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D E C I S I O N
of 5 November 2003

Case Number: T 0477/01 - 3.3.3

Application Number: 94118696.7

Publication Number: 0657476

IPC: C08F 10/00

Language of the proceedings: EN

Title of invention:
Alpha-olefin polymers, alpha-olefin polymerizing catalyst and process for producing alpha-olefin polymers

Patentee:
SUMITOMO CHEMICAL COMPANY LIMITED

Opponent:
Basell Polyolefine GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 84, 123(2), 123(3)

Keyword:
"Novelty (yes)"
"Inventive step (yes)"
"Change in category from a product-by-process to process claim (allowed)"

Decisions cited:
G 0009/92

Catchword:
-

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Case Number: T 0477/01 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 5 November 2003

Appellant: (Opponent)
Basell Polyolefine GmbH
Intellectual Property - F206
D-67056 Ludwigshafen (DFE)

Representative:
-

Respondent: (Proprietor of the patent)
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Representative:
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 22 February 2001 concerning maintenance of European patent No. 0657476 in amended form.

Composition of the Board:

Chairman: R. Young
Members: C. Idez
R. Moufang

Summary of Facts and Submissions

I. The grant of the European patent No. 0 657 476 in the name of Sumitomo Chemical Company Limited in respect of European patent application No. 94 118 696.7, filed on 28 November 1994 and claiming two JP priorities of 6 December 1993 and 20 April 1994 was announced on 3 June 1998 (Bulletin 1998/23) on the basis of 11 claims.

Independent Claims 1, 3, 5, 8 and 11 read as follows:

"1. An α-olefin polymer obtained by polymerizing an α-olefin having 3 or more carbon atoms which satisfies the following conditions:
the intrinsic viscosity [η] (measured in tetralin solvent at 135°C) of said polymer is not lower than 0.5 and not higher than 10, and
20°C xylene-soluble fraction (CXS) content (% by weight) and 105°C xylene-insoluble fraction (XIS) content (% by weight) of said polymer satisfy the following condition:

$$XIS \leq 70.00 - 3.64CXS$$

provided that CXS is not smaller than 0 and not greater than 15.

3. A process for producing an α-olefin polymer which comprises producing an α-olefin polymer obtained by polymerizing an α-olefin having 3 or more carbon atoms and satisfying the following conditions:

the intrinsic viscosity [η] (measured in tetralin solvent at 135°C) of said polymer is not lower than 0.5 and not higher than 10, and 20°C xylene-soluble fraction (CXS) content (% by weight) and 105°C xylene-insoluble fraction (XIS) content (% by weight) of said polymer satisfy the following condition:

$XIS \leq 70.00 - 3.64CXS$

provided that CXS is not smaller than 0 and not greater than 15, by the use of a catalyst system consisting of

(A) a solid catalyst component containing magnesium, titanium, halogen and an electron donative compound as essential components,
(B) an organoaluminum compound, and
(C) an electron donative compound component.

5. A polypropylene for use in the production of a biaxially oriented film which satisfies the following conditions (1) to (3):

(1) the content of 20°C xylene-soluble fraction (CXS) is 3.5% by weight or less,
(2) the content of 20°C xylene-soluble fraction (CXS, % by weight) and the content of 105°C xylene- insoluble fraction (XIS, % by weight) satisfy the following condition:

$XIS \leq 70.00 - 3.64CXS$,

and

(3) melt flow rate (MFR) at 230°C is from 0.5 to 10.0 g/10 minutes.

8. A polypropylene for use in the production of a biaxially oriented film obtained by carrying out a polymerization reaction by the use of a catalyst system consisting of:

(A) a solid catalyst component containing magnesium, titanium, halogen and an electron donative compound as essential components,
(B) an organoaluminum compound, and
(C) an electron donative compound component, which satisfies the following conditions (1) to (3):

(1) the content of 20°C xylene-soluble fraction (CXS) is 3.5% by weight or less,
(2) the content of 20°C xylene-soluble fraction (CXS, % by weight) and the content of 105°C xylene- insoluble fraction (XIS, % by weight) satisfy the following condition:

$XIS \leq 70.00 - 3.64CXS$,

and

(3) melt flow rate (MFR) at 230°C is from 0.5 to 10.0 g/10 minutes.

11. A biaxially oriented film obtained by subjecting a polypropylene for use in the production of a biaxially oriented film according to one of Claims 5 to 10 to a stretching processing."

Claims 2, 4, 6 to 7, and 9 to 10 were dependent on Claims 1, 3, 5, and 8 respectively.

II. On 1 March 1999, a Notice of Opposition was filed by Targor GmbH (later Basell Polyolefine GmbH), in which revocation of the patent in its entirety was requested on the grounds of lack of novelty and lack of inventive step (Article 100(a) EPC).

The objections were supported *inter alia* by the following documents:

D1: EP-A-0 318 049;

D2: Masahiro Kakugo et al "Microtacticity Distribution of Polypropylenes Prepared with Heterogeneous Ziegler-Natta Catalysts"; Macromolecules, 1988, Vol. 21, pages 314-319;

D3: Masahiro Kakugo et al "Characteristics of Ethylene- Propylene and Propylene-1-Butene Copolymerization over $TiCl_3$. $^1/_3$ $AlCl_3$-$Al(C_2H_5)_2Cl$"; Macromolecules, 1988, Vol. 21, pages 2309-2313;

D4: Akinori Toyota et al "Polymerization of propylene with an ethylene bis(1-indenyl)hafnium dichloride and methylaluminoxane catalyst system"; Journal of Molecular Catalysis, Vol. 56, 1989, pages 237-247;

D5: Dr. L. Bothe et al "Methoden zur Charakterisierung von Polypropylen", Kunststoffe, Vol.74, Nr.4, 1984, pages 225-228;

D6: C. Tzoganakis et al "Effect of Molecular Weight Distribution on the Rheological and Mechanical Properties of Polypropylene", Polymer Engineering and Science, March 1989, Vol. 29, No. 6, pages 390-396;

D7: EP-A-0 515 855; and

D8: Kunststoff Taschenbuch, 24th Edition, 1989, Hanser Verlag, page 371.

III. In its decision announced orally on 7 February 2001 and issued in writing on 22 February 2001, the Opposition Division held that the grounds of opposition raised and substantiated by the Opponent did not prejudice the maintenance of the patent in amended form.

The decision was based on Claims 1 to 11 as granted as main request, on Claims 1 to 11 as submitted during the oral proceedings of 7 February 2001 as first auxiliary request, and on Claims 1 to 11 as submitted during the oral proceedings of 7 February 2001 as second auxiliary request.

Claims 1 to 11 of the first auxiliary request differed from Claims 1 to 11 as granted, in that it had been indicated in independent Claims 1 and 3 that the intrinsic viscosity of the polymer must be not lower than 1,22 and not higher than 10.

Claims 1 to 11 of the second auxiliary request differed from Claims 1 to 11 as granted in that the value of the CXS of the polymer had been limited to 0,1 to 12 in

independent Claims 1 and 3, and in that Claims 5 and 8 had been made dependent on Claim 1.

The decision stated that Claim 1 of the main request lacked novelty in view of the polymers of fractions 11 of Table II, 10 and 12 of Table III and 13 of Table IV of document D3. Consequently the main request was refused.

Concerning the first auxiliary request, the decision held that the subject-matter of Claim 1 differed from fraction 13 of Table IV of D3 only in that the polymer according to Claim 1 should exhibit an intrinsic viscosity of at least 1.22 instead of 0.71 for the polymer of fraction 13 of D3. According to the decision, no unexpected effect could, however, be seen in relation to that increase in intrinsic viscosity. Thus, the Opposition Division came to the conclusion that the subject-matter of Claim 1 of the first auxiliary request lacked inventive step. This led to the refusal of the first auxiliary request.

The decision further stated that the subject-matter of the second auxiliary request was novel, since documents D1, D3, and D4 did not disclose the XIS parameter of the polymer according to Claim 1 of the second auxiliary request.

D1 or D4 (cf. in particular Examples 1 to 4, and 6 to 8 of D1,and Example 1 of Table 1 of D4) could be considered as the closest state of the art. The polymers disclosed in D1 or D4 differed from those of Claim 1 of the second auxiliary request in that they did not exhibit an XIS value in the claimed range.

Starting from D1 or D4 the technical problem was seen as to improve properties of biaxially stretched films made therefrom.

The Examples of the patent in suit showed that this problem was effectively solved. Thus, inventive step was acknowledged for the subject-matter of the claims 1 to 11 of the second auxiliary request.

IV. A Notice of Appeal was lodged on 2 May 2001 by the Appellant (Opponent), with simultaneous payment of the prescribed fee.

With the Statement of Grounds of Appeal filed on 4 July 2001, the Appellant submitted an experimental report. It also argued essentially as follows:

(i) Example 1 in Table 1 of document D4 disclosed the manufacture of a propylene polymer exhibiting an intrinsic viscosity of 2,96 dl/g.

(ii) Although the parameters XIS and CXS were not explicitly disclosed in D4, the polymer obtained in this Example 1 would meet these requirements.

(iii) In that respect documents D2 and D3 showed, as submitted in the letter of 7 December 2000 of the Opponent (Appellant), the relation between the melting points of the polymer and the elution temperature, i.e. its XIS value.

(iv) Furthermore, Run H of the annexed experimental report, which was a repetition of Example 1 of Table 1 of D4, showed that the polymer obtained

had a CXS value of 0.1% by weight and an XIS value of 8% by weight.

(v) Thus D4 was novelty destroying document for Claim 1 of the patent in suit.

(vi) One would come to the same conclusion for the Examples 1, 3, 4, 6 and 7 of D1.

(vii) Claim 2 would also lack novelty in view of D4 and D1 and Claims 5 to 7 were not novel over D4.

(viii) Since the use of the catalyst mentioned in Claims 3, 4, 8, 9 and 10 was known from document D7, these Claims lacked inventive step in view of the combination of either D1 with D7 or D4 and D7.

(ix) It was also known from D8 that polypropylene could be used for the manufacture of biaxially stretched films. Thus Claim 11 would lack inventive step in view of the combination of D4 with D8.

V. With its letter dated 14 February 2002, the Respondent (Patent Proprietor) submitted a set of 6 Claims and requested the patent be maintained on that basis.

Independent Claim 1 read as follows:

"A process for producing an α-olefin polymer which comprises producing an α-olefin polymer by polymerizing an α-olefin having 3 or more carbon atoms, said α-olefin polymer satisfying the following conditions:

the intrinsic viscosity [η] (measured in tetralin solvent at 135°C) of said polymer is not lower than 0.5 and not higher than 10, and

20° C xylene-soluble fraction (CXS) content (% by weight) and 105°C xylene-insoluble fraction (XIS) content (% by weight) of said polymer satisfy the following condition:

$$XIS \leq 70.00 - 3.64CXS$$

provided that CXS is not smaller than 0.1 and not greater than 12, by the use of a catalyst system consisting of

(A) a solid catalyst component containing magnesium, titanium, halogen and an electron donative compound as essential components,
(B) an organoaluminum compound, and
(C) an electron donative compound component."

Dependent Claim 3 read as follows:

"A process for producing a polypropylene for use in the production of a biaxially oriented film according to Claim 1, which comprises producing a polypropylene by polymerizing propylene by the use of a catalyst system consisiting (sic) of:

(A) a solid catalyst component containing magnesium, titanium, halogen and an electron donative compound as essential components,
(B) an organoaluminum compound, and

(C) an electron donative compound component, wherein said polypropylene obtained satisfies the following conditions (1) to (3):
(1) the content of 20°C xylene-soluble fraction (CXS) is 3.5% by weight or less,
(2) the content of 20°C xylene-soluble fraction (CXS, % by weight) and the content of 105°C xylene-insoluble fraction (XIS, % by weight) satisfy the following condition:

$$XIS \leq 70.00 - 3.64CXS, \text{ and}$$

(3) melt flow rate (MFR) at 230°C is from 0.5 to 10.0 g/10 minutes."

Independent Claim 6 reads as follows:

"Use of a polypropylene obtained according to the process claimed in Claim 3 in a stretching process for the production of a biaxially oriented film."

Claims 2 and 4 to 5 were dependent on Claims 1 and 3 respectively.

The Respondent argued essentially as follows:

(i) Claim 1 was directed to a process for producing an α-olefin having specific intrinsic viscosity, CXS and XIS values and obtained while using a heterogeneous Ziegler-Natta catalyst.

(ii) This Claim was novel over D1 to D8 since none of these documents disclosed the manufacture of such

an α-olefin polymer in the presence of such catalyst.

(iii) Furthermore, the polymer obtained differed from the polymer obtained by using a homogeneous catalyst as used in D1. This was evident from pages 433 and 440 of Summary Report of the Sixth International Business Forum on Speciality Polyolefins SPO 1996, annexed to the letter of 14 February 2002.

(iv) This document showed that polypropylene polymers obtained by using single site metallocene catalyst had poor stretchability.

(v) D1 and D4 did not suggest that an α-olefin polymer having the properties set out in Claim 1 might be obtained with a Ziegler-Natta catalyst system.

(vi) D7 could not suggest that α-olefin polymers having the properties set out in Claim 1 would have improved stretchability and stiffness.

(vii) Thus, the subject-matter of Claims 1 to 6 was novel and inventive over the cited prior art.

VI. With its letter dated 11 August 2003, the Appellant indicated, that, in view of the amended set of Claims submitted by the Respondent with its letter of 14 February 2002, it maintained its request for the revocation of the patent in totality.

VII. Oral proceedings were held on 5 November 2003.

Following preliminary observations of the Board concerning the wording of Claims 3 and 6 of the set of claims 1 to 6 filed by the Respondent with its letter dated 14 February 2002, the Respondent submitted a set of Claims 1 to 5 in order to replace its main request on file.

This set of claims differed from that submitted with the letter dated 14 February 2002 in that Claim 6 thereof had been deleted, in that a clerical minor error had been corrected in Claim 4 (i.e. "wherin" should read "wherein") and in that Claim 3 had been amended to read as follows:

"A process according to Claim 1 wherein the α-olefin polymer is a polypropylene for use in the production of a biaxially oriented film, wherein the process comprises producing a polypropylene by polymerizing propylene by the use of a catalyst system consisting of:

(A) a solid catalyst component containing magnesium, titanium, halogen and an electron donative compound as essential components,
(B) an organoaluminum compound, and
(C) an electrodonative compound component, wherein said polypropylene obtained satisfies the following conditions (1) to (3):
(1) the content of 20°C xylene-soluble fraction (CXS) is 3.5% by weight or less,
(2) the content of 20°C xylene-soluble fraction (CXS, % by weight) and the content of 105°C xylene-insoluble

fraction (XIS, % by weight) satisfy the following condition:

$$XIS \leq 70.00 - 3.64CXS, \text{ and}$$

(3) melt flow rate (MFR) at 230°C is from 0.5 to 10.0 g/10 minutes."

The submissions of the Parties at the oral proceedings may be summarized as follows:

(i) While the Appellant declared that it had no objection under Articles 54, 84, 123(2) and 123(3) EPC against the new main request of the Respondent and did not contest that the polypropylene resins obtained by the claimed process had good film processing properties, it submitted, however, that the subject-matter of the main request lacked inventive step. In that respect it argued essentially as follows:

(i.1) Document D4 should be considered as the closest state of the art, since it disclosed in Run 1 of Table I a polypropylene polymer which fulfilled all the requirements set out in Claim 1 of the patent in suit in terms of intrinsic viscosity, CXS content and relation between XIS and CXS.

(i.2) The polypropylene disclosed in that Example of D4 had been obtained while using a metallocene catalyst (i.e. ethylene bis(1-indenyl)hafnium dichloride).

(i.3) Even if D4 did not expressly relate to the manufacture of films, it was clear for the skilled person in view of document D1 which also referred to the manufacture of polypropylene polymers for making films in the presence of similar metallocene catalysts (i.e. zirconium based), that the polypropylene disclosed in Run 1 of D4 would be particularly suitable for making films.

(i.4) Thus, starting from D4 the technical problem might be seen as to provide an alternative process for making a polypropylene polymer suitable for making films.

(i.5) Since Ziegler Natta catalysts such as those used in the patent in suit were well known in the art (cf. for example document D7) in the manufacture of polypropylene resins, it would have been obvious for the skilled person to adapt the process of D4 to the use of the Ziegler-Natta catalysts such as those disclosed in D7 in order to obtain a polypropylene having the characteristics of that of Run 1 of D4.

(ii) The Respondent, while essentially relying on the arguments presented in its letter dated 14 February 2002, presented further arguments which may be summarized as follows:

(ii.1) Document D1 should represent the closest state of the art.

(ii.2) D1 related to polypropylene resins useful for the manufacture of films, but D1 contained no information concerning the XIS value of the polypropylene resins disclosed therein.

(ii.3) It could not be deduced from the melting point of the polypropylene disclosed in the Examples of D1, as had been done by the Appellant in its letter of 7 December 2000, that these resins would also have a XIS value in the range required in the patent in suit.

(ii.4) The polypropylenes according to D1 were said to exhibit a high crystallinity. This would result in films of high stiffness but of reduced stretchability.

(ii.5) In contrast, the polypropylenes obtained according to the process of the patent in suit led to films having a good compromise of stretchability and stiffness. In that respect, the value of the XIS parameter of the polypropylene resin was of utmost importance in order to obtain such properties.

(ii.6) Thus, starting from D1 the technical problem must be seen as to provide a process for polypropylene resins having improved films processing properties.

(ii.7) Document D4 was a scientific publication dealing with polymerization of propylene in presence of metallocene catalysts and was not concerned with the manufacture of films.

(ii.8) Although document D7 disclosed the catalysts used in the patent in suit, it did not give any indication on the CXS and the XIS values of the polypropylenes obtained.

(ii.9) Thus, the subject-matter of Claims 1 to 5 involved an inventive step.

VIII. The Appellant requested that the decision under appeal be set aside and the European patent No. 0 657 476 be revoked.

The Respondent requested that the patent be maintained on the basis of the main request consisting of Claims 1 to 5 filed during the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Procedural matter*

2.1 As stated in the decision G 9/92 of the Enlarged Board of Appeal (OJ EPO 1994, 875), if the opponent is the sole Appellant against an interlocutory decision maintaining a patent in amended form, the patent proprietor is primarily restricted during the appeal proceedings to defending the patent in the form in which it was maintained by the Opposition Division in its interlocutory decision. Amendments proposed by the

patent proprietor as a party to the proceedings as of right under Article 107, second sentence, EPC, may be rejected as inadmissible by the Board of Appeal if they are neither appropriate nor necessary.

2.2 In the present case, in the Board's view, the filing of the set of Claims 1 to 5 by the Respondent, represented an appropriate response to the arguments and evidence submitted by the Appellant in support of its objections of lack of novelty and lack of inventive step during the course of the appeal proceedings against the subject-matter of the claims on the basis of which the Opposition Division intended to maintain the patent. It is also evident that this main request, in the case it would be considered as allowable, would not worsen the position of the Appellant, since it would lead to a restriction of the scope of protection in comparison to that of the set of claims of the second auxiliary request considered as allowable by the Opposition Division (cf. decision G 9/92; points 9, 12, 15 and 16 of the Reasons).

2.3 Consequently, the Board sees no reason not to admit the main request into the proceedings.

3. *Wording of the claims*

3.1 Article 123(2) EPC

3.1.1 Claim 1 is supported by original Claim 5 read in combination with page 4, lines 49 to 50 of the application as originally filed.

3.1.2 Claim 2 finds its support in original Claim 6.

3.1.3 Although original Claim 10 was drafted as an independent claim, it is, however, clear from the application as originally filed (cf. page 4, lines 50 to 51) that the range of melt flow rate indicated in this claim, i.e. from 0.5 to 10.0 g/10 minutes corresponds to a range of intrinsic viscosity of 1.4 to 3.4, i.e. to a narrower range than the range defined in Claim 5 for this characteristic (i.e. from 0.5 to 10), so that the subject-matter of original Claim 10 *de facto* falls under the scope of original Claim 5. It thus follows that original Claim 10 provided an adequate support for dependent Claim 3. For the same reasons, one comes also to the conclusion that dependent Claims 4 and 5, which refer back to Claim 3 are supported by original Claims 11 and 12, which referred back to original Claim 10.

3.1.4 It thus follows that the requirements of Article 123(2) EPC are met by all the claims.

3.2 Article 123(3) EPC

3.2.1 Independent Claim 1 has further been limited in respect of granted Claim 3, in that the CXS of polymer has been restricted to the range 0.1 to 12. Thus, no objection under Article 123(3) EPC arises in respect of Claim 1 and, by way of consequence, in respect of Claim 2 which refers back to Claim 1.

3.2.2 Claim 3 results from the reformulation of granted Claim 8, which was drafted as a product-by-process claim, as a process claim. Consequently, the protection afforded by granted Claim 8 encompassed the product

described in this claim and its manufacture covered by the process described in this claim. Thus, the change of category in the present case results in a restricted scope of protection.

3.2.3 Thus, Claim 3 and dependent Claims 4 to 5, which refer back to Claim 3, meet the requirements of Article 123(3) EPC.

3.3 Article 84 EPC

No objection under Article 84 EPC has been raised by the Appellant in respect of the main request. The Board is also satisfied that the requirements of Article 84 EPC are met by Claims 1 to 5.

4. *Novelty*

4.1 In the Statement of Grounds to Appeal filed by the Appellant on 4 July 2001, lack of novelty of the subject-matter of the claims then on file has been alleged by the Appellant only in view of documents D1 and D4. However, at the oral proceedings of 5 November 2003, the Appellant, as indicated above in Section VII (i) raised no objection under Article 54 EPC in respect of Claims 1 to 5.

4.2 In this connection, it has been correctly highlighted by the Appellant at the oral proceedings (cf. points VII (i.2) and (i.3) above), that documents D1 and D4 relate to the use of metallocene catalysts for the manufacture of α-olefin polymers.

4.3 Since Claim 1 is directed to a process characterized, in particular, by the use of specific Ziegler-Natta catalysts, it can only be concluded that D1 and D4 cannot destroy the novelty of the subject-matter of Claim 1 of the main request.

4.4 The same conclusion applies *a fortiori* for the subject-matter of dependent Claims 2 to 5.

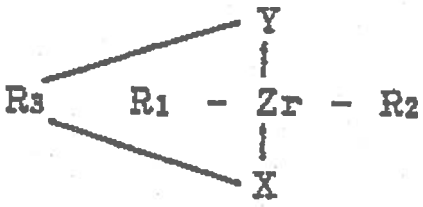
4.5 Consequently, the subject-matter of Claims 1 to 5 meets the requirements of Article 54 EPC.

5. *Problem and solution*

5.1 The patent in suit concerns a process for manufacturing α-olefin polymers, in particular polypropylene, which are suitable for the production of biaxially oriented films.

5.2 Such a process is known from D1, which the Board regards as representing the closest state of the art. Document D4 cannot adequately fulfil this function, since, as rightly submitted by the Respondent (cf. point VII (ii.7) above), it is not concerned with the manufacture of films from α-olefin polymers.

5.3 Document D1 is concerned with crystalline copolymers of propylene, and with a process for preparing them. It relates to a process comprising polymerizing mixtures of propylene with ethylene and/or alpha-olefins CH_2=CHR wherein R is an alkyl radical of from 2 to 10 C atoms, with catalysts obtained from stereorigid and chiral compounds of zirconium, of formula:



wherein:

R_1 and R_2 are halogens or alkyl groups of from 1 to 6 C atoms or hydrogen; X and Y are asymmetrical single-ring or multi-ring organic radicals; R_3 is a linear radical of from 1 to 4 C atoms, or a cyclic group containing from 3 to 6 C atoms; and by operating under conditions in which the content of ethylene and/or alpha-olefin present in the mixture in the gas phase is maintained within the range of from 2 to 10 mol %, and the polymerization temperature is lower than 20°C. Specific zirconium compounds are ethylene-bis-indenyl-$ZrCl_2$ and ethylene-bis(tetrahydroindenyl)-$ZrCl_2$. A preferred alumoxanic compound is polymethylalumoxane. The copoloymers obtained are endowed with a high crystallinity, and with very good mechanical properties. They have a melting point comprised within the range of from 110°C to 140° C and show a limited solubility in cold xylene (soluble polymer fraction in xylene at 25°C lower than 10%). They exhibit an intrinsic viscosity in tetralin at 135°C higher than 0.2 dl/g. The copolymers are mainly used in the field of films (column 1, line 33 to column 2, line 42; column 3, lines 16 to 28).

5.4 As mentioned above in paragraph 5.3, the polymers obtained according to the process of D1 exhibit a high crystallinity. However, as stated in the patent in suit (cf. page 2, lines 21 to 25), a high crystallinity of the polymer, while improving the stiffness of the films

obtained therefrom, nevertheless drastically reduces their stretchability.

5.5 Thus, starting from D1 the technical problem may be seen in the provision of a process leading to alpha-olefin polymers allowing the manufacture of films showing a good compromise between stiffness and stretchability.

5.6 According to Claim 1 of the main request, this problem is solved by conducting the polymerization of an α-olefin having 3 or more carbon atoms in presence of a specific solid catalyst containing magnesium, titanium, halogen and an electron donative compounds as essential components in order to obtain a polymer exhibiting a specific relation between solubility in xylene at 20°C (CXS) and insolubility in xylene at 105°C (XIS).

5.7 In this connection, Examples 7 to 9 of the patent show that the films obtained from the polymer prepared according to the claimed process have a good stretchability and a good stiffness (i.e. a high Young's modulus). These results have not been disputed by the Appellant. Thus, it is plausible to the Board that the technical problem has effectively been solved by the claimed measures.

6. *Inventive step*

It remains to be decided whether this solution was obvious to a person skilled in the art having regard to the state of the art relied upon by the Appellant.

6.1 As indicated above in paragraph 5.2, document D1 relates to a method for manufacturing propylene copolymers which are highly crystalline and which show a limited solubility in cold xylene and an intrinsic viscosity in tetralin at 135°C higher than 0.2 dl/g. While D1 discloses in its Examples 1, and 3 to 8 propylene copolymers having an intrinsic viscosity in tetralin at 135°C and a solubility in xylene at 20°C meeting the requirements set out in Claim 1 of the main request for these parameters (i.e. η and CXS), it is however totally silent on the insolubility of the copolymers at 105°C in xylene (i.e. the XIS value according to the patent in suit).

6.2 In that respect, the argument of the Appellant (cf. points IV (iii) and (vi) above) that the copolymers disclosed in these Examples of D1 will, in view of their melting temperature (i.e. in the range of 134,9°C to 123°C), inevitably have an XIS in the range required by Claim 1 of the main request cannot be regarded as well founded, since there is no evidence that the relation between melting points and elution temperatures in xylene shown in document D2 (cf. Figures 2 and 3) for polypropylene **homopolymers** prepared by using a **Ziegler-Natta catalyst** would also apply for **propylene copolymers** prepared in presence of a **metallocene catalyst** according to D1.

6.3 Even if the copolymers of the Examples 1, 3 to 8 of D1 would have exhibited an XIS value meeting the requirements of Claim 1 of the main request, D1 is, in any case, firstly totally silent on the influence of suchparameter on the stretchability and the stiffness of films prepared from the copolymers, and secondly

gives no indication as to whether such copolymers could also be prepared by polymerization in the presence of a Ziegler-Natta catalyst according to the patent in suit instead of a metallocene catalyst according to D1.

6.4 Thus, document D1 itself cannot suggest the solution of the technical problem.

6.5 The Appellant has further relied on documents D4 and D7 for substantiating its objection of lack of inventive step.

6.5.1 However, while document D4 deals with the polymerization of propylene in presence of a specific metallocene catalyst, i.e. ethylene bis(1-indenyl)hafnium dichloride and with the meso-meso triad sequence content of the propylene resins obtained, D4 is in no way concerned with the manufacture of films. Thus, in the Board's view, at least for this reason, D4 cannot provide a hint to the solution of the technical problem.

6.5.2 Furthermore, the line of argument developed by the Appellant was based on the assumption that the process of Run 1 of Table 1 of D4 led to a propylene polymer having all the characteristics required for the polymer obtained according to the process of Claim 1.

6.5.3 In this connection, it is noted by the Board

(i) firstly, that, while D4 indicates that the polymer of Run 1 has an intrinsic viscosity of 2.96 dl/g, it does not disclose the conditions under which this intrinsic viscosity has been

determined (temperature, solvent), so that no valid comparison can be made with the values of the intrinsic viscosity set out in Claim 1 of the main request,

(ii) secondly, that D4 discloses neither the CXS nor the XIS values of the copolymer obtained in Run 1, and for the same reasons as indicated above in paragraph 6.2 its XIS value cannot be deduced from its melting point, and

(iii) thirdly, that, although the Appellant has stated that it has exactly repeated Run 1 of D4 in its Run H of the experimental report submitted with the Statement of Grounds of Appeal, the polymer obtained in this Run H differs from that of Run 1 of D4, at least by its polydispersity (1,95 instead of 2,37), its molecular weight Mn (144 000 instead of 190 000) and its melting temperature (135,1°C instead of 132,6°C).

6.5.4 It thus follows that it is has not been established that the polymer of Run 1 of D4 indeed meets the requirements set out in terms of intrinsic viscosity, CXS and XIS in Claim 1 of the main request, so that the line of argument of the Appellant must be seen, *ab initio*, as flawed.

6.5.5 Even if, for sake of argument, one would consider that the polymer obtained in Run 1 of D4 indeed fulfilled the requirements in terms of intrinsic viscosity, CXS and XIS values set out in Claim 1, the further arguments of the Appellant

(a) that the skilled person would know, in view of the similarity of the catalyst used for the preparation of the polymer of Run 1 with those used in D1 that the polymer of Run 1 would also be suitable for manufacturing films, and

(b) that, it would have been obvious for the skilled person to prepare the copolymer of Run 1 of D4 with a Ziegler-Natta catalyst such as those required by Claim 1 of the main request,

must be regarded as not pertinent for the following reasons:

(i) D4 does not refer to D1. Neither does D1 refer to D4. Thus, in the absence of a direct link between D1 and D4 it cannot be inferred that the polymer disclosed in Run 1 of D4 would inevitably be suitable for manufacturing films as are those of D1, and

(ii) D4 also shows (cf. Fig 2 thereof) that the structures (in terms of meso-meso triad sequences content, i.e. in terms of isotactic structure and therefore in terms of solubility in xylene) of propylene polymers having the same melting points drastically differ when the polymers are prepared with metallocene catalysts instead of Ziegler-Natta catalysts. Thus D4 would indeed lead the skilled person away from trying to prepare the same propylene polymer as that of Run 1 of D4 with a Ziegler-Natta catalyst.

6.5.6 It thus follows from the above that D4 alone or in combination with D1 cannot lead to the solution of the technical problem.

6.5.7 Document D7 relates to high-flow propylene/ethylene copolymers which have a melt flow rate of from 2 to 200 g/10 min under a load of 2.16 kg at 230°C and to a process for their manufacture. They may be produced from the gas phase by polymerization in two stages in an agitated fixed bed in the presence of hydrogen acting as chain stoppage regulator and using a Ziegler-Natta catalyst system comprising a titaniferous solid component which contains a magnesium compound on finely divided silicon oxide or on finely divided aluminium oxide or on a finely divided aluminium silicate. The titaniferous solid component usually also contains electron donating compounds, for example monofunctional or polyfunctional carboxylic acids, carboxylic anhydrides, and carboxylic esters, or ketones, ethers, alcohols, lactones, and phosphorus-organic and silicon-organic compounds. The titaniferous solid component thus obtained is used in combination with an aluminium component to form the Ziegler-Natta catalyst system.

Suitable aluminium compounds are trialkylaluminium and compounds of this type in which one of the alkyl groups is replaced by an alkoxy group or by a halogen atom such as a chlorine or bromine atom.

An electron donating compound as a further catalyst component may be used in addition to the above aluminum compound, examples of which are monofunctional or polyfunctional carboxylic acids, carboxylic anhydrides, carboxylates, ketones, ethers, alcohols, lactones,

phosphorus-organic compounds, and silicon-organic compounds. The propylene/ethylene copolymers obtained are particularly well suited for the manufacture of films and moulded articles (cf. D7, page 2, lines 1 to 7; page 3, lines 16 to 44; page 4, lines 16 to 25; page 5, line 21).

6.5.8 It is true that the copolymers of D7, which have been obtained by polymerization in the presence of a Ziegler-Natta catalyst falling under the definition of the catalyst according to Claim 1 of the main request, might also fulfil, in view of their melt flow rate of 2 to 200 g/10 min, the requirements in terms of intrinsic viscosity set out in Claim 1 of the main request, and might be useful in the manufacture of films. D7 makes, however, no mention of the CXS and the XIS of these copolymers.

6.5.9 Hence, D7 would not offer to the skilled person a hint to the solution of the technical problem.

6.6 Nor would the documents D2 and D3 lead the skilled person to the solution of the technical problem, since they are not concerned with the manufacture of films, and consequently, although disclosing the XIS and CXS of propylene polymers, this is not associated with any suggestion of what the effect of these properties on the stretchability and the stiffness of films made from such polymers might be.

6.7 The information contained in the remaining documents (i.e. D5, D6, and D8) is in the Board's view, even less relevant, since they are not concerned with the XIS and the CXS of propylene polymers and, in the case of D5 and D6, not with the manufacture of films either. They

are therefore of no assistance in the solution of the technical problem.

6.8 Consequently the subject-matter of Claim 1, and by the same token, that of Claims 2 to 5 involves an inventive step (Article 56 EPC).

7. It thus follows that the main request of the Respondent is allowable.

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 on the basis of the set of claims 1 to 5 filed during oral proceedings, and after any necessary consequential amendment of the description.

The Registrar: The Chairman:

E. Görgmaier R. Young