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D E C I S I O N
of 24 September 2004

Case Number: T 0951/01 - 3.3.3

Application Number: 92304926.6

Publication Number: 0516458

IPC: C08F 4/02

Language of the proceedings: EN

Title of invention:

Olefin polymerization solid catalyst, olefin polymerization catalyst and olefin polymerization

Patentee:

MITSUI CHEMICALS, INC.

Opponent:

Basell Polyolefine GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 123(2)

Keyword:

"Amendments - added subject-matter (no)"
"Novelty (yes) - no implicit disclosure in the prior art"
"Inventive step (yes) after amendment"

Decisions cited:

G 0004/92, T 0035/85, T 0133/92, T 0771/92, T 0925/98

Catchword:

-



Case Number: T 0951/01 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 24 September 2004

Appellant: Basell Polyolefine GmbH
(Opponent) Intellectual Property - F206
D-67056 Ludwigshafen (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
3 May 2001 and posted 5 June 2001 concerning
maintenance of European patent No. 0516458 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. 0 516 458, with 11 claims, in respect of European patent application No. 92 304 926.6, in the name of Mitsui Petrochemical Industries, Ltd. (now Mitsui Chemicals, Inc.), filed on 29 May 1992 and claiming priority from six earlier patent applications in Japan, was published on 23 April 1997 (Bulletin 1997/17). Independent Claims 1, 5, 6, 7 and 11 read as follows:

"1. A solid component [A-1] of a catalyst for use in the polymerization of at least one olefin, which catalyst component comprises;

(a-1) a particulate carrier which is
(i) composed of an oxide of at least one element belonging to Group II, III or IV of the Periodic Table, (ii) contains less than 1.0% by weight of water and (iii) comprises 2.0 to 3.5% by weight of surface hydroxyl groups; and supported on said particulate carrier (a-1)

(a-2) an organoaluminum oxy compound, and
(a-3) at least one compound of a transition metal of Group IV B of the Periodic Table containing a ligand having a cyclopentadienyl skeleton.

5. An olefin polymerization catalyst which comprises a solid component [A-1] as claimed in any one of the preceding claims, and [C-2] a catalyst component which is an organoaluminum compound.

6. A process for preparing an olefin polymer which comprises polymerizing at least one olefin in the presence of a solid catalyst component [A-1] as claimed in any one of claims 1 to 4 or olefin polymerization catalyst as claimed in claim 5.

7. An olefin polymerization solid catalyst obtainable by prepolymerizing at least one olefin in the presence of;
[A-2] a solid catalyst component comprising (a-1) a particulate carrier which is (i) composed of an oxide of at least one element belonging to Group II, III or IV of the Periodic Table, (ii) contains less than 1.0% by weight of water and (iii) comprises 2.0 to 3.5% by weight of surface hydroxyl groups, and supported on the particulate carrier (a-1);

(a-2) an organoaluminum oxy compound
[B] a catalyst component which is a compound of at least one transition metal belong *[sic]* to Group IVB of the Periodic Table containing a ligand having a cyclopentadienyl skeleton; and, optionally,
[C-1] a catalyst component which is an organoaluminum compound.

11. A process for preparing an olefin polymer which comprises polymerizing at least one olefin in the presence of a catalyst as claimed in any one of claims 7 to 10."

Claims 2 to 4 and 8 to 10 were dependent claims directed to elaborations of the subject-matter of

independent Claims 1 and 7, respectively. Claims 3 and 9 read, respectively, as follows:

"3. A catalyst component according to claim 1 or 2, wherein (a-3) is a compound wherein the cyclopentadienyl skeleton is substituted by a hydrocarbon group.

9. A catalyst according to claim 7 or 8, wherein [B] is a compound wherein the cyclopentadienyl skeleton is substituted by a hydrocarbon group."

II. A notice of opposition was filed on 19 January 1998 by Targor GmbH (now Basell Polyolefine GmbH), requesting revocation of the patent in its entirety on the grounds of Article 100(a) EPC for lack of novelty and lack of inventive step. The opposition was supported *inter alia* by documents D5 and D6. Both documents were filed late (with letter dated 14 April 2000), but were introduced into the proceedings by the opposition division (point 11 of the decision):

D5: EP-A-0 313 386; and

D6: EP-A-0 287 666.

During prosecution of the case before the opposition division, amended sets of claims were filed by the proprietor, by way of a main request (filed on 14 April 2000) and auxiliary requests I to III (all filed on 5 March 2001).

III. By an interlocutory decision which was announced orally on 3 May 2001 and issued in writing on 5 June 2001, the opposition division decided that the patent could be maintained in amended form on the basis of the proprietor's auxiliary request I comprising 9 claims.

- (a) Claim 1 of auxiliary request I corresponded to Claim 1 as granted except that the subject-matter of granted Claim 3 was included (an amendment which specified that the cyclopentadienyl skeleton in the compound (a-3) was substituted by a hydrocarbon group) and that the following clause was introduced at the end of the claim:

"wherein said solid component [A-1] is obtainable by a process comprising a step of bringing the components (a-1) and (a-2) into contact with each other in an atomic ratio of $[OH/Al_{a-2}]$ of the surface hydroxyl group of the component (a-1) to the component (a-2) in terms of aluminum atom of 0.15 to 0.5".

Claim 6 of auxiliary request I corresponded to Claim 7 as granted except that the subject-matter of granted Claim 9 was included (an amendment which specified that the cyclopentadienyl skeleton in the catalyst component [B] was substituted by a hydrocarbon group), the phrase "belong to Group IVB" was replaced by "of Group IVB", and the following clause was introduced (after the wording "(a-2) an organoaluminum oxy compound"):

"wherein said solid component [A-2] is obtainable by a process comprising a step of bringing the

components (a-1) and (a-2) into contact with each other in an atomic ratio of $[OH/Al_{a-2}]$ of the surface hydroxyl group of the component (a-1) to the component (a-2) in terms of aluminum atom of 0.15 to 0.5".

Claims 2 to 5 and 7 to 9 of auxiliary request I corresponded to granted Claims 2, 4 to 6, 8, 10 and 11.

- (b) According to the decision, the amended claims of auxiliary request I met the requirements of Article 123 EPC and the subject-matter claimed in these claims was novel and inventive over D5 and D6. In particular, it was held that a two-fold selection had to be made from the disclosure of D5, ie specific silica and a specific metallocene had to be selected from two lists, in order to arrive at something falling within the scope of Claim 1.

IV. On 15 August 2001, a notice of appeal was filed against the above decision by the opponent (hereinafter referred to as the appellant) with simultaneous payment of the prescribed fee.

Together with the statement of grounds of appeal, filed on 26 September 2001, the appellant submitted documents D7 and D8:

D7: EP-A-0 129 368; and

D8: J.A. Ewen, Studies in Surface Science and Catalysis 25 (1986), pages 271 to 292.

The appellant argued that the subject-matter of the claims as maintained by the opposition division was not novel over D5 and D6. But even if novelty were acknowledged, the claimed subject-matter was not based on an inventive step over D5 (closest state of the art) in combination with D7 and D8.

- V. In response to the statement of grounds of appeal, the proprietor (hereinafter referred to as the respondent) filed on 13 August 2002 new claims 1 to 8 and requested that the patent be maintained on the basis of these claims (main request).

Claim 1 of the main request corresponded to Claim 1 of auxiliary request I as maintained by the opposition division except that it was further amended to specify that the catalyst component [A-1] had been prepolymerized in a suspension or a vapour phase and amount of prepolymer formed. Claim 5 corresponded to Claim 6 of auxiliary request I as maintained by the opposition division except that it was amended to specify the amount of prepolymer in the prepolymerized catalyst.

According to the respondent, the subject-matter of the claims was novel over D5 and D6 because neither of these documents discussed the amount of prepolymer in a catalyst of this type. Since, furthermore, the presence of the prepolymer in the catalyst had the technical advantage of reducing the amount of fine powder during olefin polymerisation (as apparent from Table 2 in the patent in suit) and such an advantage was neither taught nor suggested by the prior art, the claimed subject-matter involved also an inventive step.

VI. In a communication, issued on 16 June 2004 accompanying a summons to oral proceedings, the salient issues as to the claims on file were identified by the board as being clarity (Article 84 EPC) and allowability of the amended claims (Article 123(2) EPC). In particular, the board was of the opinion that some of the amendments introduced into Claims 1 and 5 already at the opposition stage were not supported by the application as originally filed although the decision under appeal had considered them allowable under Article 123(2) EPC and the appellant had not raised an objection in this respect. Furthermore, novelty and inventive step of the claimed subject-matter over D5 and D6, in particular Examples 4 and 5 of D5, would have to be discussed at the scheduled oral proceedings.

VII. In a letter filed on 23 August 2004, the appellant informed the board that it would not attend the scheduled oral proceedings. However, it maintained its request to revoke the patent in its entirety because the further requirement that the catalyst has been prepolymerized (Claim 1) and the specification of the amount of prepolymer formed (Claims 1 and 5) was not suitable to establish novelty and inventive step over Example 19 of D6. According to the calculation of the appellant, the catalyst used in Example 19 of D6 contained prepolymer in an amount as required in amended Claim 1.

VIII. In a letter filed on 24 August 2004, the respondent argued that the claims of the main request on file were clear and correctly supported by the application as originally filed. As regards Examples 4 and 5 of D5,

the catalyst used in these examples possessed too few surface hydroxyl groups so that claimed subject-matter was novel over D5. D5 also did not teach towards the process of prepolymerization. In addition, a first, second, third and fourth auxiliary request were submitted.

IX. On 24 September 2004, oral proceedings were held before the board at which the respondent, but not the appellant, was represented. Because the latter party had been duly summoned, however, the oral proceedings were continued in its absence in accordance with Rule 71(2) EPC.

At the beginning of the oral proceedings the discussion focussed on the question as to whether or not the amendments in Claims 1 and 5 of the main request filed on 13 August 2002 met the requirements of Article 123(2) EPC and whether the amended claims of the first auxiliary request filed on 24 August 2004 were allowable in principle (*reformatio in peius*). In view of this discussion, the respondent withdrew the main, first and second auxiliary request then on file and submitted as its new main request a set of Claims 1 to 8 wherein Claims 1 and 5 read as follows:

- "1. A solid component [A-1] of a catalyst for use in the polymerization of at least one olefin, which catalyst component comprises;
 - (a-1) a particulate carrier which is (i) composed of an oxide of at least one element belonging to Group II, III or IV of the Periodic Table,
 - (ii) contains less than 1.0% by weight of water and
 - (iii) comprises 2.0 to 3.5% by weight of

surface hydroxyl groups; and supported on said particulate carrier (a-1)

(a-2) an organoaluminum oxy compound; and (a-3) at least one compound of a transition metal of Group IV B of the Periodic Table containing a ligand having a cyclopentadienyl skeleton substituted by a hydrocarbon group, and 1 to 100g of prepolymer based on 1g of compound (a-1),

wherein said solid component [A-1] is obtainable by a process comprising a step wherein (a-1), (a-2) and (a-3) are mixed and contacted, the atomic ratio $[OH/Al_{a-2}]$ of the surface hydroxyl group of the component (a-1) to the component (a-2) in terms of aluminum atom being 0.15 to 0.5, and prepolymerizing an olefin in a suspension or a vapour phase.

5. An olefin polymerization solid catalyst obtainable by prepolymerizing at least one olefin in the presence of;

[A-2] a solid catalyst component comprising (a-1) a particulate carrier which is (i) composed of an oxide of at least one element belonging to Group II, III or IV of the Periodic Table, (ii) contains less than 1.0% by weight of water and (iii) comprises 2.0 to 3.5% by weight of surface hydroxyl groups, and supported on the particulate carrier (a-1);

(a-2) an organoaluminum oxy compound

[B] a catalyst component which is a compound of at least one transition metal of Group IVB of the Periodic Table containing a ligand having a

cyclopentadienyl skeleton substituted by a hydrocarbon group; and, optionally, [C-1] a catalyst component which is an organo-aluminum compound, wherein said solid component [A-2] is obtainable by a process comprising a step wherein (a-1) and (a-2) are mixed and contacted, followed by mixing and contacting the transition metal compound [B] and, if necessary, the organoaluminum compound [C-1], the atomic ratio $[OH/Al_{a-2}]$ of the surface hydroxyl group of the component (a-1) to the component (a-2) in terms of aluminum atom being 0.15 to 0.5; and wherein the catalyst comprises 1 to 100g of prepolymer based on 1g of compound (a-1)."

Claims 2 to 4 and 6 to 8 corresponded to granted Claims 2, 5, 6, 8, 10 and 11.

As regards novelty, the most relevant document was considered to be D6, and in particular Example 19 of D6. According to the respondent, the subject-matter of Claim 1 of the new main request differed from Example 19 of D6 in more than one aspect, ie not only in the substitution of the cyclopentadienyl ligand. Although the water content of the silica used in Example 19 of D6 was said to be 0.6%, this allegation had not been demonstrated by the appellant. As regards the appellant's calculation of the amount of prepolymer (based on 1g of carrier) obtained in Example 19, it did not take into account the loss of aluminoxane inevitably occurring during the preparation of the solid catalyst. Thus, the water content and the actual amount of prepolymer (based on 1g of carrier) of the

catalyst of Example 19 remained unknown, at best uncertain. Having regard to the assessment of inventive step, the respondent pointed out that it was the combination of features required in the claims which provided the advantageous effect associated with the solid catalyst. This was apparent, for example, from a comparison of the data of Example 7 and Example 2 (outside the scope of the amended claims) in Table 2 of the patent in suit.

Although the sets of claims of the previous third and fourth auxiliary requests were neither amended for conformity with the newly filed main request nor explicitly withdrawn, they were not pursued further during the oral proceedings.

- X. The appellant requested that the decision under appeal be set aside and the patent be revoked in its entirety (section VII, above).

The respondent requested that the decision under appeal be set aside and that the patent be maintained on the basis of Claims 1 to 8 filed at the oral proceedings before the board as main request.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 EPC and Rule 64 EPC and is therefore admissible.

2. *Amendments (main request)*

2.1 Claim 1 of the main request (section IX, above) differs from Claim 1 as granted in three aspects, namely in that

(1) the cyclopentadienyl skeleton of the ligand of the transition metal compound (a-3) is substituted by a hydrocarbon group;

(2) the solid component [A-1] further comprises 1 to 100g of prepolymer based on 1g of compound (a-1); and

(3) the solid component [A-1] is obtainable by a process comprising a step wherein (a-1), (a-2) and (a-3) are mixed and contacted, the atomic ratio $[OH/Al_{a-2}]$ of the surface hydroxyl group of the component (a-1) to the component (a-2) in terms of aluminum atom being 0.15 to 0.5, and prepolymerizing an olefin in a suspension or a vapour phase.

2.1.1 Amendment (1) finds its support in granted claim 3 (and Claim 3 as originally filed, respectively).

2.1.2 As regards the amount of prepolymer formed, this amendment (2) is supported by the passage bridging pages 43 and 44 of the application as originally filed.

2.1.3 Amendment (3) is supported by the passage on page 42 of the application as originally filed where it is stated in lines 7 to 9 that "the components (a-1), (a-2) and (a-3), which compose the solid catalyst component [A-1],

are mixed and contacted". Furthermore, the following sentence (lines 14 to 16) discloses that "the atomic ratio $[OH/Al_{a-2}]$ of the surface hydroxyl group of the component (a-1) to the component (a-2) is usually 0.1 to 0.5, preferably 0.15 to 0.4". Thus, the range of 0.15 to 0.5 now required in Claim 1 originates from a combination of a general range and a preferred range. According to established case law (eg T 0925/98 of 13 March 2001, not published in the OJ EPO, section 2 of the reasons; and Case Law of the Boards of Appeal, 4th edition 2001, III.A.3.3) such a combination does not contravene the requirements of Article 123(2) EPC. Finally, the requirement that the solid component [A-1] is obtainable by prepolymerizing an olefin in a suspension or a vapour phase is supported by Claim 4 as granted (and Claim 4 as originally filed, respectively) and by the passage on page 43, lines 12 to 14.

2.2 Claim 5 of the main request (section IX, above) differs from Claim 7 as granted in four aspects, namely in that

- (1') [A-2] is referred to as a solid component (not a solid catalyst component any more);
- (2') the cyclopentadienyl skeleton of the ligand of the transition metal compound [B] is substituted by a hydrocarbon group;
- (3') the solid component [A-2] is obtainable by a process comprising a step wherein (a-1) and (a-2) are mixed and contacted, followed by mixing and contacting the transition metal compound [B] and, if necessary, the organoaluminum compound [C-1], the atomic ratio $[OH/Al_{a-2}]$ of the surface hydroxyl

group of the component (a-1) to the component (a-2) in terms of aluminum atom being 0.15 to 0.5; and

(4') the catalyst comprises 1 to 100g of prepolymer based on 1g of compound (a-1).

2.2.1 Amendment (1') is the result of a slightly different terminology for component [A-2] which does not, however, affect the nature of the component itself. Thus, no objections under Article 123(2) EPC arise.

2.2.2 Amendment (2') finds its support in granted claim 9 (and Claim 9 as originally filed, respectively).

2.2.3 Amendment (3') is supported by the passage on page 46, lines 5 to 9 of the application as originally filed, referring to the mixing and contacting of the particulate carrier (a-1) and the organoaluminum oxy-compound (a-2), followed by mixing and contacting the transition metal compound [B] and, if necessary, the organoaluminum compound [C-1]. Furthermore, the atomic ratio $[OH/Al_{a-2}]$ is disclosed on page 47, lines 1 to 3. As in Claim 1, the range given for the ratio originates from a combination of a general range and a preferred range (section 2.1.3, above).

2.2.4 As regards the amount of prepolymer formed, this amendment (4') is supported by the passage on page 48, lines 16 to 19 of the application as originally filed.

2.3 Claims 2 to 4 and 6 to 8 correspond to granted Claims 2, 5, 6, 8, 10 and 11.

2.4 In summary, the claims of the main request meet the requirements of Article 123(2) EPC. Since, furthermore, the claims have not been amended in a way as to extend the protection conferred, the requirements of Article 123(3) EPC are also met.

3. *Clarity (main request)*

The board is satisfied that the amended claims meet the requirements of Article 84 EPC.

4. *Novelty (main request)*

4.1 D5 relates to a process for producing ethylene copolymers in the presence of a catalyst comprising a solid component [component (A)] and an aluminoxane [component (B)]. Component (A) comprises a zirconium compound having formed a π -bonding with a conjugated five-membered ring and is supported on a water-insoluble porous inorganic oxide which has been preliminarily treated with an aluminoxane. Amongst the specific examples of the zirconium compounds listed on page 4, lines 3 to 19, there are *inter alia* zirconocene compounds containing a substituted cyclopentadienyl ring. The support is preferably silica, alumina and zirconia, having a surface area from 20 to 500 m²/g (BET method), a pore volume from 0.2 to 2.5 cm³/g and a mean particle diameter from 10 to 80 μ m. They are used desirably after dehydration, ie drying at 150 to 900°C under the atmosphere of nitrogen or air to remove surface water (page 3, lines 25 to 28). However, the water content, the amount of surface hydroxyl groups of the support and the atomic ratio [OH/Al_{a-2}] are not

mentioned in D5. Nor does D5 teach prepolymerization of the catalyst.

- 4.1.1 It follows from the above, that the general disclosure of D5 does not disclose the combination of features required in Claims 1 and 5 of the main request.
- 4.1.2 It has also not been shown that one of the examples of D5 discloses, explicitly or implicitly, the combination of features now required. Although the appellant has demonstrated during the opposition procedure that the silica used for the preparation of Catalyst II of D5 (Table 1; heat treatment at 400°C for 4 hours) inherently has a water content, an amount of surface hydroxyl groups and an atomic ratio $[OH/Al_{a-2}]$ falling within the scope of Claims 1 and 5 of the main request, the zirconocene, ie Cp_2ZrCl_2 , supported onto this silica does not comprise a substituted cyclopentadienyl ring. In addition, the catalyst is not prepolymerized. Catalysts IV and V, on the other hand, do contain a zirconocene with a substituted cyclopentadienyl skeleton but the silica used for these catalysts has been subjected to a heat treatment at 600°C for 4 hours (Table 1, page 6, lines 5 to 8 and page 5, line 38). There is no reason to assume that the silica used in the preparation of Catalysts IV and V would fulfil the requirements of Claims 1 and 5 of the main request, especially since the respondent has convincingly explained in its submissions filed on 24 August 2004 (section VIII, above) that it seemed unlikely that the heat treatment at 600°C would result in a silica comprising as much as 2.0 to 3.5 wt% of surface hydroxyl groups. Furthermore, Catalysts IV and V are also not prepolymerized.

- 4.1.3 In summary, D5 does not disclose, explicitly or implicitly, the combination of features required in Claims 1 and 5 of the main request.
- 4.2 D6 discloses in Claim 1 a process for (co)polymerising olefins in the presence of a catalyst composed of (A) a solid catalyst component containing a compound of a transition metal of Group IVB of the periodic table supported on an inorganic carrier, (B) an aluminoxane, and (C) an organoaluminum compound having a hydrocarbon group other than n-alkyl groups.

On pages 10 to 15 of D6, various suitable Group IVb transition metal compounds are listed, *inter alia* compounds comprising a substituted cyclopentadienyl ring. The inorganic carrier is preferably a porous oxide (page 19, lines 16 to 17). Furthermore, it is stated at page 19, lines 28 to 35 that the porous inorganic carrier has different properties depending upon its type and the method used of production. The carrier preferably used in D6 has a specific surface area of 50 to 1000 m²/g, preferably 100 to 700 m²/g and a pore volume of 0.3 to 2.5 cm³/g and is used after it is calcined at a temperature of usually 150 to 1000°C, preferably 200 to 800°C. Prior to olefin polymerization, prepolymerization may be carried out using a small amount of an olefin (page 24, lines 2 to 3). However, the water content and the amount of surface hydroxyl groups of the carrier, the atomic ratio [OH/Al_{a-2}] and the amount of prepolymer are not mentioned in the description of D6.

4.3 Nevertheless, the appellant took the view that the claimed combination of features could not establish novelty over D6. According to its submissions, Example 19 of D6 met all the requirements of Claim 1 of the main request except that the metallocene, ie Cp_2Cl_2 , did not comprise a substituted cyclopentadienyl skeleton. However, D6 disclosed the use of alkyl substituted cyclopentadienyl groups in the transition metal compound. In fact, the majority of the cyclopentadienyl groups envisaged on page 9, line 31 to page 10, line 4 of D6 were alkyl substituted cyclopentadienyl groups. Since the teaching of a document was not confined to the detailed information given in the examples but embraced any information in the claims and description, the subject-matter of Claim 1 lacked novelty over D6.

4.3.1 According to the appellant, the silica used in Example 19 of D6 had a water content of about 0.6 wt%, about 2.5 wt% surface hydroxyl groups and an atomic ratio $[\text{OH}/\text{Al}_{a-2}]$ of 0.22 (submissions filed on 26 September 2001; section IV, above). Furthermore, the catalyst contained, depending on the basis for the calculation of prepolymer based on 1g of carrier (it is unclear from the wording in D6 whether the amount of prepolymer is given for a catalyst including the prepolymer or a catalyst excluding the prepolymer), 8.6 g or 1.19 g prepolymer per gram carrier (submissions filed on 23 August 2004, section VII, above).

4.3.2 Whilst the respondent apparently accepted that the silica used in Example 19 contained about 2.5 wt% surface hydroxyl groups, it questioned the water

content of 0.6 wt% and the appellant's calculation with respect to the amount of prepolymer produced in Example 19. Having regard to the former, the board notes that Example 19 does not disclose the actual water content obtained in that example. The appellant has neither explained how it arrived at a water content of 0.6 wt% nor has it filed experimental evidence for such a value, eg by means of a comparative test. Consequently, as pointed out by the respondent, the actual water content of the silica in Example 19 remains unknown or, at best, uncertain. As regards the latter, ie the amount of prepolymer formed in Example 19, the board agrees with the respondent that the calculation presented by the appellant does not take into account the loss of aluminoxane inevitably occurring in the preparation of the solid catalyst. As explained by the respondent at the oral proceedings, not all of the starting aluminoxane will be present in the final solid catalyst, as assumed by the appellant in its calculation, due to both chemical loss (side reactions of the aluminoxane) and physical loss (washing out). Thus, the amount of prepolymer based on 1g of carrier in Example 19 may well be lower than that calculated by the appellant, and in fact lower than the lower limit required in Claims 1 and 5 of the main request. Hence, the actual amount of prepolymer, when based on 1g of carrier, remains, at best, uncertain.

- 4.3.3 With two parameters being uncertain, or even unknown, the board cannot accept the appellant's statement that Example 19 of D6 meets all the requirements of Claim 1 of the main request except the substituted cyclopentadienyl skeleton. If an opponent alleges in an opposition appeal proceedings that a certain feature is

disclosed in a prior art document, the opponent (in the present case the appellant) bears the burden of proof in this respect (Case Law of the Boards of Appeal, 4th edition 2001, VI.J.6.1). Any remaining doubt cannot go to the disadvantage of the proprietor (in the present case the respondent).

4.3.4 Hence, it has not been demonstrated that one of the examples inherently discloses, apart from the use of a catalyst with a substituted cyclopentadienyl skeleton, the combination of technical features required in Claims 1 and 5 of the main request. This means that the appellant's novelty objection is based on an unproven assumption. Consequently, this line of argumentation must fail.

4.3.5 In summary, D6 does not disclose, explicitly or implicitly, the combination of features required in Claims 1 and 5 of the main request.

4.4 It follows, in view of the above, that the subject-matter of Claims 1 and 5, and, by the same token, the subject-matter of Claims 2 to 4 and 6 to 8 is novel over D5 and D6 and meets the requirements of Article 54 EPC.

5. *The patent in suit; the technical problem*

5.1 The patent in suit is concerned in general terms with olefin polymerization solid catalysts which are capable of preparing spherical olefin polymers excellent in particle characteristics at high polymerization activity (page 2, lines 5 to 9 of the patent specification).

- 5.2 Solid polymerization catalysts are known from D5 and D6. Apart from being structurally closely related to the solid catalysts in the patent in suit, the catalysts of D5 and D6 are also used in olefin polymerization. However, D6 is the only document which mentions prepolymerization of the solid catalyst and exemplifies such a process in Example 19. Hence, the board considers D6, and in particular Example 19, as the appropriate starting point for the assessment of inventive step.
- 5.3 In its submissions filed on 13 August 2002 (section V, above), the respondent pointed out that the data in Table 2 of the patent in suit showed that the examples having the combination required in Claim 1, namely Examples 4 to 8 and 13, had a further technical advantage as the amount of fine powder produced in the polymerization step was reduced.
- 5.3.1 A comparison of the data of Example 7 and Example 2 (due to the amendments now outside the scope of Claim 1: the catalyst is not prepolymerized) in Table 2 of the patent in suit shows that the amount of fine powder produced during the ethylene/1-butene copolymerization is indeed reduced by a catalyst meeting all the requirements of amended Claim 1. In this context, the board notes that Example 2 qualifies as a "true" comparative example. Firstly, Example 2 differs from Example 7 only in that the prepolymerization step of the catalyst is missing whereas all the other parameters eg comonomer and comonomer content, polymerization conditions and amounts of Zr and Al, were exactly the same as in Example 7. Secondly,

although Example 2 is not carried out with a catalyst according to the closest prior art, ie Example 19 of D6, it exemplifies a variant of the prior art which, if anything, lies closer to the claimed subject-matter than anything published before, in particular closer than Example 19 of D6 with one parameter being different but two further parameters being, at best, uncertain (section 4.3.2, above; and T 0035/85 of 16 December 1986; not published in the OJ EPO, section 4 of the reasons). Thus, the technical advantage derivable from the comparison of Example 7 with Example 2 in the patent in suit has to be taken into account when assessing inventive step.

5.3.2 Furthermore, it is evident from the data in Table 4 of the patent in suit that the use of a catalyst as claimed in Claim 5 results in low amounts of fine powder in the olefin polymerization.

5.3.3 Comparative Examples 5 and 7 (in the patent in suit) provide further evidence that the combination of features as now present in the claims is essential to achieve the advantageous effect of reduced fine powder. In Comparative Example 5, a solid catalyst component comprising silica (which was subjected to a heat treatment at a temperature of 700°C for 6 hours resulting in a surface hydroxyl content of 0.5 wt.% and an atomic ratio $[OH/Al_{a-2}]$ of 0.05; Table 3 in the patent in suit) is prepolymerized and subsequently polymerized. This does not result in a spherical olefin polymer having the excellent particle characteristics of the claimed subject-matter. In particular, the product contained a large amount of fine powder (0.4 wt.%; Table 4 in the patent in suit). Comparative

Example 7 demonstrates that a high water content in a prepolymerized catalyst (3.6 wt.%; Table 3) results in an even larger amount of fine powder (1.1 wt.%, Table 4).

5.3.4 Therefore, the objective technical problem to be solved by the patent in suit has to be seen in the provision of solid catalysts capable of preparing olefin polymers excellent in particle characteristics at high polymerization activity, in particular with regard to the avoidance of fine powder in the final polymer.

5.4 The solution proposed by the patent in suit is to use a solid catalyst component having *inter alia* a water content, amount of surface hydroxyl groups, atomic ratio [OH/Al_{a-2}] and amount of prepolymer as defined in Claims 1 and 5, respectively. Since the appellant has never challenged the validity of the examples and the comparative examples in the patent in suit, the board has no reason to doubt that the claimed measures provide an effective solution of the stated problem.

6. *Inventive step (main request)*

6.1 For the assessment of inventive step, it is necessary to consider whether the skilled person, in possession of the technical teaching according to D6, would have expected that the particle characteristics, in particular with respect to reducing the amount of fine powder, could be enhanced by employing the specific combination of features outlined in Claims 1 and 5, respectively.

6.2 In D6 itself, there is no suggestion as to how the polymerization process disclosed in this document might be modified further to improve the particle characteristics of the polymer resulting from this polymerization process, and in particular the amount of fine powder, let alone a hint to the combination of technical features of Claims 1 and 5 as a more promising variant within the general teaching of D6. Consequently, D6 itself offers no hint to the solution of the relevant technical problem.

6.3 As to the other initially cited document, D5, there is no reason why the skilled person should consider this document as relevant to the solution of the technical problem in the first place, since this document is also not concerned with the reduction of fine powder in an olefin polymer. Thus, there can be no pointer to the solution of the technical problem in the teaching of this document.

6.4 In the statement of grounds of appeal (section IV, above), the appellant argued that the subject-matter of Claim 1 as maintained by the opposition division did not involve an inventive step over Catalyst II of D5 in combination with D7 and D8 which disclosed the higher polymerization activity of catalyst comprising a substituted cyclopentadienyl ligand. However, the claimed subject-matter requires now the presence of a prepolymer so that this line of argumentation is not relevant to the amended claims of the main request.

In the letter submitted on 23 August 2004 (section VII, above) the appellant argued that the additional presence of a prepolymer could not establish an

inventive step over Example 19 of D6. However, this line of argumentation is based on the assumption that the only difference of Example 19 of D6 over the claimed subject-matter is the substitution of the cyclopentadienyl skeleton. As shown in section 4.3, above, this assumption has not been sufficiently substantiated and can, therefore, not form the basis for a proper novelty attack. Hence, this line of argumentation is also not convincing with respect to inventive step.

- 6.5 In view of the above, it is evident that the subject-matter of Claims 1 and 5, and, by the same token, of Claims 2 to 4 and 6 to 8, does not arise in an obvious way from documents D4 to D8. Hence, the subject-matter of Claims 1 to 8 involves an inventive step (Article 56 EPC).
7. Finally, in accordance with T 0133/92 of 18 October 1994 and T 0771/92 of 19 July 1995 (neither of the decisions published in the OJ EPO), the board holds that considering and deciding in substance on the maintenance of the patent on the basis of the main request as amended during oral proceedings in the absence of the appellant does not conflict with the opinion of the Enlarged Board of Appeal in G 4/92 (OJ EPO 1994, 149). In the present case, the appellant could also not be taken by surprise by the amendment made, since it had reasonably to expect that the respondent would try to overcome the formal objections with regard to Article 123 EPC raised by the board in the communication accompanying a summons to oral proceedings (section VI, above). Furthermore, the claims of the main request correspond to the claims of

the second auxiliary request filed by the respondent on 24 August 2004 (section VIII, above), except that part of the wording in Claims 1 and 5 has been amended to be exactly in line with the corresponding passages in the application as originally filed. In other words, no new issues arose with the filing of the main request. Consequently, the absence of the appellant during the oral proceedings does not constitute a bar to taking this decision.

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 Claims 1 to 8 filed as main request at the oral proceedings and after any necessary consequential amendment of the description and the figures.

The Registrar:

The Chairman:

E. Görgmaier

R. Young