyolefin composition comprising among others (A) from 50 to 80% of a crystalline propylene polymer having a polydispersity index value from 5.2 to 10 and a content of isotactic pentads (mmmm), measured by  $^{13}\text{C}$ -NMR on the fraction insoluble in xylene at 25°C, higher than 97.5 molar%, (B) from 5 to 20% of a first elastomeric copolymer of ethylene with at least a comonomer selected from propylene and another  $\alpha$ -olefin and (C) from 10 to 40% of a second elastomeric copolymer of ethylene with at least a comonomer selected from propylene and another  $\alpha$ -olefin (Claim 1).
  
    - 3.1.2 Example 1 and comparative examples 2c and 3c of D5 were cited against claim 1 of the main request. It was however undisputed that the ratio  $M_w/M_n$  of the propylene homopolymer of Example 1 disclosed in Table 2 (10.9) was outside the claimed range of 6-9 and the elongation at break of the compositions of examples 2c and 3c (74%) was also outside the claimed range of

150-600%. The question raised was whether the ranges given for the ratio  $M_w/M_n$  and the elongation at break as disclosed in claim 1 effectively distinguished the claimed subject matter from the examples of D5.

- 3.1.3 It was argued in view of example 1 of D5 that the range of the  $M_w/M_n$  ratio of 6-9 in claim 1 of the main request was unclear and that D27 showed that the claimed range encompassed values of  $M_w/M_n$  of up to 14. As a result the value of the  $M_w/M_n$  ratio disclosed in example 1 of D5 (10.9) fell under the claimed range. The appellant relied on excerpts of D27 in its statement of grounds of appeal (page 8). The section "10 Precision" provided in the statement of grounds of appeal discloses the results of a round-robin test for high-temperature SEC molecular weight determinations ( $M_n$  and  $M_w$ ) on several samples of polymers. In particular, it shows the repeatability and the reproducibility of molecular weight measurements of an unidentified polypropylene sample (Sample G). The average values of  $M_n$  and  $M_w$  for two different calibration standards (Tosoh and PL) are reported in Table 1 and the data shows that the polypropylene sample tested had an average  $M_w/M_n$  ratio of 4.7 (Tosoh) or 5.2 (PL) depending on the calibration standard. The reproducibility of the  $M_w/M_n$  ratio calculated therefrom by the appellant in the statement of grounds of appeal was around 20% (first line, page 9). That value is close to that (16.7% in the first line of page 10 of the statement of grounds of appeal) also derived by the appellant from D17, which shows in Figure 39 on page 30 the PDIs (abbreviation used in D17 for  $M_w/M_n$ ) of a particular polypropylene sample with application of different calibration methods. Applying a margin of error of 16 or 20% to the claimed subject matter would however only extend the claimed range from 9 to a



maximum of 10.8. That - extended - range would still be novel over the value of 10.9 disclosed in example 1 of D5.

3.1.4 In the statement of grounds of appeal, the appellant further argued that on the basis of a commonly accepted calculation, two results were considered to be not equivalent if they deviated by more than  $2.83 \times S_R^a$  ( $S_R^a$  being the standard deviation representative of about 68% of the values falling within the range defined by the average  $\pm 1$  standard deviation) which would mean in the present case that the maximum value of the range representing the variation of the  $M_w/M_n$  ratio thus extended to a value of up to 14. It was however not shown that this calculation of the error was commonly accepted or applicable in the present situation. From the argument provided in the statement of grounds of appeal, the Board does not recognize why that calculation should apply to the claimed range instead of the margin of errors disclosed in D27 and D17. That argument of the appellant therefore fails. The information provided in D27 and D17, provides no basis to conclude that example 1 of D5 takes away the novelty of claim 1 of the main request.

3.1.5 It was also argued in the case of examples 2c and 3c of D5 that the range of elongation at break of 150 to 600% as defined in claim 1 of the main request was unclear and that in view of D4a, that range encompassed values down to 0. As a result the value of 74 of the elongation at break disclosed in examples 2c and 3c of D5 fell within the claimed range. As discussed above under 1.2.2 and 1.2.3, insofar as a lack of reliability of the range claimed in the main request has been shown to exist by the appellant, the extent of that lack of accuracy cannot be inferred from the documents provided

and in particular D4a since the polypropylene polymer disclosed in that document is not a heterophasic olefin polymer composition according to claim 1 of the main request. The Board concludes that the documents provided do not show a lack of novelty of the claimed subject matter over D5.

3.2 D6, D7, D9, D10, D11

3.2.1 It was undisputed that none of Example 1 of D6, example 3 of D7, example 5 of D9, example 12 of D10, and in example 6 of D11 disclosed the value of the  $M_w/M_n$  ratio of the propylene polymer corresponding to component A) of claim 1 of the main request and that of the content of isotactic pentads (mmmm).

3.2.2 In particular, it was argued that the  $M_w/M_n$  ratio of the propylene polymer did not constitute a characterizing feature as it lacked clarity. The  $M_w/M_n$  ratio as defined by a numerical range is nonetheless a feature characterizing the molecular weight distribution of component A) in claim 1 of the main request. It is a parameter that is known to depend upon the specific conditions of polymerization and it is indicative of the viscoelastic properties of the polymer. Even if its definition lacked clarity because the boundaries of the numerical ranges defined in claim 1 were unclear, it is still a feature of the component that cannot simply be disregarded when assessing novelty of the claimed subject matter. It was alternatively alleged that since the Polydispersity Index value of the propylene polymers disclosed in D6, D7, D9, D10 and D11 was within the range of claim 1 of the main request, the  $M_w/M_n$  ratio also had to be within the claimed range. No evidence was however provided for that argument. The reference to the example 1 and

comparative examples of the patent in suit made by the appellant even contradicts that argument. The Polydispersity Index values of all the polymers produced in the examples of the patent in suit are within the claimed range of 4.5-6 (5.4 in example 1, 5.7 in comparative example 1 and 5.0 in comparative example 2). The  $M_w/M_n$  ratios reported for these polymers however (7.7 in example 1, 13.5 in comparative example 1 and 7.7 in comparative example 2) show that while the Polydispersity Index value of the polymer of comparative example 1 can be within the claimed range, its  $M_w/M_n$  ratio is not always. Also, the comparison of example 1 and comparative example 2 shows that while the Polydispersity Index value of the polymer is lower in comparative example 2 than it is in example 1, the polymers both have the exact same  $M_w/M_n$  ratio. It can therefore not be concluded from these examples that a propylene polymer similar to those disclosed in the patent in suit and having a Polydispersity Index value within the claimed range of 4.5 to 6 will necessarily have a  $M_w/M_n$  ratio within the claimed range of 6-9 as well. Since no value of the  $M_w/M_n$  ratio for the examples of D6, D7, D9, D10 and D11 can be established on the basis of the information provided, it cannot be concluded that these would fall within the claimed range, even when taking into account any ambiguity concerning the boundaries of the numerical range defined in claim 1 of the main request. As it was not shown that the propylene polymer disclosed in Example 1 of D6, example 3 of D7, example 5 of D9, example 12 of D10, or in example 6 of D11 had a  $M_w/M_n$  ratio within the claimed range, claim 1 of the main request is novel over the disclosures of D6, D7, D9, D10 and D11.

4. Inventive step

4.1 Closest prior art

4.1.1 The patent in suit concerns elastomeric polyolefin compositions (paragraph 1) that have a good balance of mechanical properties, such as high elongation at break and good impact resistance without a remarkable decrease in rigidity properties (paragraph 7), high elongation properties at a relatively low content of elastomeric polymer in the composition (paragraph 8) and high stiffness of the composition in spite of the fact that the composition exhibits high elongation at break values (paragraph 9).

4.1.2 In its contested decision, the opposition division, in consensus with the then opponent and patent proprietor, considered that D7, in particular example 3 thereof was the closest prior art. D7 is directed to providing a polypropylene composition having good transparency and improved impact properties. Specifically, D7 discloses a polymer composition obtained by sequential polymerization in the presence of a stereospecific Ziegler-Natta catalyst consisting essentially of (A) from 70 to 98 parts by weight of a crystalline propylene homopolymer, or a crystalline random copolymer of propylene with ethylene and/or C<sub>4</sub>-C<sub>10</sub> α-olefins, containing from 0.5 to 10% by weight of ethylene and/or α-olefins (fraction (A)); and (B) from 2 to 30 parts by weight of elastomeric copolymer of ethylene with one or more C<sub>4</sub>-C<sub>10</sub> α-olefins, containing from 60 to 85% by weight of ethylene and partially soluble in xylene at 25°C. (fraction (B)); wherein said composition has an intrinsic viscosity value in tetrahydronaphthalene at 135°C of the fraction soluble in xylene at 25°C ranging from 0.8 to 1.1 dl/g,

and said composition has a ductile/brittle transition temperature of  $-50^{\circ}$  to  $-26^{\circ}\text{C}$  (claim 1). The compositions according to D7 are therefore not only close to the compositions claimed in the main request, they are also obtained via a similar preparation process. Also, according to D7, the polypropylene compositions have an optimum balance of transparency, stiffness and impact resistance even at low temperatures (column 2, lines 15 to 17).

The appellant submitted in the statement of grounds of appeal as well as at the oral proceedings before the Board that D10 or D11 could also be considered as closest prior art. Both D10 and D11 concern olefin polymer compositions that are close to that of D7. The compositions of D10 and D11 are also stated to provide a good balance of mechanical properties. The Board finds that D10 and D11 are less relevant than D7 since they do not disclose the Polydispersity Index value of the propylene polymer of the composition. It was also not shown by the appellant why D10 or D11 would be more relevant than D7 as closest prior art.

#### 4.2 Technical problem

4.2.1 In its decision, the opposition division considered that it had not been shown that an improvement had been achieved over the composition disclosed in example 3 of D7. The technical problem was therefore the provision of further polypropylene impact compositions having among others a good balance of elongation at break and Izod impact properties. Since that formulation of the technical problem was not disputed between the parties at the oral proceedings before the Board, the Board sees no reason to depart therefrom.

#### 4.3 Obviousness

- 4.3.1 The question to be answered is whether the skilled person would have expected the compositions according to claim 1 with a component A) having a  $M_w/M_n$  ratio of between 6 and 9 to solve the problem posed.
- 4.3.2 D7 does not disclose the values of the  $M_w/M_n$  ratio of the polypropylene component of its compositions so that D7 does not suggest how the balance of mechanical properties of the composition, and in particular the balance between the elongation at break and Izod impact properties could be affected by the  $M_w/M_n$  ratio. The patent in suit discloses compositions in Table 2, the properties of which are disclosed in Table 3. The compositions of example 1 and comparative example 1 in particular are compositions produced by a similar process apart from an additional molecular weight broadening step in an additional 2nd reactor in the case of comparative example 1 (Table 1). According to Table 2, the compositions of example 1 and comparative example 1 only differ in their  $M_w/M_n$  ratio as measured by the same method. While the  $M_w/M_n$  ratio of example 1 (7.7) is within the claimed range of 6 to 9, that of comparative example 1 (13.5) is well outside the claimed range, even taking into account the extended range of up to 10.8 due to lack of clarity (see points 3.1.3 and 3.1.4 above). The values of elongation at break and Izod impact strength at 0°C and 23°C are reported in Table 3. The values reported for the Izod impact strength at 0°C and 23°C for both compositions of example 1 and comparative example 1 are within the claimed range. However, while the value of the elongation at break of the composition of example 1 (378%) is within the claimed range of 150 to 600, that of comparative example 1 (82%) is well below the

claimed range. As a result, the patent in suit shows that not all molecular weight distributions or  $M_w/M_n$  ratios affect the balance of mechanical properties of the prepared composition in the same way. Thus, for values of the  $M_w/M_n$  ratio outside the claimed range, the patent in suit shows that the balance of properties is lost as compared to when it is between 6 and 9, as measured by the method of the patent in suit.

4.3.3 None of the cited documents suggests that the balance of properties between elongation at break and Izod impact strength could be adjusted or optimised by maintaining a specific range of molecular weight distribution or  $M_w/M_n$  ratio (6 to 9). In particular D18 and D22 were cited by the appellant.

4.3.4 D18 pertains to polypropylene polymers obtained by selection of a catalyst system based on  $MgCl_2/TiCl_4$  and that display improved performances in terms of activity, stereoselectivity and capability to control both molecular parameters and morphology of the resulting polymers (page 196, last paragraph). Table 1 of D18 discloses the general performances of different catalysts depending on their electron donor classes. It discloses that polypropylenes having different sets of characteristics and in particular different content of isotactic pentads and  $M_w/M_n$  ratio, some of these being within the claimed ranges and others being outside the claimed ranges can be obtained by selecting the catalyst. There is no disclosure of a composition comprising the components A) and B) as claimed and there is no suggestion of the influence of the  $M_w/M_n$  ratio on the balance of properties. That part of D18 merely shows that polypropylenes having a content of isotactic pentads and a  $M_w/M_n$  ratio as claimed in the main request existed in the prior art. D18 can

therefore not render the solution of the technical problem provided by the operative claims obvious.

- 4.3.5 D22 relates to crystalline propylene polymers having a high level of chain stereoregularity, in particular a high content of isotactic pentads, improved processability in the molten state and the process for preparation thereof (page 1, first paragraph). D22 discloses propylene polymers having the following features:
- 1) a content of isotactic pentads (mmmm), measured by NMR, higher than 97%;
  - 2) a molecular weight distribution, expressed by the ratio of weight average molecular weight to number average molecular weight equal to or higher than 6; and
  - 3) a value of ratio of z average molecular weight to weight average molecular weight ( $M_z/M_n$ ) equal to or lower than 5.5 (claim 1). D22 pertains to a propylene polymer that is analogous to component A) of claim 1 of the main request. It does not disclose olefin polymer compositions comprising both components A) and B) as claimed. Several compositions are disclosed in the examples of D22. Example 3 of D22 discloses a polypropylene that has a content of isotactic pentads of more than 98%, a Polydispersity Index value of 4.9 and a  $M_w/M_n$  ratio of 8.7. That composition corresponds to component A) of claim 1 of the main request. There is no disclosure of a composition comprising the components A) and B) according to claim 1 and there is no teaching that controlling the  $M_w/M_n$  ratio would permit a good balance of mechanical properties and in particular the balance between elongation at break and Izod impact strength to be obtained
- 4.3.6 In the statement of grounds of appeal, the appellant invoked D5 as evidence of the properties of crystalline



polypropylenes that would be routinely produced with the catalyst of example 3 of D7, and specifically that such polymers would fall within the "broad ranges" of claim 1. In particular, examples 2c and 3c of D5 were cited as demonstrating that crystalline polypropylene having a Polydispersity Index value, isotactic pentad content and  $M_w/M_n$  ratio according to claim 1 were known in the art. In view of the conclusion reached on the novelty of claim 1 with respect to the disclosure of examples 2c and 3c of D5 this argument is shown to be incorrect, notwithstanding that D5 is a document comprised in the state of the art according to Article 54(3) EPC with the consequence that its content in any case cannot be cited for the assessment of inventive step. D5 was not cited by the appellant as a combination document for inventive step at the oral proceedings before the Board however the written argument based thereon was not withdrawn and consequently has been addressed in the present decision.

- 4.3.7 D12 and D13 were also briefly mentioned by the appellant in his statement of grounds of appeal (page 28) in view of inventive step.
- 4.3.8 D12 discloses a propylene-ethylene block copolymer composition having sufficient stiffness and mechanical strength required for the automobile exterior parts can be produced at low cost since no additional steps for blending other rubber components are required (column 1, lines 7-15). D12 was cited to show that when the stereoregularity index (mmmm) fraction of the polypropylene falls below 98.9%, the stiffness and, in particular, the flexural modulus properties were compromised (see column 2, lines 47 to 62). D12 however does not teach the  $M_w/M_n$  ratio and it does not teach

its influence on the balance of properties considered in the patent in suit. D12 is therefore not relevant to the question posed.

4.3.9 D13 relates to a propylene-ethylene block copolymer displaying well balanced rigidity and low-temperature barrier resistance (column 1, line 14) and having a melt flow rate (MFR), measured at a temperature of 230°C and under a load of 2.16 kgf (21.2 N), of from 0.01 to 1.0 g/10 min, and comprised of (A) from 85 to 97% by weight a 25°C xylene-insoluble fraction and (B) from 3 to 15% by weight of a 25°C xylene-soluble fraction, wherein the fraction (A) is characterized in that (a-1) its stereospecificity index [mmmm] measured through isotopic carbon nuclear magnetic resonance (<sup>13</sup>C-NMR) is at least 98.0%, (a-2) its intrinsic viscosity [η] measured in tetralin at 135°C falls between 2.5 and 5.5 dl/g, and (a-3) its weight-average molecular weight, M<sub>w</sub>, measured through gel permeation chromatography (GPC), and the content, S (% by weight), of the fraction having a molecular weight of at most 10<sup>4.5</sup> therein satisfy the following formula (I)  $S \leq -5.3 \times 10^{-6} M_w + 7.58$  (I) where M<sub>w</sub> indicates the weight-average molecular weight of the fraction (A), and the fraction (B) is characterized in that (b-1) its ethylene unit content measured through <sup>13</sup>C-NMR falls between 30 and 70% by weight, and (b-2) its intrinsic viscosity [η] measured in tetralin at 135°C falls between 2.5 and 9.0 dl/g (claim 1).

4.3.10 Since the propylene-ethylene block copolymers of D13 differ from those of the patent in suit by the amounts in xylene insoluble component A (85 to 97% by weight in D13; 60-85% in claim 1 of the patent in suit) and xylene soluble component B (3 to 15% by weight in D13; 15 to 40% in the patent in suit), the question arises

whether the teachings of D13 can be relevant to the claimed subject matter. D13 does disclose in column 5, lines 9-12 that the  $M_w/M_n$  ratio of the xylene insoluble component A is between 2 to 10 and preferably 3 to 8. D13 does however not hint at the range claimed in the patent in suit (6 to 9) and it does not suggest that that range is the solution of providing a good balance of elongation at break and Izod impact properties. The examples provided in D13 disclose five propylene-ethylene block copolymers all having amounts in component A (87.2% and 90.1% by weight) and component B (9.9% and 12.8% by weight) that are outside the ranges of the patent in suit (Tables 2-1 and 2-2 of D13). Also, since the  $M_w/M_n$  ratio of the component A disclosed in these examples is only comprised between 3.9 and 5.3, the teaching of D13 relating to the  $M_w/M_n$  ratio is to use lower values of  $M_w/M_n$  ratio than in the patent in suit. It can therefore not be concluded that D13 hints at a  $M_w/M_n$  ratio of between 6 and 9. The combination of D7 and D13 does not render the claimed subject matter obvious.

- 4.3.11 It is concluded that the claimed subject matter involves an inventive step. The main request satisfies the requirements of Article 56 EPC.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:



P. Martorana

M. C. Gordon

Decision electronically authenticated