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**Datasheet for the decision
of 24 September 2008**

Case Number: T 1618/07 - 3.3.03

Application Number: 90900353.5

Publication Number: 0495099

IPC: C08F 10/00

Language of the proceedings: EN

Title of invention:

Olefin copolymer and production thereof

Patentee:

Mitsui Chemicals, Inc.

Opponents:

THE DOW CHEMICAL COMPANY
BP Chemicals Ltd.
Basell Polyolefine GmbH
Exxon Chemical Patents Inc.

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Relevant legal provisions (EPC 1973):

-

Keyword:

"Request to set aside the decision under appeal and to revoke
the patent in its entirety - inadmissible (reformatio in
peius)"

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

G 0009/92

Catchword:

-



Case Number: T 1618/07 - 3.3.03

DECISION
of the Technical Board of Appeal 3.3.03
of 24 September 2008

Appellant: Basell Polyolefine GmbH
(Opponent 03) Industriepark Höchst
D-65926 Frankfurt (DE)

Representative: -

Respondent: Mitsui Chemicals, Inc.
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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office dated
27 June 2007 and posted 24 July 2007 concerning
maintenance of European patent No. 0495099 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. 0 495 099, in respect of European patent application no. 90900353.5, based on International application no. PCT/JP89/01281, filed on 21 December 1989 and claiming priority from Japanese applications filed on 26 December 1988 (three applications), 24 January 1989 and 21 July 1989, was published on 3 June 1998 (Bulletin 1998/23). The granted patent contained two claims which read as follows:

"1. An ethylene copolymer comprising 60 to 96% by mol of structural units (a) derived from ethylene and 4 to 40% by mol of structural units (b) derived from an α -olefin of 3 to 20 carbon atoms, and having

- (A) a density of 0.85 to 0.92 g/cm³,
- (B) an intrinsic viscosity $[\eta]$ as measured in decalin at 135°C of 0.1 to 10 dl/g,
- (C) a ratio (M_w/M_n) of a weight average molecular weight (M_w) to a number average molecular weight (M_n) as measured by GPC of 1.2 to 4, and
- (D) a ratio (MFR_{10}/MFR_2) of MFR_{10} under a load of 10 kg to MFR_2 under a load of 2.16 kg at 190°C of 8 to 50.

2. A process for preparing an ethylene copolymer as claimed in claim 1 which process comprises copolymerizing ethylene and an α -olefin of 3 to 20 carbon atoms in the presence of a catalyst comprising

- [A] a hafnium compound having as a ligand a multidentate compound in which at least two groups selected from indenyl groups or substituted groups

thereof are linked together via ethylene groups or hafnium compounds obtained by treating the above-mentioned hafnium compounds with alkylsilylated silica gel, and
[B] an organoaluminum oxy-compound."

II. Notices of opposition were filed by

- The Dow Chemical Company (opponent 01) on 19 January 1999,
- BP Chemicals Limited (opponent 02) on 1 March 1999,
- Elenac GmbH (now Basell Polyolefine GmbH) (opponent 03) on 2 March 1999, and
- Exxon Chemical Patents Inc. (now ExxonMobil Chemical Patents Inc.) (opponent 04) on 2 March 1999,

whereby opponents 01 and 02 withdrew their oppositions in the course of the opposition proceedings.

The oppositions were based on the grounds that the subject-matter of the European patent opposed was not new and did not involve an inventive step (Article 100(a) EPC) and that the European patent opposed did not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art (Article 100(b) EPC). The following documents were - *inter alia* - cited during the opposition procedure:

D1: EP 0 057 891 A2;

- D9: EP 0 164 215 A1;
- D10: Declaration of Mr Tsutsui dated 21 February 1992;
- D11: JP 59 051 905 A (and Derwent abstract and English translation);
- D19: Proprietor's Experimental Report (1) dated 9 January 1998;
- D20: Proprietor's Experimental Report (3) dated 6 July 1998;
- D21: Proprietor's Experimental Report (4) dated 10 March 1999;
- D22: Proprietor's Experimental Report (5) dated 29 October 1999;
- D23: Proprietor's Experimental Report (6) dated 29 October 1999; and
- D28: Expert Opinion of Dr Minoru dated 20 August 2001 (submitted by the proprietor with letter dated 26 October 2001).
- III. By an interlocutory decision which was announced orally on 12 March 2003 and issued in writing on 4 April 2003, the opposition division refused the proprietor's main request and auxiliary request 1 for lack of novelty in view of the prior use occurring with the sale of Vistalon[®] MDV-746 to Colonial Rubber Works. Further, the opposition division found that the patent could be

maintained in amended form according to the proprietor's auxiliary request 2.

- IV. On 30 May 2003, the proprietor lodged an appeal against the above decision of the opposition division.

In its decision T 620/03 of 13 April 2005 the board of appeal found that the alleged prior use occurring with the sale of Vistalon[®] MDV-746 to Colonial Rubber Works had not been sufficiently proven, and remitted the case to the first instance for further prosecution on the basis of the set of Claims 1 and 2 entitled "MAIN REQUEST" submitted on 14 August 2003.

The claims of this main request were identical to the main request claims considered by the opposition division in its decision, and corresponded to the claims as granted, except that in Claim 1 the upper limit of the ratio M_w/M_n was amended to 3.0.

- V. By an interlocutory decision which was announced orally on 27 June 2007 and issued in writing on 24 July 2007, the opposition division found that the patent could be maintained in amended form according to the claims of the proprietor's main request which were identical to the claims remitted by the board of appeal in T 620/03 to the first instance (see point IV, above) and were re-filed at the oral proceedings of 27 June 2007.

- (a) According to the decision of the opposition division, the claims of the main request met the requirements of Article 123(2) and (3) EPC.

- (b) The claims of the main request complied with requirements of Article 83 EPC.
- (c) The claims of the main request were entitled to a priority date of 24 January 1989.
- (d) The opponents had not sufficiently substantiated the alleged further prior use occurring with the sale of Vistalon[®] MDV-746 to Republic Plastic Co. As regards the alleged further prior use occurring with the sale of Vistalon[®] MDV-746-1 to Dexter Corp., that prior use was not relevant as the product was prepared and shipped after the valid priority date of 24 January 1989.
- (e) The claimed subject-matter was novel over D1 (Comparative Example 17), D7 and D9 (Comparative Example 5).

The opponents had not provided convincing evidence which showed that the copolymers prepared in Comparative Example 17 of D1 and in Comparative Example 5 of D9 inherently had a MFR_{10}/MFR_2 ratio inside the range of 8 to 50. As regards the objection based on the 6th condition in Table 4 of D7, D7 did not give enough information enabling a person skilled in the art to make a true repetition of this condition. Therefore, all repetitions of this test filed during the opposition procedure were no true repetitions.

- (f) The provision of novel ethylene copolymers having a specific combination of properties (A) to (D) as defined in Claim 1 of the main request and the

specific process of Claim 2 for preparing these ethylene copolymers was not obvious from the documents cited by the opponents. In particular the repetition of Example 1 of D9 (which was considered to represent the closest prior art) in the declaration of Mr Tsutsui (D10) showed that conventional Ziegler-Natta prepared ethylene copolymer would not exhibit the claimed combination of properties.

VI. On 25 September 2007, the appellant (opponent 03) filed a notice of appeal against the above decision with simultaneous payment of the prescribed fee and requested that the decision under appeal be set aside and the patent be revoked in its entirety.

The statement of grounds of appeal was filed on 29 November 2007. The arguments of the appellant may be summarized as follows:

- (a) Comparative Example 17 of D1 described a copolymer having a density of 0.92 g/cm³. Further, the general information provided in D1 disclosed the parameters (B) and (C) required in Claim 1 of the main request. As regards the melt flow ratio (D), the calculation provided by the appellant already with the notice of opposition of 2 March 1999 showed that the copolymer of Comparative Example 17 of D1 inherently had the required melt flow ratio (D).
- (b) D8, ie the repetition of the 6th condition in Table 4 of D7, showed that the copolymer of this 6th condition had all the parameters as required in

Claim 1 of the main request. In fact, there was sufficient information in D7 to enable a skilled person to repeat the 6th test in Table 4 of D7, as could be seen from D8. Further, the appellant alleged that the lack of any mention of the nature of the methylalumoxane (MAO) used in D7 was unimportant, because the claims of the patent itself did not define the nature of the cocatalyst to be used.

- (c) D9 did not describe the intrinsic viscosity and the flow characteristics of the copolymer produced in Comparative Example 5. Since, however, Comparative Example 5 was similar to Example 1, the copolymer would be expected to have the same intrinsic viscosity and MFR_{10}/MFR_2 ratio as was determined for Example 1 of D9. Therefore, Comparative Example 5 of D9 was novelty destroying to the claimed subject-matter.

- (d) The appellant suggested that D9 or D11 might be taken as the closest prior art. Following the amendment of the claims to the preferred range of 1.2 to 3.0 for the molecular weight distribution, the new technical problem to be solved was less exacting and had to be seen in the provision of a further copolymer having comparable properties.

Starting from D9 as the closest prior art, the solution was provided by Comparative Example 5 of D9 which disclosed a copolymer with a M_w/M_n ratio of 3.0 and flow properties similar to those of the other copolymers of D9. Starting from D11 as the closest prior art, it would be obvious from either

D9 or D1 that polymers having a low molecular weight distribution could be achieved.

VII. Together with its reply dated 16 April 2008, the respondent (proprietor) re-filed a copy of the main request claims which were allowed by the opposition division in the decision of 24 July 2007 (point V, above) as well as copies of auxiliary requests 1 to 4 submitted during the oral proceedings before the opposition division on 26 June 2007.

The auxiliary requests are not relevant to this decision and will therefore not be discussed in further detail.

The arguments of the respondent may be summarized as follows:

- (a) The argument put forward by the appellant with regard to D1 was identical to the arguments previously filed before the opposition division, and which were found by the opposition division to be insufficient to demonstrate a lack of novelty. In particular, no new evidence had been provided to show that the MFR_{10}/MFR_2 ratio of the copolymer prepared in Comparative Example 17 of D1 was inside the range of 8 to 50 as required in Claim 1 of the main request. As regards the calculation provided by the appellant in connection with the melt flow ratio (D), this calculation relied on the use of the Ostwaldt-de Waele equation which included a parameter m relating to the polydispersity index PI. The appellant indicated that the value of m had been selected for a

polydispersity in the relevant range. However, since the polydispersity of Comparative Example 17 of D1 was not known, it was not clear whether the chosen value of m was correct or not. In this connection, the respondent referred to D10 which showed that the MFR_{10}/MFR_2 ratio and the molecular weight distribution were intrinsically linked. Since D1 disclosed no value for the molecular weight distribution, it was clear that the appellant's calculation for MFR_{10}/MFR_2 could not be relied on.

- (b) As regards lack of novelty over the 6th condition in Table 4 of D7, there was not sufficient information in D7 with regard to MAO to enable a skilled person to repeat that test. Simply because D8 existed and was put forward as a repeat of D7 did not in itself show that D8 did provide the inevitable result of repeating D7. Moreover, the proprietor had already shown by the submission of test reports D19 to D23 that variation of the nature of MAO used in the test did have a significant effect on the result. Since it could not be established that D8 used the same type of MAO as D7, it was clear that D8 did not represent the inevitable result of repeating D7.
- (c) D9 did not describe the intrinsic viscosity and the flow characteristics of the copolymer produced in Comparative Example 5 of D9. Appellant's argument that since Comparative Example 5 was similar to Example 1, this copolymer would be expected to have the same MFR_{10}/MFR_2 ratio as was determined for Example 1 of D9 was not correct.

Comparative Example 5 differed significantly from Example 1 in terms of its molecular weight distribution and flow parameter n . Given the difference in molecular weight distribution and flow parameter n , the skilled person would expect these two polymers to have very different values for MFR_{10}/MFR_2 . In this connection, reference was made to D10 which showed that the MFR_{10}/MFR_2 parameter was dependent on the melt index ratio (n) and also on the molecular weight distribution.

- (d) The present inventors had provided access to a new group of polymers having a new range of properties. In particular, the present inventors had provided a new process as set out in Claim 2 of the main request which enabled the skilled person to achieve polymers having a combination of low molecular weight distribution and high melt flow properties. Such polymers were not disclosed in any of D1, D9 or D11 which were referred to by the appellant. Moreover, all of D1, D9, and D11 used conventional catalysts such as Ziegler catalysts which were studied further in D10. As was apparent from D10, polymers having a combination of low molecular weight distribution and high melt flow ratio could not be accessed using such catalysts. None of the prior art therefore taught the skilled person how the polymers of Claim 1 of the main request could be made. Both the polymers of Claim 1 and the process of Claim 2 therefore fulfilled the requirements of Article 56 EPC.

- VIII. In a communication dated 27 May 2008 accompanying a summons to oral proceedings, the board set out the points to be discussed at the oral proceedings to be held on 24 September 2008, namely novelty of the claimed subject-matter over D1, D7 and D9 and inventive step starting from D9 or D11.
- IX. The other party (opponent 04) indicated in the letter dated 5 June 2008 that it would not appear at the oral proceedings.
- X. With the letter dated 29 July 2008, the appellant informed the board that it would not attend the oral proceedings. However, the appellant maintained its request to set aside the decision under appeal and to revoke the patent in its entirety. As an auxiliary motion, the appellant requested to set aside the decision under appeal and to maintain the patent in amended form according to the decision of the opposition division of 12 March 2003 with claims according to auxiliary request 2 in accordance with the principle of *reformatio in peius*.
- XI. In the letter dated 22 August 2008, the respondent challenged the validity of the appellant's request to revoke the patent in its entirety since such a request would be contrary to the principle of *reformatio in peius*.
- XII. On 24 September 2008, oral proceedings were held before the board, where neither the appellant nor the other party (as announced) were represented. Since they had been duly summoned, however, the oral proceedings were continued in their absence in accordance with

Rule 115(2) EPC. The respondent relied on its written submissions.

XIII. The appellant requested that the decision under appeal be set aside and the patent be revoked in its entirety or, in the alternative, that the decision under appeal be set aside and that the patent be maintained in amended form according to the decision of the opposition division of 12 March 2003.

The respondent requested that the appeal be dismissed or, in the alternative, that the decision under appeal be set aside and the patent be maintained in amended form on the basis of one of auxiliary requests 1 to 4 filed on 26 June 2007 (re-filed with the letter dated 16 April 2008).

The other party did not file any request.

Reasons for the Decision

1. The appeal is admissible.
2. *Appellant's requests*
 - 2.1 The appellant requested as main request that the decision under appeal be set aside and that the patent be revoked in its entirety.

However, at the first oral proceedings before the opposition division, on 12 March 2003, the opposition division decided to maintain the patent in suit in amended form based on the proprietor's auxiliary

request 2 (point III, above). Only the patent proprietor appealed against that decision.

Thus, according to the principle of *reformatio in peius*, as set out in G 9/92 (OJ EPO 1994, 875), neither the board of appeal nor any of the non-appealing opponents may challenge the maintenance of the patent as amended in accordance with that decision of the opposition division announced orally on 12 March 2003 and issued in writing on 4 April 2003.

Since Basell Polyolefine GmbH did not appeal against that decision announced orally on 12 March 2003, the request of Basell Polyolefine GmbH in the present proceedings to revoke the patent in suit in its entirety is contrary to the principle of *reformatio in peius* and is therefore inadmissible.

- 2.2 Consequently, the only acceptable request of Basell Polyolefine GmbH is its auxiliary request to set aside the decision under appeal and to maintain the patent in amended form according to the decision of the opposition division announced orally on 12 March 2003 with claims corresponding to auxiliary request 2. The claims of that auxiliary request 2 correspond to those of the present 4th auxiliary request.

3. *Amendments (main request)*

The claims of the respondent's main request corresponded to Claims 1 and 2 as granted, except that in Claim 1 the upper limit of the ratio (M_w/M_n) has been amended to 3.0 (the upper limit in Claim 1 as granted was 4.0). A basis for the amendment can be found on

page 18, line 13 of the application as filed. Thus, no objections under Articles 123 or 84 EPC arise against the amendment in Claim 1. Nor has the appellant or the other party advanced any objection in this connection.

4. *Sufficiency of disclosure*

The appellant raised no objection with respect to sufficiency of disclosure. Nor does the board see a reason to challenge the finding of the opposition division in that respect (point V(b), above).

5. *Novelty (main request)*

5.1 The appellant does not challenge the finding of the opposition division that the subject-matter of the main request is novel over the alleged further prior uses occurring with the sale of Vistalon[®] MDV-746 to Republic Plastic Co. and the sale of Vistalon[®] MDV-746-1 to Dexter Corp. (point V(d), above). Nor does the board see a reason to raise an objection in this connection on its own.

However, the appellant challenges the finding of the opposition division that the subject-matter of the main request is novel over Comparative Example 17 of D1, D7 and Comparative Example 5 of D9.

5.2 Comparative Example 17 of D1

D1 relates in general terms to an ethylene/ α -olefin copolymer composition comprising two ethylene/ α -olefin copolymers which are different in density, intrinsic

viscosity and the number of short chain branching per 1000 carbon atoms.

In Comparative Example 17 of D1 a low density ethylene/butene-1 copolymer of the conventional technique was synthesized, using the catalyst produced in Example 1 of D1 and triethyl aluminium (cocatalyst) and employing the polymerization conditions shown in Table 21. The copolymer had a density of 0.920 g/cm³, a melt index (MI) of 0.5 g/10 min and a melt flow ratio MI_{21.6}/MI_{2.16} of 30 as shown in Table 18.

5.2.1 It is evident from the above that Comparative Example 17 of D1 provides very little information with regard to the properties (A) to (D) of Claim 1 of the main request. Comparative Example 17 discloses the density, namely parameter (A). However, no indication is given of the intrinsic viscosity (B), molecular weight distribution (C), nor MFR₁₀/MFR₂ ratio (D). Further, there is no explicit disclosure in Comparative Example 17 as to the relative amounts of ethylene and comonomer. Table 21 merely indicates the polymerisation conditions, eg amount of butene-1 (in kg), partial pressure of ethylene, polymerisation time. For these reasons, without additional data repeating Comparative Example 17 of D1 in reliable fashion, it is not possible to determine whether this polymer falls within the scope of Claim 1 or not.

5.2.2 Nevertheless, the appellant is of the opinion that the relevant parameters (B) to (D) are inherent to the copolymer produced in Comparative Example 17 of D1. The appellant's argumentation in this connection is, however, not convincing for the following reasons:

- (a) The appellant provides a discussion of the invention of D1, indicating that the general information provided in D1 contains information on the density, intrinsic viscosity and molecular weight distribution. Thus, the general information in D1 would provide information with respect to parameters (B) and (C) of the copolymer produced in Comparative Example 17 of D1. However, any discussion of the invention of D1 is irrelevant in the context of Comparative Example 17. The copolymer produced in Comparative Example 17 is acknowledged by the D1 inventors to have properties different from those of the claimed invention. The appellant cannot therefore rely on any combination of the features explicitly disclosed in Comparative Example 17 with the general disclosure of the D1 invention. It is therefore not possible to determine either from D1 itself or from the argumentation of the appellant, what the intrinsic viscosity or molecular weight distribution of the copolymer produced in Comparative Example 17 of D1 would be.
- (b) As regards the MFR_{10}/MFR_2 ratio, ie parameter (D) of Claim 1, the appellant provided already in the notice of opposition a calculation. Via that calculation, the appellant determines from values disclosed for Comparative Example 17, namely MI and $MI_{21.6}/MI_{2.16}$, the MFR_{10}/MFR_2 ratio which is not disclosed in D1. This calculation relies on the use of the Ostwaldt-de Waele equation which includes a parameter m relating to the polydispersity index PI. The appellant indicates

that the value of m (0.45) has been selected for a polydispersity in the relevant range and calculates a value of 14 for the MFR_{10}/MFR_2 ratio for Comparative Example 17 of D1. However, as pointed out by the respondent, since the polydispersity of Comparative Example 17 of D1 is not known, it is not clear whether the chosen value of m is correct or not.

The respondent's objection is supported by the Tsutsui declaration D10. As is apparent from the table provided by Mr Tsutsui on page 6 of D10, the MFR_{10}/MFR_2 ratio and the molecular weight distribution are intrinsically linked. A precise calculation of the MFR_{10}/MFR_2 ratio of a particular polymer therefore cannot be carried out without knowing the molecular weight distribution. Since D1 discloses no value for the molecular weight distribution, it is clear that the appellant's calculation for MFR_{10}/MFR_2 cannot be relied on.

Furthermore, as pointed out by the respondent, the appellant's calculation does not appear to correspond with experimental results for such polymers. The table appearing on page 6 of D10 provides the expected relationship between molecular weight distribution and melt flow properties of polymers produced using conventional Ziegler catalysts. In accordance with this table, a polymer having a melt flow ratio $MI_{21.6}/MI_{2.16}$ of 30, such as that described in Comparative Example 17 of D1 and also produced using a conventional Ziegler catalyst, would be expected to have a molecular weight distribution of

about 3.5 and a MFR_{10}/MFR_2 ratio of about 7.9. Thus, based on expected results, Comparative Example 17 of D1 would even fall outside the scope of Claim 1 of the main request.

5.2.3 In conclusion, the appellant's arguments go no further than those previously submitted before the opposition division. The opposition division's conclusion that Comparative Example 17 has not been demonstrated to fall within the scope of Claim 1 of the main request therefore still stands.

5.3 D7

5.3.1 The article D7 by W. Kaminski et al. relates to the use of a catalyst composition comprising a group IVB transition metal complex and methylalumoxane (MAO) for the production of various types of polymers. The introduction of the article discloses that titanocene, zirconocene and hafnocene, for example biscyclopentadienyl- and bisindenyl transition metal complexes, form together with alumoxane highly active Ziegler-Natta catalysts. Further, it is stated that MAO is a key substance responsible for the high activity of the catalyst composition. Table 2 in D7 lists ethylene homopolymerization and ethylene copolymerization with a zirconocene/alumoxane catalyst. The last paragraph on page 291 states that "The analogous titanium and hafnium compounds form active catalysts too". The copolymerisation of 4-methylpentene-1 and ethylene with two different zirconocenes, namely Cp_2ZrCl_2 and $Et(Ind)_2ZrCl_2$, and methylalumoxane as cocatalyst under various conditions is shown in Table 4 of D7. As regards the properties of the final copolymer, Table 4

discloses only the mol% of 4-methylpentene-1 in the copolymer and the M_n of the copolymer.

5.3.2 Firstly, it is evident from the above that D7, and Table 4 in particular, provides no information with regard to a copolymer having the properties (A) to (D) of Claim 1 of the main request. Secondly, the appellant's assertion (contended at the opposition stage) that D7 discloses the same catalyst and the same starting monomers as required by Claim 2 of the main request and therefore the same polymers as claimed in Claim 1 of the main request is not supported by the disclosure of D7. There is no disclosure in D7 of a process wherein a hafnium containing catalyst is used to produce an ethylene copolymer with properties (A) to (D). Indeed the only reference to the use of hafnium appears on page 291 in the final paragraph, a reference which does neither directly relate to ethylene copolymerisation nor to hafnium complexes having a multidentate ligand as required in Claim 2 of the main request.

5.3.3 In the present appeal, the appellant basically relied on a repetition of the copolymerisation of ethylene and 4-methylpentene-1 with $\text{Et}(\text{Ind})_2\text{ZrCl}_2$ and methyl alumoxane (MAO) according to the 6th condition in Table 4 of D7 to attack the novelty of the subject-matter of Claim 1 of the main request. This repetition is reported in D8.

However, there is considerable doubt as to whether or not D8 is a true reproduction of the 6th condition in Table 4 of D7.

As pointed out by the respondent, the cocatalyst MAO is a compound which has been used in catalytic polymerisation for some time, but its precise chemical structure is still not known. It is however well known in the art that the methods of production of MAO have varied over time and, due to this, the catalytic performance of MAO has improved considerably. The MAO used in D8 is said to be a commercially available sample from Altabale (*sic*: Albemarle!) Company. Presumably, this is MAO which was commercially available in 1997 rather than that available at the time (1987 or earlier) that the experiments were carried out for D7. The skilled person cannot deduce from D7 the type of MAO which should be used to produce the stated results. Indeed, the respondent has shown by the submission of test reports D19 to D23 that variation of the nature of MAO used in the polymerisation does have a significant effect on the result. Each of D19 to D23 relates to an experiment repeating the work described in D7 but using modern MAOs. Except in D23 the various MAOs were all commercially available and were used either in approximately the amount as suggested in D7 or in reduced amounts to take account of their increased activity compared with materials from 1987 when the work reported in D7 was presumably conducted. Apart from demonstrating the effect of using different MAOs, it can be seen from these reports that each experiment successfully produced polymer but none produced a polymer meeting the MFR_{10}/MFR_2 ratio of present claim 1.

Given the significant variations in the properties of the MAO component, it cannot be established that D8 uses the same type of MAO as D7. Consequently, the

board agrees with the opposition division's conclusion of paragraph 6.3 of the reasons for the decision that (i) it cannot be assumed that D8 is a true repetition of the 6th condition in Table 4 of D7 and (ii) the disclosure in Table 4 of D7 is in principle not sufficiently clear and complete for a skilled person to be able to reproduce the catalyst compositions and polymers described.

5.3.4 The appellant contests the opposition division's conclusion of paragraph 6.3 of the reasons for the decision and argues that there is sufficient information in D7 to enable a skilled person to repeat the polymerisations disclosed in Table 4 of D7, relying on the mere existence of D8 in this regard. This argument, however, does not follow. Simply because D8 exists and is put forward as a repeat of D7 does not in itself show that D8 does provide the inevitable result of repeating D7.

The Appellant is correct that D8 provides a number of details as to how the test was carried out. What is significant, however, is that many of these details are not found in D7 itself. In such a situation, it must be established (a) that the parameters and conditions used in D8 are those which the skilled person would inevitably have used on reading D7, or where this is not possible (b) that variation in any such parameter or condition would have no effect on the end result. Neither of these issues is addressed in any way by the appellant, and in particular not the issue relating to the type of MAO which was used in D7. As concluded by the opposition division, therefore, given the lack of

information in D7, it cannot be established whether D8 is a true repetition of D7 or not.

5.3.5 In the final paragraph of the discussion of D7, the appellant alleges that the lack of any mention of the nature of MAO used in D7 is unimportant. This is because the claims of the patent itself do not define the nature of the cocatalyst to be used. Again, this argument does not follow. For D8 to represent the inevitable result of repeating D7, it must be shown that D8 either uses precisely the same conditions and parameters as D7, or that any variation in such conditions and parameters would have no effect on the end result. The manner in which the proprietor has defined its claims is not relevant to this question. The appellant's final argument in relation to D7 is therefore simply not correct.

5.3.6 In view of the above, the claimed subject-matter is novel over the disclosure of D7 and in particular over the 6th condition in Table 4 of D7.

5.4 Comparative Example 5 of D9

5.4.1 D9 relates to a gas fluidised bed process for the production of ethylene copolymers using conventional Ziegler polymerisation techniques. The polymers produced in all examples except in Comparative Example 5 have a molecular weight distribution M_w/M_n of at least 4.0. Comparative Example 5 of D1 discloses an ethylene copolymer having a density of 0.918 g/cm³, a M_w/M_n ratio of 3.0 and a comonomer content of 9.9% by weight (3% butene-1 and 6.9% 4-methyl-1-pentene) (Table 1 on page 25).

5.4.2 The respondent has already argued during the first appeal that the data set out in Comparative Example 5 of D9 are not reliable and the skilled person would consider that Comparative Example 5 contains an error. The ethylene copolymer of Comparative Example 5 is produced by gas phase polymerisation using conventional Ziegler polymerisation techniques and would not be expected to have a M_w/M_n ratio as narrow as the reported "3.0". As demonstrated in the declaration D28, the copolymer of Comparative Example 5 is an anomalous result which does not follow the usual pattern for such conventional polymers, eg polymers as produced in the other examples of D9.

5.4.3 But even if the data reported in Comparative Example 5 were to be accepted at face value, the fact remains that D9 does not describe the intrinsic viscosity or flow characteristics of the copolymer produced in Comparative Example 5, ie properties (B) and (D) of present Claim 1. The appellant argues that since Comparative Example 5 is similar to Example 1 of D9, this polymer would be expected to have the same intrinsic viscosity and MFR_{10}/MFR_2 ratio as was determined for Example 1. Example 1 of D9 was repeated in D10 and it was found that the copolymer had an intrinsic viscosity of 1.75 dl/g and a MFR_{10}/MFR_2 ratio of 8.3.

However, the appellant's assumption that the copolymer of Comparative Example 5 of D9 is similar to the polymer produced in Example 1 of D9 is not correct. As pointed out above, Comparative Example 5 is an anomalous result within the disclosure of D9 and

differs significantly from Example 1 in terms of its molecular weight distribution and flow parameter n (ratio of the melt index ($MI_{21.6}$) to the melt index ($MI_{2.16}$)). The copolymer of Comparative Example 5 has a molecular weight distribution of 3.0 and a flow parameter n of 33, whereas the copolymer of Example 1 has a molecular weight distribution of 4.0 and a flow parameter n of 25. As is apparent from D10, the MFR_{10}/MFR_2 parameter is dependent on the ratio n and also on the molecular weight distribution. It is therefore not correct to conclude that the polymers described in Example 1 and Comparative Example 5 of D9 must have the same value for the MFR_{10}/MFR_2 ratio. Rather, given the difference in flow parameter n and molecular weight distribution, the skilled person would expect these two polymers to have very different values for MFR_{10}/MFR_2 .

5.4.4 Hence no reliable evidence has been provided as to the values of the intrinsic viscosity and the MFR_{10}/MFR_2 ratio for the copolymer produced in Comparative Example 5 of D9. The appellant has not discharged its burden of proof in this respect. Consequently, the claimed subject-matter is novel over Comparative Example 5 of D9.

5.5 In summary, the subject-matter claimed in the main request is novel over the prior art cited by the appellant, in particular Comparative Example 17 of D1, D7 and Comparative Example 5 of D9.

6. *Inventive step (main request)*

6.1 The claimed subject-matter relates to ethylene copolymers which are excellent in flowability in spite of their rather narrow molecular weight distribution.

The appellant suggests that either D9 or D11 might be used as the closest prior art. Both documents describe ethylene copolymers produced using conventional catalysts such as Ziegler catalysts. Consequently, they equally qualify as the closest prior art.

6.2 Following the amendment to Claim 1 to the preferred range of 1.2 to 3.0 for the molecular weight distribution, the appellant alleges that the new technical problem to be solved is less exacting. On the contrary, the technical problem to be solved by the subject-matter of amended Claim 1 is in fact more exacting. Amended Claim 1 requires a rather narrow molecular weight distribution.

6.3 Accordingly, the objective technical problem over the closest prior art has to be seen in the provision of ethylene copolymers having an improved range of properties, namely a rather low molecular weight distribution in combination with excellent flow properties.

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 and prepared in accordance with the process of Claim 2 of the main request using a specific hafnium catalyst.

Thus, the board is satisfied that the objective technical problem is solved.

6.4 D1, D9 and D11 relate to conventional ethylene copolymers made by conventional Ziegler catalysts. None of the prior art documents teaches the skilled person how the conventional polymers would have to be modified in order to achieve the beneficial combination of narrow molecular weight and excellent flow properties, let alone that this beneficial combination might be associated with the use of a specific catalyst. In fact, as is apparent from D10, when using the conventional catalysts described in all of D1, D9 and D11, polymers having a combination of narrow molecular weight distribution and good flow properties cannot be accessed. Moreover, it is apparent from D10 that on lowering the molecular weight distribution the skilled person would have correspondingly reduced the melt flow rate ratio. There is simply no teaching in D1, D9 or D11 which would enable the skilled person to maintain narrow molecular weight distribution whilst simultaneously increasing melt flow rate ratios. Thus, from whichever document the skilled person would start as the closest prior art (D9 or D11), the claimed subject-matter is not obvious from the cited prior art.

6.5 As regards the appellant's argumentation that the claimed subject-matter would be obvious either from D9 (in particular from Comparative Example 5) or from D11 in combination with D9 or D1 it appears that this argumentation is based on an *ex post facto* analysis in the knowledge of the patent in suit. The prior art does not provide any hint how the melt flow properties of ethylene copolymers prepared by conventional Ziegler

catalysts could be further improved whilst simultaneously reducing the molecular weight distribution.

6.6 In summary, the subject-matter as claimed in the main request is based on an inventive step.

7. Since the respondent's main request is allowable, any discussion of its auxiliary requests is superfluous.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young