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**D E C I S I O N**  
**of 11 March 2003**

**Case Number:** T 0647/00 - 3.3.3

**Application Number:** 89301175.9

**Publication Number:** 0328348

**IPC:** C08F 4/64

**Language of the proceedings:** EN

**Title of invention:**

Olefin polymerization catalyst and process for the  
polymerization of olefins

**Patentee:**

MITSUI CHEMICALS, INC.

**Opponent:**

Basell Polyolefine GmbH

**Headword:**

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**Relevant legal provisions:**

EPC Art. 54, 56, 84, 123(2), 123(3)

**Keyword:**

"Novelty (yes)"  
"Inventive step (yes)"  
"Interpretation of the claims"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0647/00 - 3.3.3

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.3**  
**of 11 March 2003**

**Appellant:** MITSUI CHEMICALS, INC.  
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**Respondent:** Basell Polyolefine GmbH  
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**Representative:** Seelert, Stefan, Dr.  
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**Decision under appeal:** Interlocutory decision of the Opposition Division  
of the European Patent Office posted 19 April  
2000 concerning maintenance of European patent  
No. 0 328 348 in amended form.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** C. Idez  
J. De Preter

## Summary of Facts and Submissions

I. The grant of European patent No. 0 328 348 in respect of European patent application No. 89 301 175.9 filed on 7 February 1989 and claiming priority from two earlier patents application in Japan (JP 31414/88 of 12 February 1988 and JP 43671/88 of 26 February 1988) was announced on 20 December 1995 (Bulletin 95/51) on the basis of a set of 9 claims for the Contracting States AT, BE, CH, DE, FR, GB, GR, IT, LI, LU, NL and SE and on the basis of a set of 10 claims for the Contracting State ES.

Claim 1 of the set of claims for the Contracting States AT, BE, CH, DE, FR, GB, GR, IT, LI, LU, NL and SE (hereinafter "Contracting States except ES") read as follows:

"An olefin polymerization catalyst formed from:

[A] a compound of a transition metal belonging to Group IV B of the periodic table,  
[B] an aluminoxane, and  
[C] water."

Claims 2 to 6, and 8 referred to preferred embodiments of the catalyst according to Claim 1.

Independent Claim 7 read as follows:

"A process for the preparation of an olefin polymer which comprises homo polymerizing or copolymerizing at least one olefin in the presence of a catalyst as claimed in any one of claims 1 to 6."

Independent Claim 9 read as follows:

"A process for the preparation of an olefin polymer which comprises homo polymerizing or copolymerizing at least one olefin in the presence of a catalyst as claimed in claim 8."

Claim 1 of the set of claims for the Contracting State ES read as follows:

"A process for preparation of an olefin polymerization catalyst, which process comprises contacting [A] a compound of a transition metal belonging to Group IV B of the periodic table, [B] an aluminoxane, and [C] water."

Claims 2 to 6, and 8 were dependent claims relating to specific elaborations of the process of Claim 1

Independent Claim 7 read as follows:

"A process for the preparation of an olefin polymer which comprises homopolymerizing or copolymerizing at least one olefin in the presence of a catalyst produced according to a process as claimed in any one of claims 1 to 6."

Independent Claim 9 read as follows:

"A process for the preparation of an olefin polymer which comprises homopolymerizing or copolymerizing at least one olefin in the presence of a catalyst produced according to a process as claimed in claim 8."

Dependent Claim 10 read as follows:

"A process according to claim 7 or claim 9 which comprises the initial step of preparing a catalyst by the process as claimed in any one of claims 1 to 6 and 8."

- II. On 20 September 1996 a Notice of Opposition was filed against the granted patent, 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-0 308 177;

D2: EP-A-0 170 059;

D3: FR-A-1 173 577; as well as the later filed but admitted,

D5: EP-A-0 287 666.

- III. By a decision announced orally on 6 April 2000 and issued in writing on 19 April 2000 the Opposition Division maintained the patent in amended form. The decision was based on the following requests of the Proprietor:

- (i) A main request consisting of a set of Claims 1 to 12 for the Contracting States except ES and a set of Claims 1 to 8 for ES, submitted with a letter dated 25 September 1998;

- (ii) A first auxiliary request consisting of a set of Claims 1 to 6 for the Contracting States except ES and a set of Claims 1 to 7 for ES, filed during the oral proceedings of 6 April 2000; and
- (iii) A second auxiliary request consisting of a set of Claims 1 to 6 for the Contracting States except ES and a set of Claims 1 to 6 for ES, also filed at the oral proceedings of 6 April 2000.

Claim 1 of the set of claims of the main request for the Contracting States except ES read as follows:

"An olefin polymerization catalyst formed from:

- [A] a compound of a transition metal belonging to Group IV B of the periodic table,
- [B] an aluminoxane,
- [C] water and,
- [D] an organoaluminum compound containing a hydrocarbon group other than an n-alkyl group."

Claims 2 to 5 referred to preferred embodiments of the catalyst according to Claim 1, and independent Claim 6 read as follows:

"A process for the preparation of an olefin polymer which comprises homo polymerizing or copolymerizing at least one olefin in the presence of a catalyst as claimed in any one of claims 1 to 5."

Independent Claim 7 read as follows

"A process for preparation of an olefin polymerization

catalyst, which process comprises contacting  
[A] a compound of a transition metal belonging to  
Group IV B of the periodic table,  
[B] an aluminoxane,  
[C] water, and  
[D] an organoaluminum compound containing a hydrocarbon  
group other than an n-alkyl group."

Claims 8 to 11 and Claim 12 were dependent on Claim 7  
and Claim 6, respectively.

Claim 1 of the set of claims of the main request for  
the Contracting State ES read as follows:

"A process for preparation of an olefin polymerization  
catalyst, which process comprises contacting  
[A] a compound of a transition metal belonging to Group  
IV B of the periodic table,  
[B] an aluminoxane,  
[C] water, and  
[D] an organoaluminum compound containing a hydrocarbon  
group other than an n-alkyl group."

Claims 2 to 5 were dependent claims relating to  
specific elaborations of the process of Claim 1.

Independent Claim 6 read as follows:

"A process for the preparation of an olefin polymer  
which comprises homopolymerizing or copolymerizing at  
least one olefin in the presence of a catalyst produced  
according to a process as claimed in any one of  
claims 1 to 5."

Claims 7 and 8 were dependent on Claim 6.

The first auxiliary request differed from the main request in that Claims 7 to 12 present in the set of claims for the Contracting States except ES of the main request and Claim 7 present in the set of claims for the Contracting State ES of the main request had been omitted.

The second auxiliary request differed from the first auxiliary request in that disclaimers to the subject-matter of document D5 had been inserted in Claim 1 of each of set of claims.

In its decision, the Opposition Division held that the main request was not allowable since it contained amendments (i.e Claims 7 to 12 in the set of Claims for the Contracting States except Spain and Claim 7 in the set of Claims for the Contracting State ES) not occasioned by the grounds of opposition.

The Opposition Division considered that Claim 1 of the set of claims for the Contracting States except ES of the first auxiliary request encompassed the possibility that the aluminoxane [B] was the same as an aluminoxane [B'] resulting from contacting the compounds [C] (water) and [D] (organoaluminum compound comprising a hydrocarbon group other than an n-alkyl group). It thus took the view that Claim 1 encompassed the possibility that the catalyst was obtainable by first contacting the compounds [C] and [D] to obtain an aluminoxane [B'] comprising hydrocarbon groups other than an n-alkyl group and thereafter contacting transition metal [A] with said aluminoxane [B']. Document D5 taught a catalyst obtainable by first contacting compounds [C] and [D] to obtain an aluminoxane [B'] and thereafter contacting transition metal compound [A] with



aluminumoxane [B'] (cf. D5, Claim 1; page 21, lines 2 to 4). Thus, the Opposition Division concluded that D5 destroyed the novelty of Claim 1 of the set of claims for the Contracting States except ES of the first auxiliary request, and decided not to allow the first auxiliary request.

Since, however, the subject-matter of the claims of the second auxiliary request disclaimed the full content of D5, and since documents D1, D2 and D3 did not mention organoaluminum compounds containing hydrocarbon groups other than an n-alkyl group or aluminumoxanes containing hydrocarbon groups other than an n-alkyl group, the subject-matter of the second auxiliary request was considered to be novel.

Concerning inventive step, the decision stated that the only relevant documents were D2 and D3, since D1 and D5 were intermediate documents. Document D2 was considered as the closest state of the art. Starting from D2 the objective technical problem was to provide an alternative catalyst system that had good catalyst activity and led to olefin polymers with good end properties. The inventive examples of the patent in suit showed that this problem was solved by replacing all or part of the trialkyl aluminum compound of D2 (i.e trimethyl or triethyl aluminum) by an organoaluminum compound comprising hydrocarbon groups other than an n-alkyl group.

Since D3 did not mention the organoaluminum compound containing hydrocarbon groups other than n-alkyl groups, the combination of D2 and D3 could not make the subject-matter of the second auxiliary request obvious. Thus, an inventive step was given for the subject-

matter of the claims of the second auxiliary request.

- IV. On 26 June 2000 a Notice of Appeal was lodged by the Appellant (Patent Proprietor) against this decision with simultaneous payment of the prescribed fee.

With the Statement of Grounds of Appeal lodged on 29 August 2000, the Appellant filed a main request and three auxiliary requests. The main request was identical with the first auxiliary request considered in the decision under appeal. The arguments presented in the Statement of Grounds of Appeal in support of its main request could be summarized as follows:

- (i) This set of claims corresponded to the first auxiliary request submitted at the oral proceedings
- (ii) The conclusion of the Opposition Division that these claims lacked novelty over D5 was incorrect. D5 disclosed a catalyst containing only three components, i.e. components [A], [B], and [D].
- (iii) In contrast, the claims required water i.e. component [C] as a fourth component.
- (iv) The interpretation made by the Opposition Division in view of the expression "formed from", that the wording of the claims included the possibility of components [C] and [D] reacting to form [B] and thus implied that one or more components needed not to be present in the final catalyst product was not correct.

- (v) On the contrary, it was clear from the specification that the invention resided in the use of water as a component that was present in the polymerisation reaction. The claims could not be interpreted as covering the possibility that [C] and [D] were not both present in the polymerisation system.
  
- (vi) While aluminoxane might be produced by reaction of an organoaluminum compound with water, these reactions generally went to completion. Thus, in any case, it would not be possible to form all three components [B], [C] and [D] by reacting [C] and [D].
  
- (vii) The argument of the Opponent that water would be present in the support was not pertinent, since D5 disclosed that the support was calcined at a temperature of 150°C to 1000°C and that therefore, the carrier contained no or a negligible amount of water. Furthermore, even if water would be present in the carrier after calcining, it would be in tightly bound form as part of the support and not available to be a component in the catalyst.
  
- (viii) It thus followed that the subject-matter of the claims was novel.
  
- (ix) The claims were also based on an inventive step, since neither D2 nor D3 taught the use of organoaluminum compounds containing a hydrocarbon group other than an n-alkyl group.

V. In its letter dated 23 September 2002, the Respondent

argued essentially as follows:

- (i) Document D5 disclosed catalyst obtained by contacting transition metals and aluminoxane, which contained hydrocarbon groups other than n-alkyl groups. D5 also disclosed the manufacture of the catalyst (cf. page 22, line 32 to page 23, line 2), as well as the polymerisation process.
- (ii) Thus, Claims 1 of the main request, the first auxiliary request and the second auxiliary request lacked novelty over D5.

VI. Oral proceedings were held on 11 March 2003, at which the Respondent, although duly summoned, was not present. The Appellant, while essentially relying during the hearing on its arguments presented with the Statement of Grounds of Appeal, further insisted on the fact, that Claim 1 of the main request required that water should be present as fourth component and that the subject-matter of the patent in suit represented a further development of the catalyst disclosed in D5. It was evident when reading D5 that there was a clear correspondence between the components (A), (B) and (C) of the catalyst composition according to D5 and components [A], [B] and [D] of the patent in suit, respectively, and that the use of water as catalyst component was not disclosed in D5.

VII. The Appellant requested that the decision under appeal be set aside, and a patent be maintained on the basis of the main request, or alternatively on the basis of first auxiliary request, alternatively on the basis of the second auxiliary request, or alternatively on the

basis of the third auxiliary request, all submitted with the Statement of Grounds of Appeal. It also requested as an alternative that the case be remitted back to the Opposition Division for further examination on the basis of either the first auxiliary request or the second auxiliary request.

The Respondent requested that the appeal be dismissed.

### **Reasons for the Decision**

1. The appeal is admissible.
2. *Procedural matters*

As mentioned above in section VI, the Respondent was not represented at the oral proceedings. In accordance with Rule 71(2) EPC, the proceedings therefore continued without the Respondent.

#### *Main request*

3. *Wording of the Claims*
  - 3.1 Claims 1 to 6 of the set of claims for the designated Contracting States except ES and Claims 1 to 7 of the set of claims for ES exactly correspond to Claims 1 to 6 of the set of claims for all the designated Contracting States except ES and to Claims 1 to 7 of the set of claims for ES of the first auxiliary request before the Opposition Division, respectively.
  - 3.2 These claims have been considered as meeting the requirements of Articles 123(2), 123(3) and 84 EPC by

the Opposition Division and no objection has been raised by the Respondent in that respect. Nor does the Board see any reason to depart from that view.

3.3 It thus follows that Claims 1 to 6 for all the designated Contracting States except Spain and Claims 1 to 7 for Spain are not objectionable under Articles 123(2), 123(3) and 84 EPC.

4. *Interpretation of Claim 1*

4.1 Claim 1 of the set of Claims for all the designated Contracting States except ES requires that the catalyst is "formed from" the four following components:

- [A] a compound of a transition metal belonging to Group IV B of the periodic table,
- [B] an aluminoxane,
- [C] water and,
- [D] an organoaluminum compound containing a hydrocarbon group other than an n-alkyl group.

4.2 In that respect, the Appellant has submitted that Claim 1 should be interpreted as requiring that the four components [A], [B], [C] and [D] be present in the formed catalyst composition. While it is true in view of the comparison between Examples 7 to 10 and comparative Example 3 of the patent in suit that this construction of Claim 1 represents one possible interpretation of the language of Claim 1, this does not alter the fact, in the Board's view, that the claimed catalyst being defined in terms of a product by process, the term "formed from" does not exclude that component [C] may react with [D] in order to form an aluminoxane [B'] containing a hydrocarbon group other

than an n-alkyl group, and whose hydrocarbon groups are the same as those of [D].

- 4.3 Thus, the assessment of novelty must be carried out while taking also into consideration the possibility of reaction of [C] with [D]. As a consequence, the final catalyst composition formed from [A], [B], [C] and [D] may consist of the following components:

[A], [B], [C] and [D], if [C] has not reacted with [D],

[A], [B], [B'], if [C] and [D] react in a stoichiometric ratio,

[A], [B], [B'] and [C], if an excess of [C] is used in the reaction with [D], and

[A], [B], [B'], and [D], if an excess of [D] used in the reaction with [C].

## 5. *Novelty*

- 5.1 Lack of novelty in the appeal proceedings was alleged only in relation to the disclosure of document D5.

- 5.2 Document D5 is a document belonging to the state of the art for the Contracting States AT, DE, FR, GB, IT and NL according to Article 54(3)(4) EPC. It relates to a process or polymerization of olefins, which comprises polymerizing or copolymerizing olefins in the presence of a catalyst composed of

(A) a solid catalyst component composed of a transition metal of Group IVB supported on an inorganic carrier,

(B) an aluminoxane, and

(C) an organoaluminum compound having a hydrocarbon group other than an n-alkyl group (cf. Claim 1).

5.3 Thus, D5 discloses a catalyst composition composed of components (A), (B) and (C) as defined therein, i.e a catalyst composition comprising the components [A], [B] and [D] according to the patent in suit. In that respect, the Respondent has submitted (cf. Minutes of the Oral Proceedings before the Opposition Division, point 12) that the inorganic carrier support (e.g. SiO<sub>2</sub>) would inevitably comprise water and that, as a consequence, D5 inherently disclosed a catalyst composed of the four components [A], [B], [C] and [D] and would be therefore novelty destroying document for Claim 1 for the set of Claims for the designated Contracting States except ES. This argument is not, in the Board's view, convincing, since, as disclosed in D5, the inorganic carrier which supports the transition metal compound is used after having been calcined at a temperature of usually 150°C and 1000°C, preferably 200°C to 800°C (cf. page 19, lines 29 to 35), and, as a result of the calcinating step, the inert carrier has to be considered, in the absence of any evidence to the contrary, as practically water-free.

5.4 Document D5 does, however, refer to the use of an aluminoxane component (B) having a hydrocarbon group other than an n-alkyl group (cf. page 20, line 14 to page 21, line 11; in particular formulae (II) or (III) on page 20 in which the radical R may represent a hydrocarbon radical such as cycloalkyl, aryl or alkylaryl). It is also evident, as considered in the decision under appeal, that such a component (B) could



be regarded as obtainable by reacting water with an organoaluminum compound containing a hydrocarbon group other than an n-alkyl group. To this extent, it results that this component (B) of D5 would fall under the definition of the component [B'] mentioned above in section 4.2.

5.5 In the decision under appeal, it has further been considered, that Claim 1 of the set of claims for all the Contracting States except ES encompasses the possibility that component [B] might be the same as the reaction product of [C] and [D], i.e. [B']. The possibility for [B] to be undistinguishable from [B'] represents, in the Board's view, a hypothetical possibility that the skilled person would have no technical motive to consider, since there is no practical necessity to form a component being the same as one already present in the composition, and the description of the patent in suit, in contrast to that of D5, makes no reference to an aluminoxane [B] containing a hydrocarbon group other than an n-alkyl group (cf. page 6, lines 1 to 17). Such an interpretation would also imply that [B] "added" and [B] "formed" must have been obtained from [C] and [D] under identical reaction conditions in order to fulfil the presumption of indistinguishability, i.e. that the the claimed catalyst would have been formed only from [A], [C] and [D].

5.6 Even if one would pursue such an interpretation, D5, which teaches to mix the aluminoxane compound with a transition metal compound and an organoaluminum compound (C) containing a hydrocarbon group other than an n-alkyl group could only be considered as fulfilling this condition, provided the organoaluminum compound

(C) would be the same as the organoaluminum compound used for the manufacture of the compound (B); i.e. D5 would disclose a composition consisting of [A], [B = B'] and [D] according to the patent in suit and formed only from [A], [C] and [D]. There is, however, no teaching in D5 for preparing a product from such a combination. On the contrary, in all the Examples of D5 the aluminoxane compound is a compound which has been obtained from trimethyl aluminum, i.e a compound having only n-alkyl groups.

5.7 As a consequence of the above, the Board comes to the conclusion that D5 does not destroy the novelty of the subject-matter of Claim 1 of all the designated Contracting States except ES. Hence, this claim meets the requirements of Article 54 EPC.

5.8 By the same token the further claims of this set, i.e dependent Claims 2 to 5 which refer to specific elaborations of the catalyst of Claim 1, and Claim 6 which relates to a process for the preparation of an olefin polymer or copolymer in presence of a catalyst according to Claim 1 are novel (Article 54 EPC). In other words the subject-matter of the claims for the Contracting States except ES is novel.

5.9 As indicated above in section 5.1 above, lack of novelty was alleged only in view of D5. Document D5, however, does not mention ES as one of the designated Contracting States and therefore cannot be taken into consideration for the assessment of novelty the set of claims for the Contracting State ES (Article 54(3)(4) EPC).

5.10 It thus follows that the subject-matter of the

claims for the Contracting State ES is also novel (Article 54 EPC).

6. *Problem and solution*

- 6.1 The patent in suit concerns a catalyst composition for the manufacture of polymers and copolymers of olefins.
- 6.2 Such a composition is known from document D2, which the Board, like the Opposition Division, considers as representing the closest state of the art.
- 6.3 Document D2 relates to the polymerization of olefins in the presence of a catalyst consisting of a transition metal component and an organoaluminum compound obtained *in situ* by reaction of an inorganic solid component containing adsorbed or absorbed water with a trialkyl aluminum such as trimethyl or triethyl aluminum (cf. D2, Claim 1; page 3, lines 1 to 5).
- 6.4 Starting from D2, the objective technical problem may be seen in the provision of an alternative catalyst system having a good polymerization activity and leading to olefin polymers having a high molecular weight.
- 6.5 According to the patent in suit this problem is solved by the catalyst formed from or prepared by the contacting a compound of a transition metal belonging to Group IV B, an aluminoxane, water and an organoaluminum compound containing a hydrocarbon group other than an n-alkyl group, as specified in Claim 1 of the sets of claims of the main request.
- 6.6 In view of the Examples 7 to 10 of the patent suit,

where the trialkyl aluminum component according to D2 has been replaced by an organoaluminum compound containing a hydrocarbon group other than an n-alkyl group, it is credible to the Board that the problem has been effectively solved.

7. *Obviousness*

It remains to be decided whether this solution was obvious to the person skilled in the art in the light of the cited prior art.

7.1 As indicated in section 6.3 above, D2 only discloses the use of organoaluminum compounds comprising exclusively n-alkyl groups (i.e. methyl or ethyl) in the catalyst composition for the polymerization of ethylene and copolymers thereof. Thus, it cannot itself provide any hint to the solution of the technical problem.

7.2 Documents D1 and D5 are intermediate documents and as such cannot be taken into consideration for the assessment of inventive step.

7.3 Document D3, which discloses in its Example 1 the polymerization of ethylene in presence of titanium trichloride, of diethylaluminum chloride and water, is totally silent on the possible use of organoaluminum compound containing an hydrocarbon group other than an n-alkyl group as a component in a catalyst composition for the manufacture of polymers and copolymers of olefins. Thus, it could not be of any assistance in the solution of the technical problem.

7.4 As a consequence of the above, the subject-matter of

Claims 1 to 6 for the designated Contracting States except ES and the subject-matter of Claims 1 to 7 for Spain do not arise in an obvious manner from the cited prior art. The requirements of Article 56 EPC are therefore met by all the claims of the main request.

7.5 It follows that the Appellant's main request is allowable. Thus, there is no need for the Board to deal with the auxiliary requests of the Appellant.

## **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 main request consisting of a set of Claims 1 to 6 for the Contracting States AT, BE, CH, DE, FR, GB, GR, IT, LI, LU, NL and SE and the set of Claims 1 to 7 for the Contracting State ES and after any necessary consequential amendments of the description.

The Registrar:

The Chairman:

P. Martorana

R. Young