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**Datasheet for the decision
of 12 November 2008**

Case Number: T 1305/06 - 3.3.03

Application Number: 99913213.7

Publication Number: 0980396

IPC: C08F 10/08

Language of the proceedings: EN

Title of invention:

Polybutene-1 (co)polymers and process for their preparation

Patentee:

Basell Poliolefine Italia S.r.l.

Opponent:

Mitsui Chemicals Inc.

Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 54, 56
RPBA Art. 13

Relevant legal provisions (EPC 1973):

-

Keyword:

"Amendments - added subject-matter (no)"
"Novelty (yes)"
"Inventive step (yes)"
"New inventive step attack advanced for the first time at oral proceedings based on new closest prior art (not admitted)"

Decisions cited:

T 0119/82, T 0002/83

Catchword:

See paragraph 5.5



Case Number: T 1305/06 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 12 November 2008

Appellant: Mitsui Chemicals Inc.
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office dated
10 May 2006 and posted 13 June 2006 concerning
maintenance of European patent No. 0980396 in
amended form.

Composition of the Board:

Chairman: R. Young
Members: W. Sieber
E. Dufrasne

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 980 396, in respect of European patent application No. 99913213.7, based on International application PCT/EP99/01354, in the name of Basell Poliolefine Italia S.p.A. (now Basell Poliolefine Italia S.r.l.), filed on 2 March 1999 and claiming priority from EP 98200674.4 (5 March 1998), was published on 20 August 2003 (Bulletin 2003/34). The granted patent contained 27 claims, whereby Claims 1-3 and 12 read as follows:

"1. Polybutene-1 homopolymers, or copolymers containing up to 20% by weight of alpha olefins having from 2 to 10 carbon atoms other than butene-1, characterized by the following properties:

- (i) an isotactic index (mmmm%), measured by NMR analysis according to the method specified, of higher than 94;
- (ii) a Molecular Weight Distribution (MWD) in terms of Mw/Mn, measured by GPC analysis according to the method specified, of higher than 6; and
- (iii) a content of catalytic residues expressed in terms of Ti ppm of lower than 50.

2. Polybutene-1 homopolymers according to claim 1 having an isotactic index higher than 95.

3. Polybutene-1 homopolymers according to claim 1 having a MWD higher than 7.

12. Polybutene-1 homo or copolymers according to claim 11 containing from 1 to 10% by weight of propylene."

- II. A notice of opposition was filed by Mitsui Chemicals Inc. on 19 May 2004 requesting revocation of the patent in its entirety on the grounds that the claimed subject-matter was neither novel nor inventive and that the subject-matter of granted Claim 12 extended beyond the content of the application as filed (Article 100(a) and (c) EPC).

The following documents were - *inter alia* - cited during the opposition procedure:

D1: EP 0 476 660 A2;

D2: JP 09 302038 A

D2a: English translation of D2; and

D3: Experimental Report of Mr Shin Tokui.

- III. At the oral proceedings of 10 May 2006 before the opposition division, the proprietor filed a new main request (Claims 1 to 24), whereby Claims 1, 2 and 10 of the main request read as follows:

"1. Polybutene-1 homopolymers, or copolymers containing up to 20% by weight of alpha olefins having from 2 to 10 carbon atoms other than butene-1, characterized by the following properties:

- an isotactic index (mmmm%), measured by NMR analysis according to the method specified, of higher than 95;
- a Molecular Weight Distribution (MWD) in terms of Mw/Mn, measured by GPC analysis according to the method specified, of higher than 6; and
- a content of catalytic residues expressed in terms of Ti ppm of lower than 50.

2. Polybutene-1 homo or copolymers according to claim 1 having a MWD higher than 7.

10. Polybutene-1 homo or copolymers according to claim 9 containing from 1 to 10% by weight of polypropylene."

IV. By an interlocutory decision which was announced orally on 10 May 2006 and issued in writing on 13 June 2006, the opposition division decided that the claims of the main request met the requirements of the EPC.

- (a) Amended Claim 10 (replacement of the term "propylene" by "polypropylene") overcame the objection raised under Article 100(c) EPC against Claim 12 as granted.
- (b) The opponent had repeated Example 7 of D1 and Example 3 of D2 (experimental report D3) in order to demonstrate that the blends disclosed therein had all the parameters required in Claim 1. However, the opposition division found that the subject-matter of Claim 1 was novel over the cited prior art, in particular the polymer blends disclosed in the above mentioned examples.

As regards the blend of Example 7 of D1 comprising the polymers PB-C and PB-D, the opposition division held that the theoretical calculations presented by the proprietor in view of polymers PB-C and PB-D were able to cast doubts on the opponent's experiments. Further, the proprietor had presented theoretical considerations on the amount of catalyst residue in the polymer blends prepared according to Examples 6 and 7 of D1 according to which the experimentally determined value reported by the opponent could not be correct. This argumentation again raised doubts on the opponent's experiments.

As regards the polymer composition of Example 3 of D2, the opponent had measured an isotactic index of 95.1 mmmm% whereas the proprietor which had also reworked this example had measured 93.8 mmmm%. Considering furthermore the error margins associated with the measurement of the isotactic index, it appeared that the repetition of Example 3 of D2 might lead to values for the isotactic index which were above 95% or below 95%. Thus, doubts remained as to whether this example was novelty destroying.

In summary, the benefit of doubt was given to the proprietor and novelty of the claimed subject-matter was acknowledged.

- (c) As regards inventive step, Example 3 of D2 was considered to represent the closest state of the art. The only distinguishing feature between the

subject-matter of Claim 1 and the composition disclosed in Example 3 of D2 was considered to be the isotactic index, which should be above 95 mmmm%. Since there was no evidence on file for any technical effect resulting from raising the isotactic index from 93.8 mmmm% to above 95 mmmm%, the objective technical problem had to be seen in the provision of an alternative polymer to the composition disclosed in Example 3 of D2. This problem had been solved by increasing the isotactic index. According to the opposition division, the solution was not obvious from the prior art, in particular as the prior art did not teach or suggest how the isotactic index could be increased from 93.8 mmmm% to above 95 mmmm%.

V. On 4 August 2006, the appellant (opponent) lodged an appeal against the decision of the opposition division with simultaneous payment of the prescribed fee. Together with the statement of grounds of appeal, the appellant filed on 20 October 2006 the following further documents:

D15: *N. Kashiwa et al.*, "Polymerization of butene-1 with highly active MgCl₂-supported TiCl₄ catalyst system", *Polymer*, 1987, vol. 28, pages 1227-1231; and

D16: Further experimental data relating to the reworking of Example 7 of D1 and Example 3 of D2.

The arguments of the appellant may be summarized as follows:

- (a) In view of the opposition division's finding that the theoretical calculation presented by the proprietor with respect to polymers PB-C and PB-D used in Example 7 of D1 were able to cast doubts on the opponent's experiments, the isotactic indices of PB-C and PB-D prepared according to reference examples C and D of D1 had been determined experimentally in accordance with the method indicated in the patent in suit. As a result, the experimentally determined isotactic index (mmmm%) of PB-C was 94.8 and that of PB-D was 95.6. These values gave a calculated isotactic index of 95.04 for the polymer blend according to Example 7 of D1, which was well in agreement with the experimentally determined value (95.2, D3).

As regards the catalyst residue in the polymer blend of Example 7 of D1, the opponent had experimentally determined a value lower than 5 ppm, whereas the proprietor had calculated from the polymerization activity reported in Reference Example A of D1 a catalyst residue of 6.3 ppm in terms of titanium. However, it should be kept in mind that Claim 1 was directed to a polybutene-1 resin composition having a catalyst residue of less than 50 ppm in terms of titanium. Thus, even if the catalyst residue of the polymer blend containing polymers PB-C and PB-D was slightly above 5 ppm, this would not challenge the fact that polybutene-1 resin composition of D1 was pertinent to novelty of Claim 1.

- (b) As could be seen from experimental report D3, the polymer composition prepared according to

Example 3 of D2 had an isotactic index (mmmm%) of 95.1, a molecular weight distribution of 8.3 and a catalyst residue of less than 5 ppm. According to the opposition division, the repetition of Example 3 of D2 might lead to values of the isotactic index of above 95 mmmm% or below 95 mmmm% having regard to the accepted error margin of 0.5 mmmm%. However the error margins associated with a measuring method had to be applied also to the parameter values indicated in the claims. The value of 95.1 mmmm% measured by the appellant was well within the error margin of 0.5 mmmm% as accepted by the proprietor for the NMR experiments and, as a result, took away novelty of the range of 95 mmmm% and above.

- (c) Even if the measurements presented by the appellant were disregarded and the experimental data presented by the proprietor for the polymer composition according to Example 3 of D2 were taken as granted, according to which the polymer composition had an isotactic index of 93.8 mmmm% and a molecular weight distribution of 7.9, the claimed subject-matter lacked an inventive step.

The only distinguishing feature between the subject-matter of Claim 1 as maintained by the opposition division and Example 3 of D2 was the isotactic index, which had to be 95 mmmm% and above. Since there was no evidence on file for any technical effect resulting from raising the isotactic index from 93.8 mmmm% to above 95 mmmm%, the objective technical problem solved by the polymer composition as defined in Claim 1 was to

provide an alternative polymer in view of the composition as disclosed in example 3 of D2.

According to D1, the isotactic value of a polybutene resin was preferably 93 to 98% in view of superior rigidity, heat resistance and creep resistance. Furthermore, the skilled person knew at the filing date of the opposed patent that the isotacticity of a polybutene-1 composition could be increased by using an increased amount of electron donor in the polymerization. This was demonstrated by D15, showing that the isotactic index (II), expressed by the weight fraction of the C₁₀-insoluble poly(butene-1), increased with increasing ethylbenzoate (EB) or tetramethylpiperidine (TMP)/Ti molar ratio. Thus, the skilled person had been motivated to increase the isotactic index of a polybutene-1 composition and, furthermore, he also knew how to provide a polybutene composition having an increased isotacticity. Furthermore, the experimental data provided with the statement of grounds of appeal demonstrated that, contrary to the proprietor's allegation, using the specific electron donor diisopropyldimethoxysilane was not required to prepare a polybutene composition having an isotactic index of 95 mmmm% or above. In summary, the skilled person starting from the polymer composition of Example 3 of D2 had been motivated and, furthermore, clearly had the means to prepare a polybutene-1 composition having an isotactic index of higher than 95 mmmm%.

- (d) The appellant also raised an inventive step objection against Claim 16 of the main request as maintained by the opposition division ("Process for the preparation of the polybutene-1 homo or copolymers according to any of claims 1-14 carried out in the presence of").

VI. Together with its reply dated 14 May 2007, the respondent (proprietor) filed the following document:

D17: technical report relating to the repetition of Example 7 of D1 as well as the thermal and mechanical characterization of the polymer composition prepared according to Example 3 of D2.

The arguments may be summarized as follows:

- (a) The data provided by the appellant in D3 with respect to polymers PB-C and PB-D used in Example 7 of D1 even further highlighted the general unreliability of the experimental data generated by the appellant. Firstly, the isotactic index values (mmmm%) determined for PB-C and PB-D were in total disagreement with those calculated on the basis of the measured values for the blends of Examples 6 and 7 of D1. Secondly, it was technically impossible that the blend of Example 6 had an isotactic index of 94.4 mmmm% (as measured by the appellant in D3) when PB-C had an isotactic index of 94.8 mmmm% and PB-D an isotactic index of 95.6 mmmm% (both measured by the appellant in D16), because such value was lower than the lowest value of the components of the blend.

Apart from that, the respondent had also repeated the preparation of the composition according to Example 7 of D1 and measured an isotactic pentad content (mmmm%) of 93.6.

Under these circumstances, the content of the catalyst residue was not decisive for the finding on novelty.

- (b) As regards Example 3 of D2, the respondent pointed out that it had repeated this example and measured the pentad content with the same instrument and same methodology described in the patent in suit and had gotten a value (93.8 mmmm%) which, even considering the error margin associated with the instrument and technique ($93.8+0.5=94.3$) did not arrive at the lowest limit indicated in Claim 1 even considering the error associated therewith ($95-0.5=94.5$). Accordingly, also the repeat of Example 3 of D2 did not clearly and unambiguously disclose the claimed subject-matter.
- (c) Example 3 of D2 had been considered as the closest prior art. The results of the characterization for the polymer therein described showed a M_w/M_n over 6, a content of catalyst residues lower than 50 ppm of Ti and an isotactic index of 93.8% expressed as isotactic pentads content. In order to demonstrate that an increased isotacticity index led to superior mechanical properties, the respondent characterized the polymer blend obtained by reproducing Example 3 of D2 by determining the melting temperature (T_{m1}) and the mechanical properties of the blend and the deriving pipe

according to the methods disclosed in the patent in suit, namely flexural modulus, tensile modulus and 1000 hrs burst stress. The characterization in terms of the mechanical properties demonstrated an unsatisfactory level of properties that was by far lower than that of either of Example 1 or 2 of the patent in suit. It was therefore clear that a technical effect due to increasing of isotacticity was present. Moreover, D2 did not teach to increase isotacticity in terms of pentad content in order to improve mechanical properties of the polymers and of the pipes. Even less was said about the combination of molecular weight distribution (MWD) and isotacticity, because according to D2 the preferred MWD could be indifferently lower or higher than 6. Hence, D2 failed to teach the claimed polybutenes having both broad MWD and isotactic pentads higher than 95 mmmm% as key-features for obtaining pipes with high burst stress resistance.

VII. In a letter dated 6 September 2007, the appellant argued that a comparison of the mechanical properties of the resin prepared following Example 3 of D2 and the resins of Examples 1 and 2 of the patent in suit did in no way allow to correlate an increase in isotactic index with an improvement in mechanical properties. For such a correlation, it would be necessary to compare the mechanical properties of two resins which were identical with respect to all other properties except their isotactic indices.

Further, the appellant reiterated that the skilled person starting from Example 3 of D2 had been motivated

and able to prepare a polybutene-1 resin having an increased isotactic index of 95 mmmm%.

VIII. In a communication dated 29 August 2008, the board raised *inter alia* a question concerning the basis for dependent Claims 2 and 4-9 of the claim set maintained by the opposition division and drew attention to the diverging results obtained by the parties repeating the prior art.

IX. In a letter dated 2 October 2008, the appellant stated that the different NMR instruments used by the parties could not be the reason for the different isotactic values (mmmm%). It was submitted that the appellant's measurements took the uncertainty of the baseline position into account and also showed that each pentad was correctly assigned in the measured spectra. On the other hand, the respondent only had indicated the calculated results and had failed to submit any measured spectra. In the proceedings before the opposition division the respondent had argued that the spectrometer as used automatically adjusted the baseline. However, there was no evidence that the automatically adjusted baseline was the only and exact one. Further, it was not clear whether the respondent correctly assigned the signals to the relevant pentads so that the isotactic index values as submitted by the respondent could not be considered as being reliable.

Finally, the appellant summarized its previously submitted inventive step objection, starting from Example 3 of D2 as the closest prior art.

X. With a letter dated 10 October 2008, the respondent filed a new main request and first to third auxiliary requests. Apart from an editorial amendment in Claim 1 (reintroduction of the numbering (i)-(iii) for the properties isotactic index, MWD and content of catalytic residue) and a clarifying amendment in Claims 7 and 8 (re-introduction of "melt index (ASTM D 1238 condition "E")" for the term "MIE"), the claims of the new main request were identical with the claims which had been considered allowable by the opposition division (point III, above). The auxiliary requests are not relevant to this decision and will not be discussed in further detail.

The respondent also submitted the following further documents:

D18: Declaration of Dr Fabrizio Piemontesi dated 10 October 2008;

D19: NMR spectra: Figures 1 to 4; and

D20: Experimental Report (characterization of a comparison example).

D18 was filed to clarify aspects concerning the theoretical calculations, and D19 to demonstrate the very high accuracy of the respondent's NMR measurements. Since the comparison of Example 3 of D2 with Examples 1 and 2 of the patent in suit had been criticized, the respondent submitted a further comparative example (D20), namely a variant of the closest prior art prepared according to the conditions of Example 2 of the patent in suit. A comparison of

that variant with Example 2 of the patent in suit showed that the complex of mechanical properties of the variant was by far lower than that of Example 2 of the patent in suit. It was therefore clear that a technical effect due to increasing the isotacticity was present. This was neither taught by D2 nor by D1.

XI. On 12 November 2008, oral proceedings were held before the board.

- (a) The respondent confirmed that the claim sets filed with the letter dated 10 October 2008 formed the basis for its requests.
- (b) The appellant maintained its objection that the combination of features as claimed in dependent Claims 2 and 4-8 had no basis in the application as filed. Also the examples of the patent in suit were not suitable to support the subject-matter of Claims 2 and 4-8. This would be a not allowable intermediate generalization.
- (c) The appellant requested that the respondent's submissions D18 and D20 not be admitted into the proceedings for consideration, since they were filed so late that it had had no time to verify the experimental data in these documents and to conduct alternative counter experiments. In this context, reference was made to T 569/02.
- (d) As regards novelty, the appellant argued that the reliability and consistency of its reproduction of the prior art, ie Example 7 of D1 and Example 3 of D2, was higher than the respondent's experiments

in this context. In order to show that its experimental results were not flawed by theoretical calculations when the error margins were taken into account, the respondent filed a calculation (D21) based on Example 6 of D1 and a table (D22) summarizing experimental and calculated pentads for PP1 and PP3 originating from D18.

The respondent argued that its data relating to the reproduction of the prior art were more reliable than those of the appellant. For example, the integration procedure adopted by the appellant deviated from what was considered by the respondent as best practice. In particular, the integration did not cover all the pentad peaks which led to a more favourable result for the appellant. In this context, the respondent filed the scientific article mentioned in paragraph [0027] of the patent in suit (D23):
T. Asakura et al., "Carbon-13 NMR Spectral Assignment of Five Polyolefins determined from the Chemical Shift Calculation and the Polymerization Mechanism", *Macromolecules* 1991, 24, pages 2334-2340), a magnified version of part of Figure 1 of the above article (D24) and an NMR spectrum with annotation (D25).

- (e) As regards the assessment of inventive step, the appellant considered both D1 and D2 as possible starting points. The only difference over the closest prior art, namely the isotactic index, did not provide a technical effect so that the objective technical problem had to be seen in the

provision of an alternative to the closest prior art. It was, however, obvious from D1, in particular Table 1, that an increase of the isotacticity would also increase the mechanical properties, in particular pressure resistance.

- (f) When asked with reference to Article 13 of the Rules of Procedure of the Boards of Appeal, why it had started for the first time at the oral proceedings from D1 as closest prior art, the appellant argued that D1 had been mentioned in the notice of opposition and that it was totally clear to all that D1 and D2 were equally relevant as closest prior art. The respondent, on the other hand, pointed out that all the comparisons in appeal had been provided over D2 because this was the only document mentioned. It had been impossible for the respondent to anticipate all possible attacks and to provide comparative tests over other documents, in particular D1, in its defence.

XII. The appellant requested that the decision under appeal be set aside and the patent be revoked.

The respondent requested that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the main request, or, in the alternative, on the basis of one of the first to third auxiliary requests, all requests filed with the letter dated 10 October 2008.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments (main request)*
 - 2.1 Apart from a clerical amendment in Claim 1 (re-introduction of the numbering (i)-(iii)) and an amendment in Claims 7 and 8 (re-introduction of "melt index (ASTM D 1238 condition "E")" for the term "MIE"), the claims of the main request are identical with the claims which have been considered allowable by the opposition division.
 - 2.2 In Claim 1 of the main request the isotactic index (mmmm%) has been amended, compared to Claim 1 of the patent as granted, to higher than 95. This amendment finds its basis in granted Claim 2 which corresponds to Claim 3 as filed. Thus, Claim 1 of the main request meets the requirements of Article 123(2) EPC.
 - 2.3 However, in the course of the appeal procedure, the question arose as to whether or not the amendment to Claim 1 might have induced an objection under Article 123(2) EPC against dependent Claims 2 and 4-9 of the main request.

For example, dependent Claim 2 of the main request specifies that the polybutene-1 homo or copolymers have a molecular weight distribution (MWD) of higher than 7. Due to the back reference to Claim 1 (which now requires an isotactic index (mmmm%) of higher than 95), dependent Claim 2 creates the combination of an isotactic index (mmmm%) of higher than 95 and a MWD of

higher than 7. Such a combination is not supported by the original claim structure. Claim 4 as filed ("Polybutene-1 homo or copolymers according to claim 1 having a MWD higher than 7.") refers back to Claim 1 as filed which only discloses an isotactic index (mmmm%) of higher than 93. Nor has the combination of a MWD of higher than 7 and an isotactic index of higher than 95 an explicit basis in the description of the application as filed.

Similar considerations apply to Claims 4-6 (specific comonomers and content thereof), Claims 7-8 (specific melt indices) and Claim 9 (presence of polypropylene).

2.4 Thus, the decisive question is as to whether or not the application as a whole supports the subject-matter claimed in Claims 2 and 4-9 of the main request.

2.4.1 By examining the description of the application as filed the following statement can be found at page 2, lines 21-24:

"Preferably, the copolymers of the present invention have an isotactic index higher than 94 and more preferably higher than 95. Moreover, polybutene-1 (co)polymers having a MWD higher than 7 and more preferably higher than 9 are highly preferred since it has been observed that the (co)polymers coupling very high cristallinity and very broad MWD have better mechanical properties."

This paragraph clearly discloses (co)polymers having isotactic index higher than 94 or higher than 95 in combination with MWD higher than 7 or higher than 9.

This is evident from the first word of the second sentence, namely "*moreover*", and from the explicit reference to "*coupling*" very high cristallinity and very broad MWD. The fact that a (co)polymer with isotactic index higher than 95 and a MWD higher than 7 is clearly and unambiguously derivable from the above mentioned passage is further corroborated by Example 2 which discloses a polybutene resin having a MWD of 8, ie higher than 7, in combination with an isotactic index of 95.4, ie higher than 95. Thus, the board agrees with the respondent that the subject-matter of Claim 2 of the main request is clearly and unambiguously derivable from the application as filed.

- 2.4.2 The same is true for Claims 4-6 which specify the type and content of additional α -olefins in the (co)polymers having isotactic index higher than 95%. These claims find support in first full paragraph of page 3 of the application as filed where it is stated that "... also copolymers of butene-1 containing up to 20% by weight of α -olefins, provided that they fulfill [*sic*] the above conditions, are within the scope of the present invention". Clearly, the wording "*fulfill [sic] the above conditions*" refers to the previous sentences where isotactic index higher than 93, 94 or 95 is specifically disclosed. Thus, it is clearly and unambiguously derivable from the application as filed that copolymers with isotactic index higher than 93% or 94 or 95% and also containing up to 20% by weight of α -olefins were contemplated. This is further demonstrated by the last sentence of the above mentioned paragraph specifying that "the copolymers of the present invention preferably contain from 2 to 15% by weight of such olefins and more preferably from 5 to 10% by

weight." The sentence has clearly a broad applicability (the copolymers of the invention) and it would not be justified to read it as limited to only a certain group of (co)polymers.

2.4.3 The situation is not different with respect to dependent Claims 7 and 8 of the main request. These claims find support at page 3, lines 7-11 of the application as filed where it is said that "the (co)polymers have a Mw such that the Melt Index "E" is comprised in the range of from 100 to 0.01, more preferably from 10 to 0.1. In particular, when the polymers are used in the extrusion devices for the manufacture of pipes, polymers having a Melt Index in the range of from 1 to 0.1 and particularly from 0.3 to 0.5 are preferred". There is nothing in these statements that indicates that the above ranges should be combined only with a certain value of isotacticity. The statement broadly refers to the (co)polymers and therefore it is perfectly clear to the skilled reader that this feature can be combined with the preferred range of isotacticity. This is further supported by Examples 1 and 2 in the application as filed which disclose polybutene polymers having respectively a melt index of 0.48 and 0.35 in combination with an isotacticity index of 95.1 and 95.4, ie above 95.

2.4.4 Similar considerations apply to dependent Claim 9. Page 8, line 17 to page 9, line 2 of the application as filed refers to pre-polymerization and the amount of propylene pre-polymer in the method for preparing the polybutene-1 homo- or copolymers identified as the final polybutene-1 product. It is clear that such pre-polymerization and final amount of prepolymer is of

broad applicability and intended to be combined with any of the preferred characteristics in terms of MWD and isotacticity as demonstrated by Example 1 of the present invention which discloses a final polybutene-1 product having an isotactic index of 95.1, a MWD of 10.3, a melt index of 0.48 g/10 min and a polypropylene content of 5 wt.-%. Accordingly, also in this case the claimed subject matter is clearly and unambiguously derivable from the application as filed.

2.4.5 In view of the above detailed analysis regarding the basis for the subject-matter of Claims 2 and 4-9 it is evident that the appellant's criticism advanced at the oral proceedings that the examples of the application as filed were used to create an intermediate generalization is not justified. The examples of the application as filed merely support the conclusions a skilled reader would derive from the relevant general statements in the application as filed. This does not amount to a generalization of specific examples.

2.4.6 Summing up, the subject-matter of dependent Claims 2 and 4-9 of the main request is clearly and unambiguously derivable from the application as filed and does therefore not introduce any new matter in the sense of Article 123(2) EPC.

3. *Late filed document D18*

The appellant contended that D18 was late filed and requested that its admission to the proceedings be refused, because the data in that document were given without any experimental protocol so that it was impossible for the appellant to verify these data.

However, as pointed out by the respondent, D18 was filed in reaction to the board's communication so that both the board and the other party could have been reasonably expected to deal with the issue. Further D18 was only relied upon as a witness document to demonstrate that the "additive rule" employed in the respondent's theoretical calculations relating to the blends in Example 7 of D1 and Example 3 of D2 did apply. D18 demonstrated a general principle and it was not necessary to exactly repeat the respondent's data. If intended, that general principle could have been challenged with any other data and/or experiment. There was no need to actually repeat the respondent's experiments. Thus, the board rejected the appellant's request and admitted D18 in its entirety into the proceedings.

4. *Novelty (main request)*

4.1 The appellant was of the opinion that the polymer blends disclosed by Example 7 of D1 and by Example 3 of D2 anticipated the polybutene-1 homo- or copolymer as defined in Claim 1 of the main request.

4.2 D1 and D2 disclose blends containing two different butene-1 polymers whereas Claim 1 of the main request is directed to polybutene-1 homo- or copolymers. However, this difference in terminology does not amount to a difference in substance. As stated in paragraph [0025] of the patent specification, one method for obtaining the broad molecular weight distribution required for the polybutenes of Claim 1 is that of blending butene-1 polymers having different

enough molecular weights using conventional mixing apparatus. Thus, as already pointed out by the appellant in its notice of opposition, the term "polybutene-1 homopolymers, or copolymers" in Claim 1 of the main request clearly encompasses polybutene-1 blends of different butene-1 homo- and/or copolymers and/or further polymers such as eg polypropylene.

- 4.3 D1 relates to a polybutene-1 resin composition which has excellent rigidity, creep characteristics and impact resistant strength, and at the same time is excellent in mouldability, particularly mouldability at high moulding speed. This is accomplished by melt-mixing two polybutene-1 resins having different melt flow rates (MFR) (Claims 1 and 12).

According to Example 7 of D1, a polybutene-1 resin composition was prepared by compounding 70 weight% of a butene-1 homopolymer (PB-C) and 30 weight% of a butene-1 homopolymer (PC-D). The resulting blend had a MFR of 0.5 g/10 min and an isotactic value of 97%, determined as weight% of the n-decane insoluble part of the whole resin (Table 1). The parameters required in Claim 1 of the main request, namely the isotactic index (mmmm%), the MWD and the content of catalytic residues, are not disclosed in D1.

- 4.4 D2 relates to butene-propylene copolymers capable of giving formed articles, in particular pipes (Claim 10 of D2a), excellent in pressure resistance, heat resistance and handling properties, having appropriate rigidity, low temperature properties and superior dust repellent properties (page 5 of D2a). The butene-propylene copolymers have a propylene content of above

1 mol% but less than 10 mol%, and specified crystalline melting point, tensile modulus, intrinsic viscosity and n-decane soluble content (Claim 1). The MWD of the butene-propylene copolymers of D2 preferably is in the range of 3 to 10 (Claim 4) and it is mentioned at page 14 in paragraph [0023] of D2a that the butene-propylene copolymers having such a MWD exhibit appropriate flexibility and good pipe-forming properties.

The polymer composition according to Example 3 of D2 was prepared by melt blending two different butene-1 polymers in a ratio of 4:1. The resulting blend had a MWD of 7.2 (Table 2). However, the isotactic index (mmmm%) and the content of catalytic residues of the blend are not disclosed.

4.5 Since the relevant parameters set out in Claim 1 of the main request are not disclosed for the polymer blends of Example 7 of D1 (parameters (i)-(iii)) and Example 3 of D2 (parameters (i) and (iii)), the appellant has repeated these examples and has determined the relevant parameters according to the methods defined in the patent in suit (experimental report D3). The following values have been obtained:

		D1 Example 7	D2 Example 3
(i)	isotactic index (mmmm%)	95.2	95.1
(ii)	MWD	12.6	8.3
(iii)	Catalytic residue (Ti ppm)	<5	<5

On the other hand, also the respondent has repeated Example 7 of D1 and Example 3 of D2 and has determined the relevant parameters (technical report D17 and experimental report annexed to the letter dated 30 March 2005). The respondent has obtained the following values:

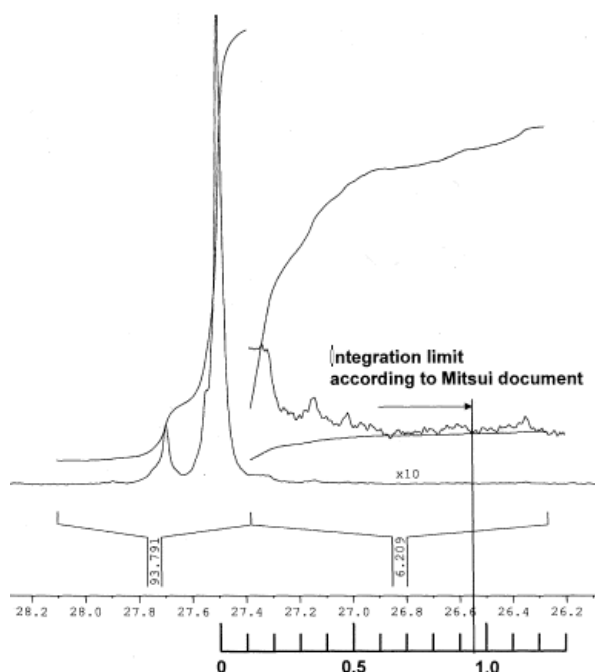
		D1 Example 7	D2 Example 3
(i)	isotactic index (mmmm%)	93.6	93.8
(ii)	MWD	9.2	7.9

As is apparent from the above data, the board was confronted with contradictory evidence, in particular with respect to the isotactic index. The consequence of this situation was that the subject-matter of Claim 1 of the main request would lack novelty over Example 7 of D1 and Example 3 of D2 if one were to accept the appellant's data, whereas the subject-matter of Claim 1 would be novel over the cited prior art if one were to follow the respondent's data. Thus, the decisive question for the board was, as pointed out by the appellant at the oral proceedings, which party's data were more reliable.

4.5.1 As regards the determination of the isotactic index (mmmm%), it is stated in paragraph [0027] of the patent specification that "The Isotactic index is then calculated according to: *Carbon-13 NMR Spectral Assignment of Five Polyolefins Determined from the Chemical Shift Calculation and the Polymerization*

Mechanism, T. Asakura and others, Macromolecules 1991, 24 2334-2340." This document has been filed by the respondent at the oral proceedings as D23. It is apparent from Figure 1 in D23 that the most intensive peak in the ^{13}C NMR spectrum of isotactic polybutene is assigned to the isotactic peak (mmmm) and the smaller peaks at a lower field relative to the isotactic peak are assigned to the other pentads, namely mmmr, rmmr, mmrr, mrrr, rrrr, mrrr and mrrm. For the determination of mmmm% all pentad signals have to be integrated. Thus, it has to be ascertained that the integration of the ^{13}C NMR signal does not stop too early and covers all pentad signals, in case of polybutene-1 as far as the signal assigned to the mrrm pentad.

However, as explained by the respondent at the oral proceedings and shown in the NMR spectrum (D25) below, the integration carried out by the appellant in its experiments stopped too early thereby cutting out some of the pentads.



The fact that the integration may have stopped too early in its repetition experiments was even acknowledged by the appellant at the oral proceedings. Since, furthermore, the incomplete integration of the ^{13}C NMR signal is likely to lead to a more favourable finding on isotacticity, ie to a higher isotactic index (mmmm%), the board considers the respondent's ^{13}C NMR data relating to the determination of the isotactic index more reliable than the appellant's data.

4.5.2 The appellant's arguments that the respondent's lower values might be due to a systematic apparatus error and that the difference in the integration might be small are not convincing. For the former argument no evidence whatsoever has been provided so that the board cannot accept this argument. As regards the latter argument, it cannot be denied that the appellant's integration of the ^{13}C NMR spectra has an influence on the amount of isotacticity. Since, furthermore, there has been provided no other plausible reason for the diverging data, the incomplete integration may very well explain the divergence. Finally, an integration that wrongfully favours the appellant's case does not necessarily enhance the credibility of the appellant's data.

4.5.3 In summary, there is no convincing evidence and/or document on file which clearly and unambiguously discloses that the polybutene-1 blends prepared in Example 7 of D1 and Example 3 of D2 have an isotactic index of higher than 95 mmmm%. For this reason alone, the subject-matter of Claim 1 of the main request is novel over the cited prior art.

Under these circumstances there is no need to elaborate on the issues as to whether or not the theoretical calculations presented by the respondent with respect to the isotactic values measured by the appellant raise (further) doubts on the appellant's experiments or as to whether or not the appellant's data with respect to the catalytic residues are correct.

- 4.6 If follows from the above that the subject-matter of Claim 1 of the main request and, by the same token, the subject-matter of Claim 15 ("Manufactured articles obtained from the polybutenes according to any of the preceding claims."), Claim 16 ("Process for the preparation of polybutene-1 homo or copolymers according to any of claims 1-14 carried out") and all dependent claims, is novel over the cited prior art.

5. *Inventive step*

- 5.1 The polybutene-1 homopolymers or copolymers according to Claim 1 have a high crystallinity and a broad molecular weight distribution. These polymers have excellent mechanical properties and are capable of providing pipes with high burst stress resistance (paraphrased [0005] and [0006] of the patent specification).

- 5.2 As set out in point 4.4, above, D2, and in particular Example 3 of D2, not only has most of the technical features in common with the claimed subject-matter, it also discloses technical effects and an intended use similar to the claimed subject-matter. Consequently, the board, just as the opposition division in the decision under appeal and the respondent, regards

Example 3 of D2 as the closest prior art. Also the appellant started in its written submissions in appeal from Example 3 of D2 for the assessment of inventive step.

5.3 The next step in the "problem and solution approach" is the formulation of the objective technical problem based on an assessment of the technical effects provided by the claimed subject-matter over the closest prior art.

5.3.1 In this context, the respondent emphasized that an increased isotacticity index in combination with a broad MWD led to superior mechanical properties. Since, however, the opposition division had not given full credit to this aspect in the absence of adequate evidence and the appellant had argued in its statement of grounds of appeal that no technical effect over Example 3 of D2 was associated with the increase in isotacticity index, the respondent characterized the polymer composition that has been obtained by reproducing Example 3 of D2 by determining the melting temperature according to the method described in D2 and by determining the mechanical properties of the blend and the deriving pipe according to the methods disclosed in the patent in suit. As is evident from the data provided in the submissions dated 14 May 2007, the characterization in terms of mechanical properties demonstrates an unsatisfactory level of properties, in particular with respect to "1000 Hrs Burst Stress", that is by far lower than that of either Example 1 or Example 2 of the patent in suit. Thus, the improvement of the mechanical properties referred to in paragraph [0005] of the patent in suit, in particular

the high burst stress resistance of pipes formed from the claimed polymer, has been demonstrated by respondent.

5.3.2 The appellant criticised the respondent's comparison of the resin of Example 3 of D2 with the resins of Examples 1 and 2 in the patent in suit, because the polymerization conditions for the preparation of the resins of Examples 1 and 2 of the patent in suit were completely different from those of the resin prepared following Example 3 of D2. Thus, the comparison did in no way allow correlating an increase in the isotactic index with an improvement of the mechanical properties. Since the existence of a technical effect over the closest prior art could not be acknowledged, the appellant saw the objective technical problem underlying the claimed subject-matter in the provision of an alternative butene-1 homo- or copolymer.

However, the appellant did not show how the alleged different polymerisation conditions would distort the comparison. The appellant's rather general assertion is, in the board's view, not enough to query the comparison made by the respondent. Furthermore, it appears from the table on page 18 of D3, ie the appellant's own experiments relating to the polymer prepared following Example 3 of D2, that at least the polymer of Example 1 of the patent in suit is not so different from the polymer of Example 3 of D2 that a comparison with this polymer could not be relied upon. Both Example 1 of the patent in suit and Example 3 of D2 produce a butene-1/propylene copolymer having a comparable melt index (0.48 vs 0.44 g/10 min). The only striking difference the board can see between these two

polymers is that Example 1 of the patent in suit uses a catalyst intrinsically capable of producing a broad molecular weight distribution whereas in Example 3 of D2 the broad molecular weight distribution is achieved by melt blending two different butene-1 polymers. However, as already pointed out in point 4.2, above, one of the methods for producing the required broad MWD is the melt blending of two different butene-1 polymers (in this context see also paragraph [0025] of the patent in suit). Thus, the patent in suit rather gives the impression that this difference in the preparation method between Example 1 of the patent in suit and Example 3 of D2 has no influence on the technical effect achieved by the polymers according to the invention.

5.3.3 In view of the above the board cannot accept the appellant's line of argumentation that the objective technical problem underlying the claimed subject-matter has to be seen in the provision of an alternative butene-1 homo- or copolymer to Example 3 of D2. Rather the respondent's comparison shows that the objective technical problem over the closest prior art has to be seen in provision of butene-1 homo- or copolymers having improved mechanical properties, in particular with respect to high burst stress resistance.

As demonstrated by the examples in the patent in suit, the above stated objective technical problem is solved by the provision of the polymers as defined in Claim 1 of the main request. Thus, the board is satisfied that the objective technical problem is solved.

5.3.4 Since the respondent did not rely on the additional experiment D20 for its assessment of inventive step at the oral proceedings, there was no need for the board to decide upon the appellant's request not to admit D20 into the proceedings. Also the above considerations concerning the definition of the objective technical problem to be solved do not rest upon D20.

5.4 There is no teaching in D2 itself to increase isotacticity in terms of pentad content in order to improve the mechanical properties of the polymers and the pipes prepared therefrom, respectively. Even less is said in D2 about the combination of molecular weight distribution and isotacticity. According to the first paragraph of page 14 of D2, the preferred molecular weight distribution can be indifferently lower or higher than 6. Hence, D2 fails to suggest to modify Example 3 of D2 in order to obtain butene-1 polymers with improved mechanical properties, in particular with respect to high burst stress resistance.

No other conclusion can be reached when considering D1 which relates also to a polybutene-1 resin composition obtained by melt-mixing polybutene-1 resins having different melt flow ratios (point 4.3, above). There is nothing in the general disclosure of D1 which would link an increased isotacticity with improved mechanical properties, in particular high burst stress resistance. Although the parameter "internal pressure resistance" is indicated in Table 1 of D1 for the blends of the various examples, it is not possible to deduce from the data in Table 1 of D1 that an increased internal pressure resistance comes along with increasing the

isotacticity. Basically, there are three groups of examples in Table 1:

	Resin (weight%)		Nucleating agent (weight part)	MFR (g/10min)	Isotactic value (%)	internal pressure resistance (h)
	PB-A	PB-B				
Example 1	90	10	PE*	0.3	95	3500
Example 2	80	20	0.2	0.5	95	2800
Example 3	70	30	0.2	0.9	95	4100
Example 4	PB-A 80	PB-A 20	EBSA** 0.05	0.5	95	>5000
Example 5	80	20	-	0.5	95	2100
Example 6	PB-C 80	PB-D 20	PE* 0.2	0.2	97	>5000
Example 7	70	30	0.5	0.5	97	>5000

* polyethylene

** ethylenebisstearoamide

Examples 1-3 show that with varying MFR of the blend the internal pressure resistance increases for a blend composed of PB-A and PB-B. Examples 4 and 5 show that a nucleating agent improves the internal pressure resistance. A comparison between Examples 2 and 4 (which use exactly the same polymers in the same amounts) suggests that also the nature of the nucleating agent might have an influence on the internal pressure resistance. As regards Examples 6 and 7 in the above table, it is true that the isotacticity (in terms of isotactic value) is with 97% higher than in Examples 1-5, but it is conspicuous to the board that these examples use completely different

polymers than Examples 1-5. Thus, polymer PB-C has an unusually low MFR of 0.05 g/10 min compared with polymer PB-A (MFR: 0.2 g/10 min) and polymer PB-D has with 100 g/10 min a much higher MFR than polymer PB-B (MFR: 20 g/10 min). Whether the good values for internal pressure resistance are due to the higher isotacticity value or due to the use of polymers with different MFR is, however, not apparent from D1. The appellant's argumentation that Table 1 of D1 would provide a hint to increase the isotacticity of the resin of the closest prior art in order to improve the internal pressure resistance appears to be based on an *ex post facto* analysis of Table 1, using knowledge of the invention as assistance. The question to be answered is not whether the skilled person could have arrived at the invention by combining the closest prior art with the teaching of D1, but whether he would have done so because the prior art incited him to do so in the hope of solving the objective technical problem (see T 2/83, OJ 6/1984, 265). However, D1 does not provide any unambiguous hint concerning a relationship between isotacticity and internal pressure resistance. Therefore, a person skilled in the art would not combine D2 with D1 in order to solve the above defined objective technical problems.

Consequently, the subject-matter of Claim 1 of the main request is based on an inventive step.

- 5.5 At the oral proceedings the appellant argued for the first time that D1 could equally be used as the closest prior art with the result that the subject-matter of Claim 1 of the main request was also not inventive over D1. In the written appeal procedure, Example 3 of D2

has always been considered as the closest prior art and a crucial point in the parties' submissions has been as to whether or not the subject-matter of Claim 1 of the main request provides any technical advantages over Example 3 of D2. In this connection, the respondent has filed twice comparative data for Example 3 of D2 to rebut the appellant's allegation that the claimed butene-1 polymers were mere alternatives to the closest prior art (experimental data in the letter dated 14 May 2007 and D20). If admitted, the new attack would have raised the question as to whether or not the claimed butene-1 polymers show any advantage over D1 and might have necessitated, for example, the filing of new comparative data in view of D1. However, the respondent could not reasonably be expected to deal with this new issue at the oral proceedings so that the admittance of the new attack would have entailed an adjournment of the oral proceedings. Therefore, in line with Article 13 of the Rules of Procedure of the Boards of Appeal (OJ EPO, 2007, 536), the board did not admit the appellant's case for lack of inventive step of the subject-matter of the main request on the basis of taking D1 as closest state of the art into the proceedings.

- 5.6 In the written procedure, the appellant has also raised an objection under Article 56 EPC against Claim 16 ("Process for the preparation of the polybutene-1 homo or copolymers according to any of claims 1-14 carried out in the presence of a stereospecific catalyst comprising (A) a solid component comprising a Ti compound and an internal electron-donor compound supported on MgCl₂; (B) an alkylaluminum compound and, (C) an external electron-donor compound."). However,

due to the reference to a process for preparation of the "polybutene-1 homo or copolymers according to any of claims 1-14", the patentability of the subject-matter of Claim 16 hinges on the patentability of the subject-matter of Claim 1 (see eg T 119/82, OJ EPO 1984, 217).

- 5.7 In summary, the subject-matter of Claim 1 of the main request, and, by the same token, the subject-matter of Claims 2-24 is based on an inventive step.
6. Since the respondent's main request is allowable, any discussion of its auxiliary requests is superfluous.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent as amended in the following version:
Description:
Pages 3-8 of the patent specification
Page 2 filed during the oral proceedings of 10 May 2006
Claims:
1-24 according to the main request filed with the letter dated 10 October 2008.

The Registrar:

The Chairman:

E. Görgmaier

R. Young