

Internal distribution code:

- (A) Publication in OJ
(B) To Chairmen and Members
(C) To Chairmen

**D E C I S I O N
of 11 May 1994**

Case Number: T 0281/91 - 3.3.3

Application Number: 81110845.5

Publication Number: 0055863

IPC: C08F 10/00

Language of the proceedings: EN

Title of invention:

Catalyst, method for making and use of same for polymerizing olefins

Patentee:

Phillips Petroleum Company

Opponent:

BASF Aktiengesellschaft

Headword:

-

Relevant legal norms:

EPC Art. 56, 114

Keyword:

"Newly cited document (admitted)"
"Inventive step (affirmed)"

Decisions cited:

-

Catchword:



Case Number: T 0281/91 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 11 May 1994

Appellant:
(Opponent)

BASF Aktiengesellschaft
Patentabteilung C6
Carl-Bosch-Strasse 38
D-67056 Ludwigshafen (DE)

Representative:

-

Respondent:
(Proprietor of the patent)

Phillips Petroleum Company
5th and Keeler
Bartlesville
Oklahoma 74004 (US)

Representative:

Dost, Wolfgang, Dr.rer.nat., Dipl.-Chem.
Patent- und Rechtsanwälte
Bardehle, Pagenberg, Dost, Altenburg,
Frohwitter, Geissler & Partner
Galileiplatz 1
D-81679 München (DE)

Decision under appeal:

Decision of the Opposition Division of the
European Patent Office of 12 February 1991
rejecting the opposition filed against European
patent No. 0 055 863 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: F. Antony
Members: R. Young
W.M. Schar

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 055 863, in respect of European patent application No. 81 110 845.5, filed on 30 December 1981 and claiming a priority of 31 December 1980 (US 221 877) was announced on 20 August 1986 (cf. Bulletin 86/34). The patent was granted with two sets of claims (Claims 1 to 16 for the Contracting States BE, DE, FR, IT, NL and SE; and Claims 1 to 27 for the Contracting State AT). Claim 1, which is the same for all Contracting States, reads as follows:

"1. A catalyst system comprising a catalyst comprising a chromium compound on a predominantly amorphous aluminum phosphate-containing base, said catalyst system being characterized by containing a boron compound which boron compound is contained in said base and/or in a cocatalyst."

The remaining independent claims are directed either to the making or preparation of a catalyst system (method Claims 11 and 15 for all the designated States and process Claim 17 for the designated State AT), or to the use of the catalyst system for polymerising mono-1-olefins (Claim 16 for all designated States and Claim 27 for the designated State AT).

II. Notice of Opposition was filed on 24 April 1987 on the ground of Article 100(a) EPC, alleging lack of novelty. The opposition was supported by the document:

D1: DE-A-2 610 422.

III. By a decision dated 12 February 1991, the Opposition Division rejected the opposition.

According to the decision, lack of novelty had not been established because the contention that D1 contained an implicit anticipating disclosure was a mere assertion which could not be accepted in the absence of convincing supporting evidence. Although the Patentee had submitted no arguments whatsoever in respect of inventive step, this was considered in the public interest under Article 114(1) EPC, it being held that it would not have been obvious for the skilled person to replace the catalyst system of D1 by that of the patent in suit in the expectation of achieving an improved productivity.

IV. On 11 April 1991 a Notice of Appeal against the above decision was filed, together with payment of the prescribed fee.

In the Grounds of Appeal filed on 10 June 1991 and at the oral proceedings held on 11 May 1994, the Appellant (Opponent) argued that the subject-matter of the patent in suit did not involve an inventive step in the light of D4: US-A-4 219 444. In particular, D4 disclosed a catalyst system as defined in the precharacterising part of Claim 1 of the patent in suit, suitable for use in the slurry system process of this patent, and capable of solving the problems referred to therein, the catalyst of D4 differing therefrom only by the lack of a boron compound. The use of the same boron compounds which were preferred according to the patent in suit, was, however already recommended for obtaining polymers of improved properties in D1, which related to a catalyst system similar in its capabilities to that of the patent in suit.

V. The Respondent, on the other hand, argued that the question of inventive step should not be gone into, because in the opposition proceedings only novelty had been contested. Alternatively, the newly cited document D4 should be excluded from consideration.

In any case, a comparison of the test results in terms of Density and Environmental Stress Crack Resistance between the patent in suit and D4 showed an unexpected improvement, for the achievement of which there had been no guidance available to the skilled person.

VI. The Appellant requested that the decision under appeal be set aside and the patent in suit be revoked.

The Respondent requested that the appeal be dismissed and the patent maintained.

Reasons for the Decision

1. *Admissibility*

The appeal is the means by which a decision of an Opposition Division may be contested and, where appropriate, rectified. This means, in the present case, that the Appellant must be allowed to rely on a ground of appeal which, although not alleged by him within the nine-month opposition period, was nevertheless a material element in the decision under appeal. This would apply even where the ground was truly a different one, such as insufficient disclosure (Art. 100(b) EPC), unlike the present case which merely concerns a different aspect falling under the same ground of opposition (Art. 100(a) EPC).

Consequently, as the other requirements of Articles 106 to 108 and Rule 64 EPC are met, the appeal is admissible.

2. *Relevance of document D4; closest state of the art*

The newly cited document D4 represents the closest state of the art and is thus certainly relevant. It was therefore introduced into the proceedings.

The patent in suit, in its product aspect, relates to an olefin polymerisation catalyst system comprising a chromium compound on a predominantly amorphous aluminium phosphate-containing base (cf. page 2, lines 4 to 6). The system is suitable for use in slurry (particle form) polymerisation systems, is sensitive to the presence of hydrogen and is capable of giving olefin polymers having inter alia high shear response, as measured by the ratio of High Load Melt Index to Melt Index (HLMI/MI), with no observable induction period (page 2, lines 34 to 47; page 6, lines 1 to 5; and page 8, lines 62 to 64).

Such catalysts are, however, known from D4.

- 2.1 According to D4, an olefin polymerisation catalyst was prepared by depositing a Cr compound upon an amorphous inorganic carrier containing Al and P moieties, the carrier having been prepared by neutralizing an acidic aqueous solution containing Al(+++) cations and PO4(---) anions to form a solid precipitate containing Al and P moieties and recovering the precipitate, the acidic solution Al:P ratio being about 5:1 to 1:1 (Claim 1). The catalyst could be activated by being heated to a temperature in the range 350°C to 950°C (cf. Claim 2).

2.2 Ethylene polymer was produced in a particle form process using such a catalyst in a series of continuous polymerisation runs. Certain parameters, such as polymerisation temperature, inclusion of comonomers such as hexene, and variation of the polymer solids content, were varied to determine their effect upon the properties of the ethylene polymers produced (cf. Example 22). According to Table VIII in this Example (columns 19 to 21), selected polymer properties such as MI, HLMI/MI ratio, Density, and Environmental Stress Crack Resistance (ESC resistance or ESCR) were tested. Inclusion of hexene comonomer, for instance, gave increased ESC(R) values in the resulting copolymers (cf. runs 22-13 to 22-16).

2.3 The inclusion of such higher olefins was known, however, to produce copolymers having lower densities than the corresponding ethylene homopolymers (cf. D4, column 7, lines 3 to 7). According to the known relationships, the low density of such a copolymer is moreover associated with a poor (low) flexural modulus (cf. patent in suit, page 5, lines 37 to 45, and page 7, lines 58 to 61).

3. *The technical problem and its solution*

Compared with this state of the art, the technical problem could be seen in the search for systems capable of delivering olefin polymers of improved ESC(R) without a corresponding loss of density and hence of flexural modulus.

The solution proposed according to Claim 1 of the patent in suit was to incorporate a boron compound into the base and/or in a cocatalyst.

3.1 A comparison of the results in terms of ESC(R) and density values of homopolymers obtained with the boron-containing catalyst system of the patent in suit and given in Table C (page 7), with the corresponding values given in Table VIII of D4, shows the following:

3.1.1 The densities obtained with the catalyst of the patent ~~in suit varied from a low of 0.9626 to a high of 0.9727,~~ whereas those reported in Table VIII of D4 were, for homopolymers of ethylene, from 0.950 (low) to 0.962 (high).

Thus the lowest density of a homopolymer exemplified in the patent in suit was at least as high as, or even higher than, the highest density reported in D4.

3.1.2 On the other hand the ESC(R) values obtained with the boron-containing catalysts in the patent in suit varied from a minimum of 47 to a maximum of 428 (indicating the number of hours to 50% failures). The respective values in Table VIII of D4, for a homopolymer of ethylene, were a low of 0 (run 22-27) and a high of 57 (run 22-18).

Thus the upper end of the ESC(R) values in D4 just overlaps the bottom end of the range of the ESC(R) values given in the patent in suit.

3.1.3 The majority of the values of ESC(R) for homopolymers in Table VIII of D4 were, however, roughly in the range 18 to 32, whereas other values given in Table C of the patent in suit were, respectively, 82, 181 and 214. More strikingly still, for a corresponding value of the density (0.962 in D4; 0.9626 in the patent in suit), the ESC(R) value in D4 was 0 (run 22-27) whereas that according to the patent in suit was 428 (cf. Table C).

3.2 Even taking into account the Appellant's observation at the oral proceedings that the ESC(R) values in the patent in suit were not in every case greater than those in D4, therefore, it is clear that in the majority of cases the environmental crack resistance obtained according to the patent in suit was more than double that reported in D4, and, for homopolymers of comparable density (and therefore flexural modulus) the factor of improvement ran into orders of magnitude.

Hence, it is credible that the claimed measures are effective to solve the technical problem.

4. *Novelty*

No allegation of lack of novelty was repeated in the appeal, nor was any made in respect of the newly cited document D4, which incidentally made no mention of boron compounds.

The decision under appeal found that the catalyst system of the patent in suit was novel. In particular, there was a difference from the catalyst system of D1, which comprised a calcination product of an aluminium alkoxide and a chromium oxide/organo-phosphorous acid reaction product, supported on silica (cf. decision under appeal, paragraph 14). The Board sees no reason to diverge from this conclusion.

Consequently the subject matter of Claim 1 is novel.

5. *Inventive step*

For the determination of inventive step, it is necessary to answer the question of whether the skilled person, starting out from D4, would have expected that improved ESC(R) performance could be achieved without loss of

density and therefore of flexural modulus, by incorporating a boron compound in the base of the catalyst and/or in a cocatalyst.

- 5.1 There was no hint in D4 itself in this direction. On the contrary, the solution provided by D4 for increasing ESC(R) values was the inclusion of higher olefin comonomers, which, however, concomitantly reduced the density and hence the flexural modulus (cf. sections 2.2, last sentence, and 2.3, above).

Thus the teaching of D4 led away from the claimed solution.

- 5.2 On the other hand, D1 contained no hint to the possible boron content of its catalyst system leading to improved ESC(R) performance or to maintaining density or the associated flexural modulus values. Thus, as was admitted by the Representative of the Appellant at the oral proceedings, it contained no disclosure whatever of the stated problem. Consequently, the skilled person would not have regarded the disclosure of D1 as being of any relevance in solving the stated problem.

- 5.3 As regards the catalysts of D1 themselves, these did not contain Al phosphate at all, let alone a predominantly amorphous aluminium phosphate base (cf. section 4 above). Furthermore, although D1 mentioned the use of boron compounds, and even of the boron trialkyls preferred according to the patent in suit, it did so only as particular examples of a more generally defined reducing agent, and there was no indication in D1 that the presence of the reducing agent had been primarily responsible for the solution of any of the specific problems addressed therein. Thus the argument of the Appellant, that D1 recommended the use of boron

compounds, and in particular boron trialkyls, for "improving the properties" of polymers, cannot help his case.

In summary, the subject-matter of Claim 1 does not arise in an obvious way from the cited art. It therefore involves an inventive step. By the same token, the subject-matter of Claims 2 to 10, which are directly or indirectly dependent on Claim 1, is also novel and based on an inventive step.

6. No specific objections were substantiated at any stage of the proceedings against the remaining claims. As these are based on the same inventive concept as Claims 1 to 10, the Board sees no reason to differ from the implicit finding of the decision under appeal, that they could be equally maintained in their granted version.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

F. Antony