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Datasheet for the decision
of 21 September 2009

Case Number:	T 0948/07 - 3.3.03
Application Number:	99909825.4
Publication Number:	1159311
IPC:	C08F 10/00
Language of the proceedings:	EN

Title of invention:
Process for producing polyethylene

Patentee:
EASTMAN CHEMICAL COMPANY

Opponent:
Univation Technologies, LLC

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 100(a), 100(b)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Novelty (yes)"
"Inventive step - problem and solution (yes)"
"Opposition grounds - insufficiency of disclosure (no)"

Decisions cited:
-

Catchword:
-

Case Number: T 0948/07 **-** 3.3.03

DECISION
of the Technical Board of Appeal 3.3.03
of 21 September 2009

Appellant:
(Opponent)

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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dated 14 March 2007 and posted 5 April 2007 rejecting the opposition filed against European patent No. 1159311 pursuant to Article 102(2) EPC 1973.**

Composition of the Board:

Chairman: R. Young
Members: A. Däweritz
C.-P. Brandt

Summary of Facts and Submissions

I. The grant of European patent No. 1 159 311 in respect of European patent application No. 99 909 825.4, filed on 3 March 1999 as International patent application No. PCT/US99/04765, was announced on 4 June 2003 (Bulletin 2003/23). The patent was granted with twenty-six claims, including the following independent claims:

> **1.** A process for polymerizing ethylene and/or ethylene and at least one or more other olefin(s) comprising contacting, under polymerization conditions, the ethylene and/or ethylene and at least one or more olefin(s) with a Ziegler-Natta type catalyst, trimethylaluminum and tetrahydrofuran as external electron donor.
>
> **25.** A film fabricated from the polyethylene produced in accordance with Claim 1.
>
> **26.** An article fabricated from the polyethylene produced in accordance with Claim 1.

The remaining process claims 2 to 24 were all dependent.

In this decision, any reference to passages in the patent in suit as granted will be given underlined in squared brackets, eg [Claim 1] or [0001]. References in underlined italics concern passages in the application as filed and as published in WO-A-00/052066, eg ***page 1, lines 8 to 11***. "EPC" refers to the revised text of the EPC 2000, the previous version is identified as "EPC 1973". Moreover, "IED" is intended to mean internal electron donor, "EED" external electron donor, "TMA" trimethyl aluminium, "TEAL" triethyl aluminium and "THF" tetrahydrofuran.

II. On 4 March 2004, a Notice of Opposition (NoOp) was filed, in which revocation of the patent in its entirety was requested.

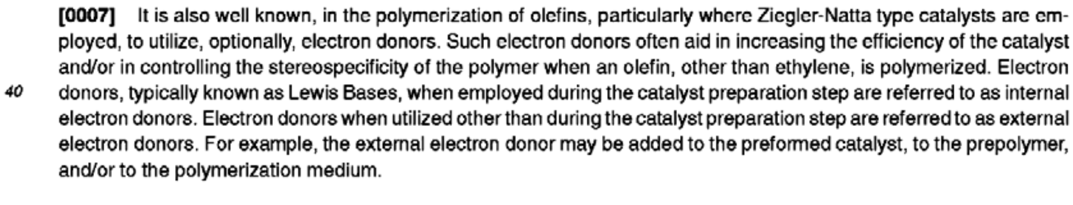
(1) The Opponent invoked Articles 100(a) and 100(b) EPC 1973 and raised objections of insufficiency of disclosure, lack of novelty and lack of inventive step with regard to the following fourteen documents:

D1: US-E-Re.33 683,

D2: US-A-4 981 930,
D3: EP-A-0 171 200,
D4: US-A-5 625 012,
D5: US-A-5 733 988,
D6: US-A-5 442 018,
D7: US-A-5 055 535,
D8: US-A-5 378 672,
D9: EP-A-0 703 246,
D10: US-A-4 533 705,
D11: US-A-5 556 820,
D12: EP-A-0 083 456,
D13: US-A-4 543 399 and
D14: EP-A-0 315 192

(2) Furthermore, the Opponent asserted that the patent in suit "*provides no guidance to the skilled person as to how he or she is to use THF as external electron donor in all the claimed circumstances. Claim 1, when read in combination with the definition at page 2, lines 41 to 43, appears to extend to processes where the THF is added to the preformed catalyst, but no examples of such a process are provided. Thus, it is entirely unclear to the skilled person as to how to proceed and how to ensure that the THF is then present as external, rather than internal electron donor.*" (item 5.0 of the NoOp).

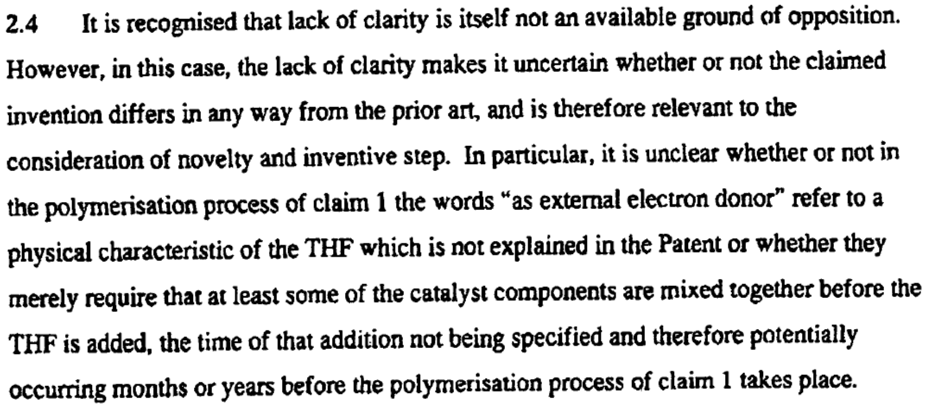
(3) The reference to [page 2, lines 41 to 43] points to the last two sentences of [0007] (see also NoOp, 2.2):



[0007] It is also well known, in the polymerization of olefins, particularly where Ziegler-Natta type catalysts are employed, to utilize, optionally, electron donors. Such electron donors often aid in increasing the efficiency of the catalyst and/or in controlling the stereospecificity of the polymer when an olefin, other than ethylene, is polymerized. Electron donors, typically known as Lewis Bases, when employed during the catalyst preparation step are referred to as internal electron donors. Electron donors when utilized other than during the catalyst preparation step are referred to as external electron donors. For example, the external electron donor may be added to the preformed catalyst, to the prepolymer, and/or to the polymerization medium.

(4) Thus, no clear distinction was made, according to the Opponent, in the patent in suit between IED and EED

on the basis of the chemical composition or other physical characteristics, but only on the basis of the time of utilisation. Furthermore, based on the argument that "*preformed catalyst*" would presumably refer to the Ziegler-Natta catalyst of Claim 1 and that no further definition of the word '*preformed*' had been provided, the Opponent took the view that "*that definition* (ie the above sole distinction between IED and EED) *is wholly unclear*" (NoOp, 2.3). It further argued:



> **2.4 It is recognised that lack of clarity is itself not an available ground of opposition. However, in this case, the lack of clarity makes it uncertain whether or not the claimed invention differs in any way from the prior art, and is therefore relevant to the consideration of novelty and inventive step. In particular, it is unclear whether or not in the polymerisation process of claim 1 the words "as external electron donor" refer to a physical characteristic of the THF which is not explained in the Patent or whether they merely require that at least some of the catalyst components are mixed together before the THF is added, the time of that addition not being specified and therefore potentially occurring months or years before the polymerisation process of claim 1 takes place.**

(5) In the course of the opposition proceedings, the Patent Proprietor submitted an Auxiliary Request, which did not, however, play any role in those proceedings.

III. At the end of oral proceedings held on 14 March 2007, the Opposition Division rejected the opposition. The decision was issued in writing on 5 April 2007.

(1) In the decision, the Opposition Division rejected the Opponent's argument that THF having been added to the catalyst in a prepolymerisation step (cf. [Claim 1] in conjunction with [0007]) would no longer be present as THF capable of acting as an EED during the main polymerisation, because during the long period of contact and due to the prepolymerisation the THF would have reacted with the rest of the catalyst system, and that this would, in particular, be the case when the prepolymerisation had been carried out a long time

before the resulting prepolymer was used as a catalyst system in the polymerisation. Moreover, it was established that the Opponent had not provided convincing evidence showing that its assumption was more than mere speculation.

Rather, the Opposition Division held, that a person skilled in the art knowing the difference between an IED and an EED was able to work the invention as "***he will take care that at least some THF in the catalyst system used is outside the structure of the catalyst and thus acts as an external electron donor.***", and, consequently, took the view that the patent in suit did not contravene the requirements of Article 83 EPC 1973.

(2) Novelty of the subject-matter of the process claims was acknowledged, because each of D1 and D2 referred to the use of THF as IED only. Furthermore, D7 to D9 and D12 to D14 mentioned only the use of either THF or TMA, but was silent about the respective other compound, and "***D3 to D6, D10 and D11 require more than one selection to arrive at a process for polymerizing or copolymerizing ethylene using a Ziegler-Natta type catalyst together with TMA as the cocatalyst and with THF as (internal or external) electron donor.***".

Furthermore, it was held that a comparison between the [examples] and the [comparative examples] made credible that the films and articles according to the granted product-by-process claims had a combination of properties that made them different from the films and articles prepared from polyethylene as disclosed in D1 to D14. The Opponent, who had the onus of proof, had not provided convincing evidence showing identity between the films or articles, as claimed in the patent in suit and at least one film or article made from the polyethylene polymers disclosed in those documents. Consequently, the Opposition Division concluded that the subject-matter of [Claims 25 and 26] was novel (Nos. 3 to 3.7 of the reasons).

(3) With regard to the Opponent's arguments concerning inventive step, it was found that D7 could not form the closest state of the art, because it was not directed to the preparation of films or articles with improved extractables level and/or strength properties, whereas D1 mentioned that the use of TMA instead of TEAL as the co-catalyst would lead to films having lower hexane extractables, improved dart drop and "***machine dimension*** [***sic***] ***tear properties***". In the examples of D1, THF was used, however, as an IED. Thus, the process of the patent in suit differed from the process of D1 by the use of THF as an EED (Nos. 4.1 to 4.4 of the reasons).

(4) The technical problem to be solved in respect to D1 was seen in the provision of a process for preparing ethylene polymers, of which polymers films and articles could be made showing "***an improved combination of level of extractables, Dart Impact values and balance between machine direction and transverse direction tear values***" (No. 4.5 of the reasons), which will be referred herein below to as "***improved combination of properties***". The machine direction and transverse direction tear values will be referred to as MD_{Tear} and TD_{Tear}, respectively.

(5) Whilst [Comparative Example 2] was carried out to prepare polyethylene within the scope of Claim 1 of D1, [Example 1] differed therefrom by the use of THF as an EED. The comparison between these examples showed that the claimed process led to polymers having the above improved combination of properties. None of D2 to D14 suggested that a film having this combination of

properties could be obtained from a polyethylene prepared in a process according to D1 by means of a Ziegler-Natta catalyst and THF as an EED. Nor did D1 show or suggest that a film of polyethylene prepared with a combination of THF as IED in the Ziegler-Natta catalyst and TMA as the co-catalyst would lead to properties better than a film, the polyethylene of which had been prepared with TMA as the co-catalyst but without an IED. Since, furthermore, no convincing evidence to disprove this finding had been provided by the Opponent, the Opposition Division concluded, that, in the process of D1, the presence or absence of THF as an IED had no influence on the above improved combination of film properties (Nos. 4.6 to 4.8 of the reasons).

(6) Therefore, it was found that the subject-matter of the [claims] was inventive over the teachings of D1.

(7) Consequently, the Opposition Division came to the decision, in accordance with the above findings, that the grounds for opposition mentioned in Article 100 EPC 1973 and raised by the Opponent did not prejudice the maintenance of the patent in suit in unamended form.

IV. On 5 June 2007, an appeal was filed, with concomitant payment of the appeal fee, against this decision by the Opponent (Appellant), who requested that the decision under appeal be set aside and that the patent in suit be revoked in its entirety. The Statement of Grounds of Appeal (SGA) was received on 15 August 2007, wherein the Appellant maintained its previous objections raised in the opposition proceedings.

(1) Furthermore, it enclosed a Declaration by Dr. Eisinger, dated 14 August 2007.

The Declarant considered IED compounds as being electron donors having been combined with the catalyst during its manufacture. By contrast, if the electron donor ***"is added to the polymerisation reactor separately to the catalyst, i.e., it is not combined with the catalyst prior to addition to the polymerisation reactor, it is generally referred to as an 'external electron donor'. In either case, the electron donor acts as a mild catalyst poison and thereby moderates the activity of the catalyst."*** (point 3).

In points 5 to 7 of the Declaration, he referred in more detail to the examples of D1, in particular its Examples 1 and 4. Because of less stringent drying conditions in Example 4, he expected a significantly higher THF content of its catalyst than the catalyst of Example 1. The Declarant further expressed his belief that catalysts as described in the above examples would include THF not bound to the catalyst components (eg by the two Al-compounds DEAC and THNAL added in step (b)(i) of Example 4 to the precursor in amounts "***less than that required to fully complex the THF***", ie the IED). Moreover, some of the THF would inevitably be released to the polymerisation reactor environment during polymerisation, because catalysts of the type as used in D1 would release THF during the polymerisation of ethylene in a fluidised bed and this would result in a build-up of THF within the reactor. This THF could not be distinguished from THF added separately to the reactor. According to the Declarant's statement in point 9, the reaction of an electron donor (eg THF) and a Ziegler-Natta catalyst would occur very rapidly and completely following the contact between those components even at room temperature, so that he would expect that the THF would complex with the Ziegler-

Natta catalyst within the timescale of the prepolymerisation reaction if added during the prepolymerisation stage in the preparation of a prepolymerized Ziegler-Natta catalyst. Therefore, the person skilled in the art would not regard THF having been combined with a prepolymerized Ziegler-Natta catalyst during the prepolymerisation stage as an EED as that term was generally understood and used in the art.

In Point 8 of the Declaration, the Declarant additionally referred to D4 and D5, both of which described fluidised bed polymerisation processes in which an anti-fouling agent was fed to the recycle line in order to reduce polymer build-up within that line. ***"It is my belief that THF injected into the recycle line of a fluidised bed reactor in the manner described in those documents will inevitably be carried into the main reactor chamber where it will contact the catalyst. As mentioned above, our extensive experience of operating fluidised bed reactors in which THF is released from the catalyst is that the THF is carried from the main reactor through the recycle line and back into the main reactor without it being lost or otherwise consumed within the recycle line."***

(2) The Appellant used this Declaration to support, within its submissions concerning its objection of insufficiency of disclosure (see SGA: 2.2 and 2.6), the argument that the patent in suit did not contain a clear distinction between EED and IED components. Rather "***the Proprietor has attempted to extend the scope of protection by defining an external electron donor to include even electron donors which are added to a preformed catalyst or to a prepolymer during a***

prepolymerisation step (see paragraph [0027] of the Patent)", even carried out months before the main polymerisation as confirmed by D4, column 7, lines 18 to 25 (SGA: 2.3 and 2.4). When accepting that the skilled person knew the difference between IED and EED components, the Opposition Division had ignored, in the Appellant's view, the explicit definition of EED in [0007] and [0027] (SGA: 2.7 and 2.8).

(3) Furthermore, the Appellant relied on D4 to further assert insufficiency of disclosure. The person skilled in the art realised, in its opinion, that the recycle line in the process of D4 flowed directly into the polymerisation reactor so that THF added as an anti-fouling agent to the recycle line could go nowhere else than the polymerisation reactor. Moreover, the preferred amounts of the anti-fouling agent in column 8 of D4 would be significantly larger than the amount of THF added to the recycle line in [Example 1] (as calculated in Annex 1 filed therewith). Hence, D4 would describe exactly the same process as disclosed in the patent in suit. If any specific measure were required in order to carry THF from the recycle line to the reactor, then the patent in suit was insufficient for failure to disclose such measures (SGA: 2.9).

(4) In order to show lack of novelty over D1, the Appellant essentially argued along the same lines as in the opposition proceedings (cf. SGA: 3.2 to 3.4 and section II(4), above). The meaningfulness of the requirement, that the THF be used as an EED, was contested on the basis of the Declaration referred to in section IV(1), above (SGA: 3.5).

Moreover, it its opinion, there was no suggestion in the patent in suit that using THF as an EED rather than as an IED (as in D1) made any difference whatsoever to the polyethylene produced. The polymers' features of low hexane extractables, enhanced film tear strength and lower melt flow ratios as mentioned in the patent in suit were "***exactly those disclosed in D1 (column 2, line 57 to column 3, line 9 and column 5, lines 33 to 63 of D1)***". Therefore, the polyethylene of the patent in suit lacked any distinguishing feature over the polyethylene of D1, so that the subject-matter of [Claims 25 and 26] lacked novelty (SGA: 3.7).

In items 3.8 to 3.10 of the SGA, the Appellant furthermore disputed the findings in the decision (section III(2), above) and pointed out that the patent in suit contained no examples or comparative examples in which THF had been used during the catalyst preparation step as in D1, and additionally argued that the properties mentioned in D1 were exactly the same as those described in the patent in suit. "***Accordingly, the lack of novelty is evident from D1 itself and the burden of proof should shift to the Proprietor.***" (SGA: 3.10, last sentence).

(5) With regard to D2 and D3, the Appellant argued that "***in attempting to stretch the definition of 'external electron donor' the Proprietor has ensured that there is actually no difference between some embodiments of the claimed subject matter and a process in which THF is added during catalyst manufacture. Such processes are also disclosed in D2 and D3 (...) which are therefore also relevant to the novelty of claim 1.***"

(6) Document D4 was, according to the Appellant, directed to a process for the polymerisation of olefins, in particular for the preparation of ethylene/propylene copolymers, in which an anti-fouling agent was added

into the recycle gas line of a fluidised bed reactor, like THF in the [examples] (***"see paragraph [0039]"***). Therefore, the anti-fouling agent was carried into the reactor and was present during polymerisation in exactly the same way as described in the [patent]. It was therefore to be expected that THF used as described in D4 would inevitably act as an EED. Moreover, THF was mentioned as one of the three most preferred anti-fouling agents and it was common practice in gas phase polymerisation processes of this type to feed all components other than the catalyst into the recycle gas line where they could mix with the recycled ethylene flow before being carried into the reactor. Hence, D4 disclosed all features of [Claim 1] (SGA: 3.12 to 3.14).

The finding quoted in section III(2), above, that more than one selection had been required in D4 to arrive at the claimed process, was disputed on the basis of the argument that, in D4, THF was disclosed as one of only three preferred anti-fouling agents and that, according to D8, TMA and TEAL were probably the most widely used cocatalysts. "***Accordingly, the combination of features required by claim 1 would be made immediately available to the skilled reader of D4 or D5.***" (SGA: 3.16).

(7) Considering the disclosure of D5 as being similar to that of D4, the Appellant came to the same conclusion for both of these documents (SGA: 3.15).

(8) Document D6 was referred to as disclosing an ethylene polymerisation process using two catalyst systems, the first comprising a vanadium-based catalyst and two further optional components (a first electron donor and a first modifier compound) along with a first cocatalyst and a halohydrocarbon promoter, the second comprising a titanium-based catalyst, a second electron

donor and a second cocatalyst. THF was stated to be the preferred electron donor. Moreover, ethers (including THF) could be added to the reactor, ie as EED. TMA was mentioned as a suitable cocatalyst. For these reasons, D6, in the Appellant's view, made the claimed subject-matter available to the skilled person (SGA: 3.17).

(9) Contrary to the finding in section III(3), above, the Appellant maintained its opinion that D7 could be considered as closest prior art because it disclosed all features of [Claim 1] except for the use of TMA as the activator. This use of TMA would, however, be only a routine, workshop modification. "***D7 does disclose the use of alkyl aluminium cocatalysts (...) and discloses a short list of such compounds. However, TMA is not mentioned, presumably for reasons of cost.***" (SGA: 4.1).

(10) Moreover, D7 was directed to the preparation of polyethylene which could even be used in alimentary (ie food related) applications. For these uses the US Food and Drug Administration (FDA) had specified a maximum level of hexane extractables for polyolefins which were to be used in contact with food. The test as specified on [page 5, line 27] was, according to the Appellant, in fact the FDA test. Moreover, D7 stated that the polyethylene had a narrow molecular weight distribution (MWD). In that connection the polydispersity and melt flow index (MFI) of the polyethylene were described in the paragraph bridging columns 2 and 3 of D7. The skilled person would immediately understand that narrow MWD was relevant to polymer film fabrication and film strength properties. Accordingly, the skilled person would read D7 as being directed to the same purpose as the [patent], and D7 could, therefore, be regarded as the closest prior art. "***All that is required to arrive***

at the claimed invention from D7 is to use TMA as co-catalyst. TMA is, of course, extremely widely used as a co-catalyst in olefin polymerisation (see, for example, column 7, lines 38 to 40 of D8 where TMA and TEAL are stated to be probably the most widely used co-catalysts). Of the cited documents D1, D2, D3, D4, D5, D6, D8, D9, D10 and D11 all disclose the use of TMA. In fact, the use of TMA as a co-catalyst lies well within the common general knowledge of the skilled person." This modification would, therefore, be devoid of inventive step (SGA: 4.2 and 4.3).

(11) The technical problem to be solved with respect to D7 was seen by the Appellant in a further improvement of the film strength and in a further reduction of hexane extractables, as described in [0014].

The skilled person would have been aware from D1 (column 3, lines 3 to 9) that the use of TMA as co-catalyst gave exactly the desired benefits (D1, column 2, lines 57 on and the passage at column 12, lines 24 to 65). Moreover, both D1 and D7 related principally to the same type of Ziegler-Natta catalysts activated with alkylaluminium compounds for the gas phase polymerisation of the same monomers. Therefore, the skilled person would have the incentive to modify the teaching of D7 to use TMA, thereby arriving at the claimed process (SGA: 4.4).

(12) Furthermore, the Appellant contested the presence of an inventive step in a second approach on the basis of D1 as the closest state of the art. With regard to this document, it saw the technical problem in the provision of an alternative polymerisation process, since D1 delivered exactly the same benefits as were mentioned in the patent in suit. As the only difference

between D1 and the claimed subject-matter the Appellant acknowledged that THF was added in D1 during the catalyst preparation. The addition of an electron donor directly to the polymerisation reactor had, at the priority date, been well-known and was, therefore, an obvious alternative process. Moreover, D7 taught not to bring the electron donor into contact with the catalyst without the presence of co-catalyst, in particular, "***a complex of co-catalyst and THF is added to the reactor separately from the catalyst, as in the Examples of D7***". In those examples, THF gave higher catalyst productivity and a lower melt index ratio than other monoethers used. It was known that polyolefins having a narrow MWD were especially suitable for the production of high strength films which would presumably show a better balance between machine direction and transverse direction strength. The skilled person was therefore, in the Appellant's opinion, motivated to modify the process of D1 by adding THF separately to the polymerisation reactor either in place or in addition to the THF already present in the catalyst, thereby arriving at the same claimed process (SGA: 4.6 and 4.7).

(13) The objective problem, as addressed in the decision under appeal (section III(4), above), had already been solved by the process of D1 itself, which had been overlooked by the Opposition Division (SGA: 4.8).

(14) The comparison between [Example 1] and [Comparative Example 2] was not, in the Appellant's view, a valid basis for the conclusion drawn in the decision under appeal, because [Comparative Example 2] was neither representative for D1 (because it did not include any type of THF as required in D1), nor could it be

compared with [Example 1], because of many differences in the process parameters. (SGA: 4.10 and 4.11).

(15) Moreover, the fact had been overlooked, according to the Appellant, that some of the further cited documents, eg D4 and D5 taught the use of THF added to the reactor for other reasons. The main point was, however, that the only difference between D1 and the claimed subject-matter had been the time at which the THF was added. The [patent] contained no suggestion, let alone any evidence, that this difference made the slightest difference to the properties of the polyethylene produced. Thus, there was no comparison in the patent in suit between uses of THF as IED and THF used as EED; nor did the description contain an allegation in this respect.

(16) In each of D4 and D5, an antifouling agent such as THF (disclosed as one of three or four such agents) was added to the recycle line of a fluidised bed reactor during an olefin polymerisation involving a Ziegler-Natta catalyst (eg in Example 12 of D5). Moreover, TMA, an extremely widely used co-catalyst, was mentioned in each of those documents as a co-catalyst. Therefore, each of these documents gave on its own the necessary teaching which enabled the skilled person to achieve the claimed combination simply by routine choice of antifouling agent and co-catalyst from within the preferred materials proposed in those documents.

(17) Finally the Appellant did not agree that the burden of proof had been on the Opponent with respect to the issue addressed in section III(5), above.

V. In its rejoinder dated 22 February 2008, the Respondent disputed the Appellant's arguments and requested that the patent in suit be maintained as granted or, in the alternative, with Claims 1 to 26 of the Auxiliary Request filed therewith.

(1) The Respondent considered that there was common ground between the parties, eg confirmed by the Declarant (section IV(1), above), that in principle two types of electron donors existed, IED and EED, and referred to the identical meaning of "internal" as used, on the one hand, in D8, D2, D3 and D11 and, on the other hand, in [0007], ie addition of the electron donor as a raw material during the production of the Ziegler-Natta catalyst. This was also the case in D1 (also referred to in this respect in [0009], line 52), wherein THF was added as in IED during the "***Precursor Preparation***" of its Example 1. The Ziegler-Natta catalyst was prepared by reacting a mixture of silica, dry isopentane, C_2H_5MgCl and THF. In a second step, $TiCl_4$ was reacted with the product of the first step. The end product was repeatedly washed and thereafter dried in order to remove all solvents. The THF (1.91 wt.%) being part of this catalyst could not easily be removed therefrom (otherwise it would have been removed, according to the Respondent, by the washing and drying). This catalyst was then used in combination with TEAL as the co-catalyst to prepare LLDPE. A similar procedure was followed in Example 4. This procedure was in full accordance with the definition of IED in [0007] (rejoinder: 2.1 and 2.2).

(2) Furthermore, the Respondent disputed the "***belief***", the "***expectations***" and all the further arguments of the Declarant and of the Appellant. Thus, it referred to a "discrepancy" in those arguments, namely the views that the catalyst would release THF, which would then be

present as an EED (section IV(1), above, paragraph 2, point 5 of the Declaration), or (in its point 9), that THF added to a reactor during the prepolymerisation stage would complex with the Ziegler-Natta catalyst within the time scale of that reaction and that such a THF would no longer exist as an EED in the final polymerisation, but would thus become an IED. According to the definition in ([0007]), however, the only electron donors disclosed in D1 were IED, because they were employed during the catalyst preparation step, whereas electron donors added at a time other than during the catalyst preparation step were referred to as EED. The explanation of the Appellant for EED was, in the Respondent's view, too restrictive. Its own view on EEDs was, according to the Respondent, supported by some cited documents including eg in column 3, lines 44 to 49 of D8, as opposed the explanation of IED in D8, column 2, lines 21 to 27 (rejoinder: 2.3 to 2.7).

The Respondent pointed out furthermore that the above arguments of the Appellant and the allegations (belief, expectations) of the Declarant had not been supported by any documentation or experimental results (rejoinder: 2.5, 2.6 and 2.8). Without any evidence, the considerations of the Opponent remained, however, pure speculation, which could not support an insufficiency argument (rejoinder: 3.1).

(3) In respect to the first insufficiency objection based in particular on the Declaration (sections IV(1) and IV(2), above), the Respondent supported the decision under appeal and argued that the [patent] contained clear definitions of the two terms "IED" and "EED", which could easily be followed, and that there

was no evidence to the contrary (rejoinder: 3.1, and pages 2 and 5 thereof containing references to [0007]).

(4) Concerning the second aspect of this objection on the basis of D4 and D5, the Respondent pointed out that these documents dealt with the addition of an anti-fouling agent to the recycling line of a polymerisation reaction, but stated furthermore that the anti-fouling agent should not be added to the polymerisation reactor. This insufficiency argument was not suitable to cast doubt on the process of the contested patent, and any comments with respect to the recycle line seemed not to be relevant for the claims of the patent.

(5) In items 4.1 and 5.3.6 of its rejoinder, the Respondent pointed out that the burden of proof in opposition proceedings were with the Opponent. However, the Appellant had, in the Respondent's opinion, discharged this burden neither with regard to the process claims nor with regard to the product-by-process claims of the [patent].

(6) In items 4.2.1 and 4.2.2 of the rejoinder, the Respondent dealt with the details of D1 relating to the polymerisation of an α-olefin in which TMA was used as the catalyst activator. Two preferred embodiments of the catalyst were referred to, one of which related to the preparation of a Ziegler-Natta catalyst (precursor) in the presence of an electron donor (D1, column 2, lines 34 to 44), ie with an IED, the other embodiment without (D1, column 2, lines 27 to 33). The first embodiment was exemplified in its Examples 1 and 4, wherein the Ziegler-Natta catalyst was prepared in the presence of THF. After the preparation of the catalyst, the catalyst of Example 1 was extensively washed with isopentane and then dried for 8.5 h with a slow

nitrogen purge at 60°C. The catalyst of Example 4 was after its preparation dried under nitrogen purge at 60°C for about 4 h to obtain a dry impregnated free-flowing powder. As the THF was employed during the catalyst formation, it was, according to the definition in the [patent] (and in accordance with the definition in the prior art), used as an IED. The allegation that the presence of some EED would be implicit to the process of D1 had not been proved. Nor had any proof been provided for the allegation that the claimed products were inherently the same as those products obtained according to the process of D1. The Respondent furthermore referred to a "***unique combination of low amount of n-hexane extractables a very high dart impact value and an excellent balance of*** MD_{Tear} ***and*** TD_{Tear}". None of the polyethylenes disclosed in the examples of D1 showed properties that were comparable to those of the polyethylene obtainable by the claimed process. D1 did not even disclose any dart impact values. D1 only referred to improvements of the dart drop (admittedly corresponding to dart impact) of films of D1 being 20 to 30 % improved above the prior art (using a catalyst system with TEAL as co-catalyst). In the patent in suit, however, the improvement over the product of [Comparative Example 3] was more than 100% in [Example 1], whereby [Comparative Example 3] differed from [Example 1] by the use of TEAL instead of TMA as the co-catalyst. Moreover, D1 was silent about TD_{Tear}.

According to column 9, lines 38 to 40, the lowering of the density of a polymer should increase the amount of n-hexane/FDA extractables. The lowest value of these extractables disclosed in D1 was 3.69 wt.% in its Example 7 (at a polymer density of 0.9159). The highest value in the [examples] was 3.5 wt.% in [Example 5] (at a polymer density of 0.908). Therefore, the Respondent expected for a polymer prepared according to D1 and having such a low density of 0.908 would have an even higher amount of extractables than 3.69 wt.% and concluded that it was not possible with the process of D1 to prepare polyethylenes with such low amounts of n-hexane extractables as the polymers obtainable by the process claimed in the patent in suit.

(7) Neither D2 nor D3 disclosed, according to the Respondent, a process for producing polyethylene using TMA in combination with THF as EED. Nor did D6 which related to polyethylene having a broad MWD disclose why a skilled person should combine the features "*use of an external electron donor*", "*use of THF as an electron donor*" and "*use of TMA as co-catalyst*". Whilst it was admitted that D6 disclosed various ethers which could be added to "*boost*" the activity of its vanadium catalyst and THF was mentioned in a long list of ethers in D6, the Appellant's own expert would not consider the ether of D6 to be an electron donor, which he defined as being a mild catalyst poison and therefore a moderator of catalyst activity (section IV(1), above, last sentence of the first paragraph). Therefore, D6 did not appear to contain a clear and unambiguous disclosure of the claimed process.

(8) With regard to D4 (rejoinder: 4.4.1 to 4.4.4), the Respondent referred to the fact that a catalyst was used therein comprising a catalyst precursor consisting of vanadium triacetylacetonate, optionally supported on a carrier, a co-catalyst consisting essentially of an alkyl aluminium halide and optionally a trialkyl aluminium (D4, column 4), 12 of which were listed in column 5. D4 did not mention electron donors, neither

IED nor EED to be used as part of the reaction, but only to add an anti-fouling agent, "***selected from a huge number of compounds***". THF was named as one of three most preferred anti-fouling agents. No example was contained in D4, wherein a catalyst was employed together with TMA as co-catalyst a THF was used as an anti-fouling agent.

Even if a skilled person made all the above selections, the anti-fouling agent would have to be introduced into the polymerisation reactor, because it could only act in the reactor as an EED. However, D4 explicitly disclosed that the anti-fouling agent should not be added to the reactor, as this could adversely affect the polymerisation reaction due to the formation of undesirable side products and/or inactivation of the catalyst system (D4, column 8). In view of this warning, one could not automatically assume, let alone was it evident that the anti-fouling agent was added in D4 to the recycle line at a position where it necessarily and in sufficient quantity reached the reactor. The Appellant's assumption was not supported by D4 but was in clear contrast thereto. According to the explanation in column 8, line 13 ***et seq.*** of D8, the agent selectively interacted with the co-catalyst in the recycle line to reduce or eliminate polymer build-up in that line or in the heat exchanger.

(9) With regard to inventive step, the Respondent supported the decision under appeal in that D1 was the closest state of the art, because D7 did not disclose the improved combination of properties (section III(4), above), whereas D1 made some statements with respect to hexane-extractables, improved dart drop and MD_{Tear} of the

produced polyethylene. Nevertheless the Respondent discussed both combinations, ie D7/D1 and D1/D7.

(10) Document D7 related to a process for the production of linear polyethylene having a narrow MWD. In one example (ie Example 2), trihexylaluminium was used as a co-catalyst in connection with several ethers, amongst them THF. However, the use of TMA was not envisaged. The structurally closest co-catalyst disclosed in D7 was TEAL.

As shown by [Comparative Example 3] and [Example 1], the replacement of TEAL by TMA gave a significant improvement of the productivity, ie higher activity of the catalyst system, a reduction of the amount of n-hexane extractables and an improved dart impact property (by more than 100%), whilst the balance between the MD_{Tear} and TD_{Tear} was maintained due to no significant change of these values.

Document D7 itself did not mention TMA and could not therefore give any suggestion that TEAL should be replaced by TMA, let alone that the advantages shown in the contested patent could be achieved, if such replacement was made. Therefore, the claimed subject-matter was based on an inventive step over D7 alone. The arguments of the Appellant in section IV(10), above were, in the Respondent's opinion, clearly based on hindsight (rejoinder: 5.2.1 to 5.2.5).

(11) The Appellant's assessment concerning a combination of D7 and D1 was, in the Respondent's view, also incorrect. D1 contained no restrictions as to the composition of the Ziegler-Natta catalyst. Nor did it consider the use of an electron donor being mandatory. In its examples, an IED was used.

Document D1 clearly disclosed that "*the use of TMA as activator (or co-catalyst) in place of TEAL produced a catalyst composition with somewhat less productivity (D1, column 9, lines 21 to 23). Thus, a skilled person trying to solve the problem as stipulated above and to provide a catalyst system with a higher productivity ... would certainly not have any incentive to use TMA, which according to document D1, decreases the activity. ... Thus, document D1 actually leads away from the subject matter claimed in the contested patent.*"

The Respondent pointed out further that D1 (which did not disclose the use of an EED) did not contain any disclosure or suggestion that the improved combination of properties as addressed in the second paragraph of section V(10), above, could be achieved, despite using TMA (cf. the last paragraph above).

(12) Contrary to the Appellant's assessment, the person skilled in the art would not have expected that using TMA in combination with an EED achieved the advantages shown in the patent in suit, and the Respondent submitted accordingly that the subject-matter claimed was based on an inventive step with regard to a combination of D7 and D1.

(13) In items 5.3.1 to 5.3.5 of its rejoinder, the Respondent finally commented on the Appellant's arguments based on the combination of D1 and D7.

(14) The catalyst system used in D1 was a combination of a Ziegler-Natta catalyst and TMA as co-catalyst. No mention was made of any use of an EED together with the above catalyst system. Nor did D1 disclose any effects caused by the presence of an electron donor, let alone any advantageous effect which could be achieved with an

electron donor, although one of two preferred embodiments was referring to the use of an IED, whilst the other was silent in this respect. In other words, the general disclosure of D1 did not mention that an electron donor was necessary. Therefore, the Respondent considered [Comparative Example 2] as being a valid comparison with the subject-matter of D1. Moreover, the Respondent argued with regard to the Appellant's arguments questioning the validity of the comparison between [Examples 1 and 2], that the corresponding relevant product parameters (ie the amount of n-hexane extractables, dart impact/drop values, MD_{Tear} and TD_{Tear}) of different polymers could best be compared with one another, when the polymers (in the present case both being LLDPE) had the same density and melt index. In both [examples] mentioned above the density of both polymers was 0.918 g/cm^3 and their melt index I_2 was 0.9 dg/min. In order to obtain these polymers, the process conditions had, according to the Respondent, to be adapted, so that the differences occurred which were criticised by the Respondent (section IV(14), above).

In the Respondent's opinion, the two above [examples] demonstrated that the polymer according to the claims showed significant improvements in the amount of n-hexane extractables (reduction by about 50%) and in dart impact (increase by 165%) at MD_{Tear} and TD_{Tear} values which were not much changed, so that the balance between MD_{Tear} and TD_{Tear} was maintained.

(15) The criticism of the Appellant concerning the comparison of the two above [examples] (section IV(14), above) was contested by the Respondent, because the intention claimed in the patent in suit was not to replace an IED with an EED, but rather the invention

was based on the unexpected finding that a certain catalyst composition, namely a Ziegler-Natta catalyst in combination with TMA as a co-catalyst and an EED was advantageous and provided a polyethylene having surprisingly advantageous properties.

(16) Moreover, whilst according to D1 using TMA with a Ziegler-Natta type and with an IED reduced the catalyst activity in comparison with a TEAL co-catalyst (column 9, lines 21 to 25), the patent in suit showed (according to the comparison of [Examples 1 and 3]) that if an EED was used with a Ziegler-Natta catalyst and TMA as the co-catalyst the productivity was in fact increased compared to a catalyst with TEAL as the co-catalyst.

(17) The results in these examples also demonstrated that the dart drop could be doubled by replacing TEAL by TMA in the presence of an EED, which was not mentioned anywhere in D1 (cf. section V(11), above, paragraph 2), whilst the same replacement resulted in D1 in only a moderate improvement of this property.

(18) With regard to the tear properties, the Respondent argued that the balance between MD_{Tear} and TD_{Tear} was maintained, contrary to D1 referring to an increase of MD_{Tear} by using TMA as the co-catalyst (D1, column 5, lines 55 to 59). As far as the n-hexane extractables were concerned, the Respondent referred to its arguments as mentioned in section V(6), above).

(19) The Respondent came to the conclusion that neither D1 nor any other cited document suggested that using a combination of a Ziegler-Natta catalyst with TMA as co-catalyst and an EED (as claimed in the [patent]) had the above advantages and produced a polyethylene with

the advantageous properties as shown in the patent in suit. Consequently, even a combination of another document with document D1 could not lead a skilled person to the subject-matter claimed in the contested patent.

VI. On 23 June 2009, the parties were summoned to oral proceedings on 16 September 2009. The oral proceedings were, however, postponed by Communication, dated 8 July 2009, until 23 September 2009.

VII. In a fax dated 7 August 2009, the Appellant informed the Board that it had decided not to attend the oral proceedings, and it withdrew its request for oral proceedings, but it maintained its request that the decision under appeal be set aside and the patent in suit be revoked.

VIII. In a letter dated 13 August 2009, the Respondent requested the Board, in view of the letter of the Appellant (section VII, above), to consider whether the oral proceedings were still necessary or whether the case could be decided on the basis of the written submissions of the parties.

Moreover, the Representative of the Respondent informed the Board that, if the oral proceedings were held, he would attend and he would be accompanied by (i) the US representative of the Respondent and (ii) by a technical expert, ie Dr. J.J. Vanderbilt.

IX. On 18 September 2009, the parties were informed by fax of the cancellation of the oral proceedings.

X. According to the written submissions of the parties the state of the requests was as follows:

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

The Respondent requested that the appeal be dismissed or, in the alternative, that the decision under appeal be set aside and that the patent be maintained on the basis of the Auxiliary Request (Claims 1 to 26) as filed with the rejoinder dated 22 February 2008.

Reasons for the Decision

1. The appeal is admissible.

2. In view of the situation that (i) the Statement of Grounds of Appeal had been communicated to the Respondent with a Communication dated 21 August 2007, setting time limit for reply of four months, extended with a Communication dated 8 January 2008 by two months, (ii) the rejoinder of the Respondent was received by the Board on 22 February 2008, ie within the above extended time limit (Rule 131(4) EPC) and was forwarded to the Appellant on 6 March 2008, (ii) the parties were summoned by letter dated 23 June 2009, (iii) the oral proceedings were postponed by letter dated 8 July 2009 to 23 September 2009, (iv) the Appellant withdrew its request for oral proceedings by letter dated 7 August 2009, (v) the Respondent requested in a letter dated 13 August 2009 that the possibility of cancellation of the oral proceedings be considered by the Board and that the case be decided on the basis of the written submissions of the parties, which letter was communicated to the Appellant on 21 August 2009, the Board decided to cancel the oral proceedings and to

decide on the basis of the written submissions of the parties (section IX, above).

Objection of insufficiency of disclosure

3. The sufficiency of disclosure was contested by the Appellant with the arguments (i) that the patent in suit did not contain a clear distinction between internal and external electron donors (IED and EED, respectively) and (ii) that, in view of D4 (or D5) wherein THF had been fed to the recycle gas line, the specification failed to describe any specific measures, which, if necessary, would ensure that the THF was carried from the recycle gas line of D4 (or D5) to the reactor (sections IV(2) and IV(3), above).

3.1 Before investigating the substance of these arguments in detail, the Board wishes to clarify its position with regard to the meaning of the term of "*catalyst*" as used in [0007] in the context of the "*catalyst preparation step*". As confirmed eg by D1, column 2, lines 34 to 39; D2, column 4, lines 31 to 58; and D3, Claim 1 (= component (A) in Claim 11), this term can at the end of that preparation step only mean the same as "*precursor*", before it is activated by a "co-catalyst" or "*activator*", as referred to eg in D1, in particular, in its Examples 1 or 4. This equivalence is also held valid with regard to "*catalytic component*" as eg referred to in Example 1, step A of D7.

3.2 In respect to the first of the Appellant's above objections, the Respondent referred to the definition in [0007], which identifies the internal electron donor (IED) to be a compound "*employed during the catalyst preparation step*", whereas those electron donors "*utilized other than during the catalyst preparation*

step are referred to as external electron donors" (EED). This definition is consistent with the further explanation in [0027], stating that the EED "***may be added to the preformed catalyst, to the prepolymer during the prepolymerisation step, to the preformed prepolymer and/or to the polymerization medium.***" (cf. the rejoinder; sections V(1) to (4), above).

3.2.1 Whilst the definition of the IED had been accepted in the Declaration filed by the Appellant (section IV(1), above), the EED was interpreted by the Declarant only as being an electron donor which "***is added to the polymerisation reactor separately to the catalyst, i.e., it is not combined with the catalyst prior to addition to the polymerisation reactor., ...***", ie in agreement only with the last option in the quotation from [0027] in the last paragraph, above.

3.2.2 However, with regard to the other options in that paragraph, referring to the addition of the electron donor to "***the preformed catalyst***", to "***the prepolymer during the prepolymerisation step***" and to "***the preformed prepolymer***", the Board sees no valid interpretation other than that, in each of these further options, the catalyst ***preparation step*** (in the sense of the definition in [0007] inclusive of any washing and drying steps) has already been terminated before any addition of (optionally further) electron donor. In other words, according to each of these further options, the electron donor is added as an EED to the polymerisation mixture containing the preformed catalyst. This means evidently that the definitions of IED and an EED as given in [0007] and [0027] dealing with this question provides, contrary to the Appellant's opinion (section IV(2), above), a clear and unambiguous distinction between, on the one hand, the electron donor forming an integral component of the catalyst (which cannot even be removed by repeated washing steps and drying, as shown in Examples 1 and 4 of D1; cf. section V(1), above) and, on the other hand, the external electron donor being a further component of the reaction mixture, irrespective of whether the activated catalyst is prepolymerized in an additional intermediate stage.

3.3 In the Board's opinion, this finding is, moreover, consistent with and even confirmed by statements, identical in D4 and D5, that an electron donor when used as an "***antifouling agent should not be added to the reactor as this can adversely affect the polymerization process due to the formation of undesirable side reactions and/or inactivation of the catalyst system. It is believed that the antifouling agent selectively interacts with the cocatalyst in the recycle line gas or on entrained particles to reduce or eliminate polymer buildup in the recycle line and/or the heat exchanger.***" (D4, column 8, lines 11 to 17; D5, column 4, lines 2 to 9). Therefore, D4 clearly states also that the anti-fouling agent is preferably fed into the recycle line (column 8, lines 8/9), presumably upstream of the heat exchanger in order to avoid any fouling in this device. Consistent with this finding is the fact that neither of D4 and D5 provide in their examples any information about any presence of THF in the reactor.

3.3.1 From the above wording in D4 and D5 it is clear to the Board that it is essential for such a process that an electron donor added as an anti-fouling agent to the recycle line will and must be consumed completely in a reaction with the co-catalyst before it could enter the reactor. Furthermore, the arguments in points 5 and 6 of the Appellant's Declaration that the IED would be released from the catalyst into the reactor during the polymerisation, which could not be distinguished from THF added separately to the reactor (section IV(2), above), are not convincing in view of the discrepancy in the arguments in points 5, 6 and 9 of the Appellant's Declaration as referred to in the comments of the Respondent on the Declaration, which remained undisputed by the Appellant, and the absence of any evidence supporting the validity of the Appellant's arguments (see section V(2), above).

3.3.2 Nor does D1 provide any information about any build-up of free THF in the reactor. Apart from (i) the content of THF bound in the "precursor" of Example 1 (D1, column 8, line 18), (ii) the amounts (per mol of THF) of two aluminium compounds (DEAC and TNHAL) added to the precursor of Example 4 during its activation before the feed of the activated precursor to the reactor (D1, column 10, lines 39 to 48, 59 to 61 and 65 to 68, respectively) and (iii) DEAC/THF- and TNHAL/THF-ratios shown in column 11, lines 7, 21 and 22 of D1, the examples do not provide any information concerning the catalyst/precursor feed to the reactors (which could provide some information about the possible amount of THF, in any form, in the reactor). The only statement in Example 2 to these missing values reads "***the feed rate of catalyst precursor was adjusted to achieve a substantially equal rate of polymer production.***" (D1, column 8, lines 34 to 38), in Example 3 it reads: "***LLDPE polymer was produced with the catalyst precursor of Example 1, using substantially the same reaction conditions as in Example 2 ...***" (D1, column 8, lines 55 to 57), in Example 5 (D1, column 11, lines 9/10) is stated: "***Reaction conditions were substantially equivalent to those of Examples 2 and 3, ...***" and in Examples 6 to 10 (D1, column 11, lines 24/25) the only information in this respect says: "***Reaction conditions were substantially equivalent to those in Example 5***".

3.4 In view of these findings, the Board sees no reason to deviate from the decision made by the Opposition Division in this respect (Nos. 2 to 2.5 of the reasons). Therefore, the objection of insufficient disclosure under Article 100(b) EPC is rejected.

Novelty

4. The novelty objection raised by the Appellant relies to a large extent on the argument that there was no clear distinction between THF as present an IED and THF present as an EED (sections IV(4) and 3, above).

4.1 However, as shown with regard to the objection of insufficiency, the patent in suit discloses its subject-matter in such a way that IED and EED can clearly and unambiguously be distinguished from one another (sections 3.1 to 3.2.2 [0007] and [0027]). Nor has it convincingly been shown that in D1, D4 or D5, THF would have been present in the reaction mixture in the polymerisation reactor as an EED. The arguments of the Respondent have not been disputed, let alone refuted by the Appellant (cf. sections IV(6), IV(7), V(6), V(8) and 3.3 to 3.3.2, above).

4.2 Nor has the Appellant shown that the assessment of novelty with regard to D2 (No. 3.2 of the reasons) or D3 in the decision under appeal and as agreed to by the Respondent was wrong (sections III(2), IV(5) and V(7), above).

4.2.1 More particularly, D2 mentions the use of THF as an IED, not as an EED. Thus, within a long list of electron donors (A-3), being a raw material for the solid catalyst component (wherein (A-1) a magnesium compound and (A-2) a titanium halide are the other constituents; cf. D2, column 2, lines 60 to 63 and column 3, line 25 to column 4, line 23), THF is mentioned in column 4, line 7 as one, not preferred species. Whilst the document additionally refers to the use of EED compounds including particular ethers of formulae [1a] and [1b] which do not encompass cyclic ethers, carboxylic esters, organosilicon compounds and azo compounds (D2, column 1, line 58 to column 2, line 44), the long list of exemplified species in from column 5, line 42 to column 8, line 40 does not refer to THF.

4.2.2 Document D3 relates primarily to the preparation of a titanium containing supported catalyst component (A) obtained by contacting (1) a reaction product of (a) an oxide or composite oxide of an element of Groups II or IV of the Periodic Table, (b) at least one dihydrocarbyl Mg compound or a mixture or a complex thereof with an organic compound of Al, B, Be or Zn and (c) a halogen-containing alcohol held with (2) (d) an electron donor and (e) a di-, tri- or tetravalent Ti compound (Claim 1). The catalyst component (A) can be used in combination with (B) an organometallic compound of an element of Groups I to III as a catalyst for the polymerisation of olefins (Claim 11). According to this wording, component (B) is used as the co-catalyst.

Component (B) is further described on from page 12, line 3 to page 15, line 11. The organometallic compound of component (B) encompasses various organic compounds of Li, Mg, Ca, Zn and Al. Within a long list of organic aluminium compounds represented by the general formula R_nAlX_{3-n} (wherein R denotes an alkyl or aryl group, X denotes a halogen or hydrogen atom or an alkoxy group and n denotes a desired number in the range of $1 \leq n \leq 3$). TMA is mentioned as only one example within a long row of such aluminium species (in a list extending from page 12, line 25 to page 13, line 6). Furthermore, on page 13, lines 9 to 18, further reference is made further more complex aluminium compounds.

According to page 13, line 19 to page 15, line 11, the option of using the organic metal compound in combination with an electron donor of different types (including those mentioned in Claim 1 in the context of component (2) (d) as disclosed on from page 5, line 9 to page 7, line 21). The various listed suitable species disclosed on page 13 ***et seq.*** range from organic silicon compounds to phosphoric acid esters and include within this long list also THF (page 14, line 27).

Amongst those examples ("Applied Examples") describing the polymerisation of olefins, namely of propylene, only Applied Example 74 concerns a copolymerisation of propylene and ethylene. In this polymerisation TEAL in combination with phenyl triethoxy silane, both dissolved in n-heptane, was used as Component (B). The only properties of the polymers referred to on page 16, lines 23 to 29 are the melt flow rate, the bulk density of the polymers and the content of heptane insolubles as an indication of the proportion of crystalline polymer in the whole polymer. In Applied Example 74, the ethylene content of the copolymer was given instead of the heptane insolubles content.

In view of these findings, the Board concurs with the assessment in No. 3.3 of the reasons of the decision under appeal (cf. section III(2), above).

4.3 As stated by the Appellant (section IV(8), above), the process of D6, which aims at a broad MWD of its polymer product (contrary to the other cited documents D1 and D7), involves the use of two different catalyst systems. One of these catalyst systems is based on (a) a titanium complex being the reaction product of a Ti compound, a Mg halide and a first electron donor and optionally a first modifier compound and (b) a first co-catalyst. The other catalyst system is based on (i) a vanadium compound optionally reacted with a second electron donor, and optionally a second modifier compound and (ii) a second co-catalyst (Claims 1 and 5, respectively). Alternatively, a mixture of these catalysts could be used (Claim 9).

Numerous electron donors for either catalyst are listed in the passage of from column 7, line 57 to column 8, line 13, whereof THF is referred to as being the preferred electron donor. In column 9, lines 55 to 68, THF is furthermore mentioned as one of a long list of ethers which can be added to the process of D6 together with a halohydrocarbon promoter in order to boost the activity of the vanadium catalytic sites. In column 8, lines 14 to 29, numerous modifier compounds having the formula $AlX_aR_{(3-a)}$ (with X being a halogen and R being a C_{1-14}-alkyl) for either catalyst type are listed. Within a row of different species of this kind, TMA is also mentioned. However, this document neither clearly nor directly discloses, anywhere in the general description or the examples, a combination of a Ziegler-Natta catalyst, TMA and THF as an EED, which concurs with the finding in No. 3.3 of the reasons for the Decision under appeal (cf. section III(2), above).

4.4 Furthermore, the Appellant has not commented on, let alone refuted the arguments of the Respondent (cf. sections V(6) to V(8), above) that none of the cited documents discloses a polymer or film having the same properties as those obtainable by the process of Claim 1. Nor has any evidence been provided by the Appellant in this respect to prove its case (section V(5), above).

4.5 In view of the above facts and findings and since no further novelty objection on the basis of another document has been raised by the Appellant, the Board has come to the conclusion that the requirements of Article 54 EPC are met by the claimed subject-matter of Claims 1, 25 and 26.

Problem and solution

5. The patent in suit relates to a process for the manufacture of ethylene homo- and/or copolymers by means of a Ziegler-Natta catalyst, TMA and, as an external electron donor (EED), THF. Moreover, it relates to films and articles made from these polymers.

The above polymer of the above process was to have a reduced level of extractables (in terms of n-hexane extractables) and films made therefrom were to have improved strength properties ([0001]), expressed in terms of dart impact values and a good balance between MD_{Tear} and TD_{Tear} values ([0014]).

Closest state of the art

5.1 Whilst the Opponent had considered D7 as being the closest piece of prior art, the Opposition Division had decided that D1 represented the closest state of the art (section III(3), above). However, in its SGA, the Appellant/Opponent maintained its above view in this respect, on the basis of the argument that D7 differed from [Claim 1] only by not disclosing the use of TMA as the co-catalyst, but referred to the suitability of its products for alimentary applications and to the narrow MWD of its products being relevant for polymer film fabrication and film strength properties (sections IV(9) and IV(10), above), whereas the Respondent supported the Opposition Division's view that D1 was the closest state of the art, because D7 did not disclose any of the desired properties of the polyethylenes, whereas D1 made some statements with respect to hexane-extractables, improved dart drop and MD_{Tear} of the produced polyethylene (section V(9), above).

5.2 The arguments of the Appellant concerning the selection of the closest prior art document, namely the reference to the fact that D7 had all features in common with the patent in suit except for the use of TMA, are based, in the Board's view, on hindsight. This view is not invalidated by the references to the suitability of the product of D7 for alimentary applications or the reference to the narrow MWD, the polydispersity and melt flow ratios, allegedly indicating that D7 would be directed to the same purpose as the patent in suit. In fact, D7 aims at the fabrication of linear polyethylene having a narrow MWD, thereby noticeably maintaining the productivity of the catalyst (D7, column 2, lines 50 to 53). The reference to the suitability of the polymer in alimentary applications as such is not, in the Board's view, indicative for a ***further lowering*** of the level of extractables. Nor is a narrow MWD clearly indicative for an improved dart impact resistance and a good balance between MD_{Tear} and TD_{Tear}. As pointed out by the Respondent, none of these properties, let alone any improvement thereof has been addressed in D7.

5.3 By contrast, document D1 does not only relate to a method for preparing a high activity catalyst composition which produces medium density and linear low density polyethylene having a relatively narrow MWD, and to the polymerisation process using this catalyst. It rather mentions, furthermore, in its column 5, lines 46 ***et seq.***, that the polymers obtained in D1's process have about 20 to 30% lower hexane extractables and the films made therefrom exhibit about 20 to 30% improvement in dart drop and MD_{Tear} properties than the films prepared with previously known catalysts.

5.4 Therefore, the Board concurs with the decision under appeal (No. 4.1 to 4.4 of the reasons) and the view of the Respondent that D1 is to be considered as being the closest piece of prior art (sections III(4) and V(9), above).

5.4.1 As already mentioned in section 5, above, the patent in suit refers to a reduced level of extractables and to improved strength properties, such as dart impact or dart drop at a good balance of the two (MD and (TD) tear strength values. The results of the [examples] and [comparative examples] even show for polymers of identical density and I_2 melt index, that the choice of a particular co-catalyst or the addition of a particular EED results in changes of the amounts of (ether and n-hexane) extractables and a change of the dart resistance whilst maintaining the tear strength values in both directions and their ratios at about the same levels (cf. the comparisons in [Examples 1, 3 and 4] and, furthermore, those in [Examples 1 and 2]).

5.5 Therefore, the technical problem with regard to D1 can be seen in the provision of a process for making polymers which can be further processed to films having further lowered contents of extractables and are further improved in their dart drop resistance, whilst the level of MD and TD tear strengths and the level of the MD_{Tear} and TD_{Tear} ratio are essentially maintaining the same level.

5.6 As referred to in section V(6), above, the Respondent set out that, as shown in [Example 1], the dart impact resistance could be improved to a significantly higher extent than contemplated by D1, ie by more than 100% by replacing the conventionally used TEAL by TMA and by adding THF as an EED. At the same time the contents of ether and of n-hexane extractables could also be significantly lowered to values remarkably lower than the best values in D1 (even when comparing the values of polymers of different densities to the disfavour of the polymers of the patent in suit, cf. the second half of the first paragraph and the last paragraph of section V(6) and section V(14), above).

5.7 The arguments provided by the Respondent on the basis of the above experimental data have not been disproved by the Appellant, who has not discharged its burden of proof by providing any evidence for the validity of its assertions and the invalidity of the Respondent's arguments or its experimental data in the [patent].

5.8 Consequently, the Board is satisfied that the above technical problem has been credibly solved.

Inventive step

6. It remains to be decided whether the solution of this problem, as claimed, derives in an obvious way from the cited documents.

6.1 Although document D1 suggests to lower the content of n-hexane extractables and to improve the dart drop resistance, each by 20 to 30%, it does not provide any suggestion of how to achieve the significantly better results as reported in the examples of the patent in suit. Nor does the document suggest that by replacing TEAL by TMA and by adding THF as an ***external*** electron donor, any improvement in this respect could be achieved, quite to the contrary, according to column 9, lines 34 ***et seq.***, rather an increase in the amount of the n-hexane extractables was to be expected. Reference can be made to the detailed comments of the Respondent in its rejoinder (sections V(11) and V(14) to V(18), above), which have not been disputed, let alone refuted by the Appellant.

Therefore, document D1 itself does not provide any hints or teachings to solve the above problem, let alone to solve the problem by something within the terms of the independent [claims].

6.2 As pointed out by the Respondent (section V(9) and V(10), above), D7 did not consider at all the use of TMA, which in the light of D1 (column 9; as referred to in section 6.1, above) would rather have appeared as being counterproductive. Moreover, D7 has not considered at all the above film properties. Hence it cannot contribute to the solution of the relevant technical problem.

6.3 As mentioned in section 4.3, above, the process of D6 aims at products, which have a broad MWD, ie contrary to the aims of D1 (or D7). It is, furthermore, completely silent with regard to the other properties mentioned in section 5.4.1, above. Consequently, the Board cannot see any connection between D6 and the technical problem as formulated in section 5.5, above. D6, cannot, therefore, provide any incentive to solve the above problem.

6.4 This finding is also valid for D4 and D5, both of which as considered in sections 3.3 and 3.3.1, above, try only to cope with the problem of fouling in the recycle lines and heat exchanger of a gas phase fluidised bed reactor by introduction into those lines of an anti-fouling agent, which furthermore, should not enter the reactor (cf. section V(8), above).

6.5 The Board is, therefore, satisfied that neither the combination of D1 and D7, nor a combination of D1 and D4, D5 or D6 provides an incentive to solve the relevant technical problem in a way as described in the independent [Claims 1, 25 and 26], the subject-matter of which is therefore based on an inventive step.

6.6 By the same token, this finding is also valid for the subject-matter of the dependent [Claims 2 to 24].

7. Therefore, the Main Request of the Respondent is successful, and there is no need for the Board to consider the Auxiliary Request of the Respondent.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:	The Chairman:
P. Cremona	R. Young