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**Datasheet for the decision
of 11 December 2019**

Case Number: T 2690/16 - 3.3.03

Application Number: 08873769.7

Publication Number: 2231726

IPC: C08F110/06, C08F2/06,
C08F4/6592

Language of the proceedings: EN

Title of invention:

ISOTACTIC POLYPROPYLENE PRODUCED FROM SUPERCRITICAL
POLYMERIZATION PROCESS

Patent Proprietor:

ExxonMobil Chemical Patents Inc.
ExxonMobil Research and Engineering Company

Opponent:

Borealis AG

Relevant legal provisions:

EPC Art. 56, 114(2)
RPBA Art. 12(4)

Keyword:

Inventive step - (no)- main request, auxiliary request

Admittance of documents to proceedings - yes

Incorrect application of problem solution approach - elements
of solution in definition of problem



Beschwerdekammern

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Case Number: T 2690/16 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 11 December 2019

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Decision under appeal:

**Decision of the Opposition Division of the
European Patent Office posted on 11 November
2016 rejecting the opposition filed against
European patent No. 2231726 pursuant to Article
101(2) EPC.**

Composition of the Board:

Chairman D. Semino
Members: M. C. Gordon
 C. Brandt

Summary of Facts and Submissions

- I. The appeal lies from the decision of the opposition division posted on 11 November 2016 rejecting the opposition against European patent number 2 231 726.
- II. The patent was granted with a set of 15 claims, whereby claim 1 read as follows:

"An isotactic propylene homopolymer having:
more than 15 and less than 90 regio defects (sum of 2,1-erythro and 2,1-threo insertions and 3,1-isomerizations, as measured by ^{13}C -NMR) per 10,000 propylene units;
an Mw (weight average molecular weight) of 50,000 g/mol or more;
a peak melting temperature, Tmp (as measured by DSC, as described in paragraph [0107]), of greater than 149 °C;
an mmmm pentad fraction of 0.85 or more;
a heat of fusion of 80 J/g or more; and
a $\text{Tmp}-\text{Tcp} \leq (0.907 \times \text{Tmp}) - 99.64$, as measured in °C on the homopolymer having 0 wt% nucleating agent, wherein Tcp is the peak crystallization temperature (as measured by DSC, as described in paragraph (*sic*) [0107])."

- III. An opposition against the patent was filed invoking the grounds pursuant to Article 100(a) EPC (lack of inventive step) and Article 100(c) EPC.

The following documents, *inter alia* were cited in support of the opposition:

D2: WO-A-00/012572

D3: WO-A-2008/006532.

- IV. According to the decision, the requirements of Article 123(2) EPC were satisfied.

The closest prior art was held to be D2. The subject-matter claimed was distinguished therefrom at least by the defined relationship of the melting and crystallisation temperatures.

The objective problem was to provide homopolypropylene having an increased crystallisation temperature. This problem was solved by a homogeneous polymerisation process working under supercritical conditions. The polymers of D2 had been prepared under relatively low pressure conditions. D2 provided no guidance and no incentive to produce the polymers as claimed or to adopt the necessary process conditions. Nor would the combination of D2 with D1, which related to the use of nucleation, lead to the claimed subject-matter. Accordingly the opposition was rejected.

- V. The opponent (appellant) filed an appeal against the decision.

Together with the statement of grounds of appeal a number of further documents were cited, *inter alia*:

D6: Polypropylene Handbook, Carl Hanser Verlag, Munich, 2005, Ed.: Dr Nello Pasquini, pages 116, 117, 127.

The appellant maintained objections of lack of inventive step.

- VI. With the reply, the patent proprietor (respondent) submitted a set of claims designated "Set A" in which claim 1 differed from that of the main request (patent as granted in that:

- the lower limit of regiodefects was 40;
- Mw was specified as 100,000 g/mol or more.

A document:

D14: De Rosa, et al., *Macromolceules* 2005, 38(22), pp. 9143-9154

was submitted.

VII. The Board issued a summons to oral proceeding and a communication.

Inter alia the Board observed that the formulation of the problem in the decision under appeal appeared not to be according to the case law since it anticipated elements of the solution, namely the crystallisation temperature.

It was also noted that it would be necessary to decide on the admittance of the documents submitted by the parties during the appeal proceedings.

VIII. Oral proceedings were held before the Board on 11 December 2019.

IX. The arguments of the appellant can be summarised as follows.

(a) Admittance of documents D6 (appellant) and D14 (respondent)

D6 had been cited to establish common general knowledge in respect of the polymers. In particular this document established that the cited examples of D2 complied with the requirements of the claim

in terms of heat of fusion and melting temperature and demonstrated the resulting structure of the polymer in terms of regio and stereo errors arising from use of the catalysts in the invoked examples of D2. D6 was therefore to be admitted.

Admittance of D14 was not objected to.

(b) Main request- inventive step

The finding of the decision that the closest prior art was represented by D2 and that the distinguishing feature was the inequality in terms of the melting and crystallisation temperatures was not disputed. However, the problem as formulated by the opposition division was not valid since it constituted a repetition of the distinguishing feature, namely increasing the crystallisation temperature and thus reducing the gap between melting and crystallisation temperatures (statement of grounds of appeal, section 2.1.4, first-fourth paragraphs).

Similarly the formulated solution - in terms of a process - was incorrect, because the claim was directed to a product, not a process (statement of grounds of appeal, section 2.2.1).

No technical effect was reported to be associated with the distinguishing feature beyond what was stated in paragraph 92 of the patent that the high crystallisation temperature resulted in faster crystallisation without the need for external nucleating agents.

There was however no evidence of such "faster

crystallisation". In particular, and accepting that crystallisation started at a higher temperature, there were no data that the actual speed of the process, once it commenced, was any faster than in other propylene homopolymers, whether under isothermal or non-isothermal conditions.

Hence the problem was to be formulated as the provision of alternative propylene homopolymers.

The solution, as formulated in the decision and by the respondent was also incorrect, since it relied on a particular process. The claim contained no such feature but was directed to a product independently of any manner of preparation.

Furthermore the evidence of the patent was that a particular process was not required and also that there was no process which reliably yielded products with the required profile. As shown in the summary designated D16, 25 out of the 87 examples carried out under supercritical conditions did not result in polymers with the required property profile, contrary to the findings of the decision and the position of the respondent. Similarly in each of the sets of examples carried out under solution or slurry conditions one polymer was obtained which, nevertheless, did comply with the claimed requirements. In particular examples S021 (solution) and SL5 (slurry) of the patent showed that complying with the process conditions set out in D2 without operating under supercritical conditions yielded polymers with the required properties.

The patent appeared merely to define the result of

a screening based generally on the teaching of D2 to identify compositions with sufficiently high crystallisation temperature and to formulate the outcome of this screening in the claim in the form of a desideratum, derived from the inequality.

Also the selection of the catalyst was already taught in D2, examples 26, 28, 30 which catalyst, as shown by D6, resulted in polymers with high isotacticity, thus providing an indication that the resulting polymers would exhibit high crystallisation temperature.

On this basis inventive step could not be acknowledged.

(c) The above conclusions remained valid with respect to the auxiliary request.

X. The arguments of the respondent can be summarised as follows:

(a) Admittance of D6 and D14

D6 had been filed late. The decision under appeal had been based essentially on D2. The documents, *inter alia* D6, filed with the statement of grounds of appeal in effect constituted a new case and should not be admitted.

D14 had been submitted to show the effect of polypropylene molecular weight on crystallisation behaviour.

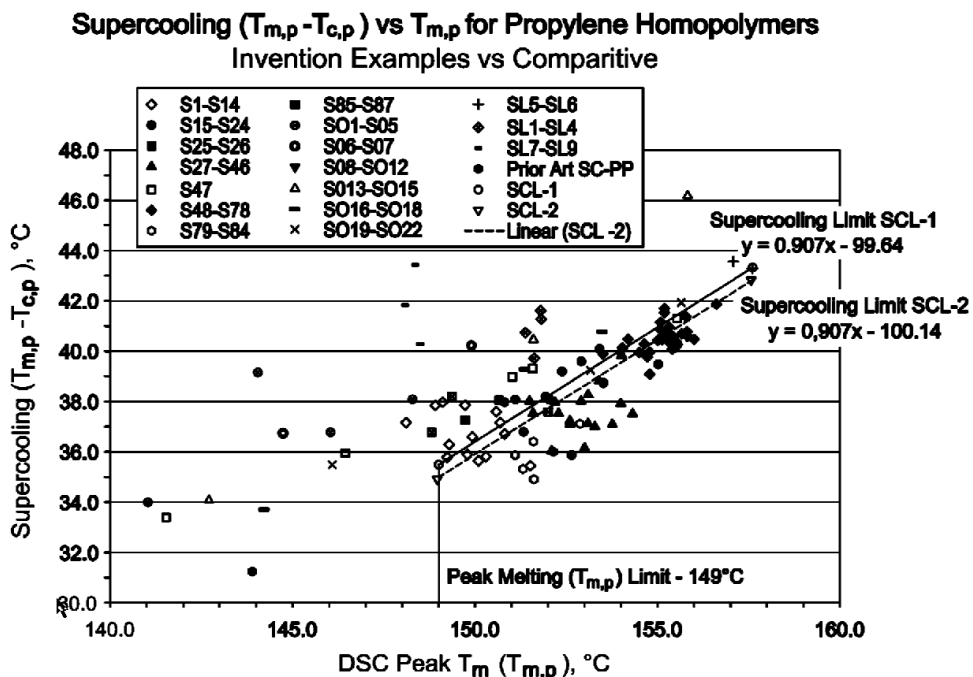
(b) Inventive step

The appellant adopted a hindsight approach, in effect seeking explanations in the prior art for the effects shown.

D2 was accepted as the closest prior art. Three distinguishing features existed - melting temperature, heat of fusion and the relationship expressed by the inequality ("supercooling limit" - hereinafter "SCL") of which the third was the crucial one for the assessment of inventive step.

The reliance on D6 in combination with D2 was not appropriate. The polymers of D2 were prepared under specific conditions including use of an activator whereas D6 was silent on the conditions, and did not mention an activator. A further divergence was that D6 stated that stereoerrors were below the limit of detectability whereas D2 provided measurements of these, showing that they were in fact above the limit of detectability.

As shown by the examples of the patent, when operating under supercritical reaction conditions in the majority of cases polymers satisfying the inequality relationship were obtained. However under slurry or solution conditions in each case only a single "outlier" meeting this requirement was obtained. The inequality, as shown in figure 1 of the patent:



marked the border between polymers which exhibited the desired properties and those which did not, whereby those data points under the line were those in the scope of the claim.

The variations in the properties of polymers prepared under supercritical conditions in respect of whether or not they lay above or below the line on the graph could be ascribed to instabilities in the polymerisation process. However it had not been shown that the patent did not teach how to obtain the required polymers. On the contrary, it was shown that supercritical conditions reliably resulted in the required polymers whereas the other methods shown almost never did.

The objective problem could be formulated as providing polymers with fast crystallisation time in particular under non-isothermal conditions such as arose when a composition was moulded and ejected from the mould. The figures in the patent showed

that polymers prepared under supercritical conditions clustered differently to those prepared under the other two types of conditions. The evidence confirmed that crystallisation under non-isothermal conditions would be faster in the case of the claimed polymers and hence that the problem was adequately solved by the claimed subject-matter.

Regarding obviousness, the position of the appellant in questioning whether it would be obvious to reduce the supercooling range based on examples 26, 28 and 30 of D2 was nonsensical. It was not possible simply to "select" a particular property for a polymer. Rather the question was whether there would be any incentive starting from D2 to make the necessary modifications once the requirement for more rapid crystallisation was defined. This was however not the case. The examples of D2 employed much lower temperature than those of the patent. Example SL5 of the patent used a pressure within the general teaching of D2 although higher than in the examples thereof and did yield a polymer with the required properties. However it would only have been in the light of the examples of the patent that the teaching of D2 in terms of pressure and necessary modifications thereto became relevant, i.e. this was an *ex post facto* approach.

The combination with D6 was likewise unsuitable to render the claimed subject-matter obvious. The catalyst employed in D6 was different to that employed in SL5 of the patent and no activator was used.

Even the premise that starting from D2 and raising the pressure would provide a route to the claimed polymers was provably wrong. Example SL6 of the patent employed higher pressure than SL5 (and therefore higher than exemplified in D2) and did not result in the required property profile.

The claim did not - contrary to the position of the opponent - merely define an obvious desideratum, but set out a specific property profile of the polymer with reference to technical features. There was no indication in D2 that such a combination of properties was known to be useful, or obvious for any other reason, or that it would be known how to achieve this. On the contrary, the formulation of the problem and the obviousness of the solution proposed by the appellant relied on foreknowledge of the patent. On this basis the presence of an inventive step should be acknowledged. The same reasoning applied to the auxiliary request.

- XI. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

- XII. The respondent requested that the appeal be dismissed, in the alternative it is requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the claims designated "Set A" filed with the rejoinder to the statement of grounds of appeal.

Reasons for the Decision

1. Admittance of documents - D6 and D14

D6 was submitted by the appellant in order to elucidate the relationship of the melting temperature and of the heat of fusion to the crystallinity and the presence of defects. By means of this it was intended to show that the examples of D2 had values of these properties in the range of claim 1.

Since in the decision it was left open whether the melting temperature and the heat of fusion constituted distinguishing features (point 10.2), the submission of D6 can be seen as a reaction to the decision, addressing a matter which could become relevant in appeal.

Furthermore it has not been shown that there would have been any reason to submit this document at an earlier stage of the proceedings.

Accordingly the Board can identify no reason not to admit D6 to the proceedings, which document is therefore in the proceedings.

No objection was raised by the appellant to admission of respondent's D14. The Board also can identify no reason to exclude this document from consideration. Accordingly this document is also admitted to the proceedings.

2. Main request - inventive step

2.1 The decision of the opposition division

According to the decision under appeal (section 10.2) the closest prior art was considered to be D2, a finding with which the Board cannot find fault.

The distinguishing feature was identified - at least - as the defined supercooling range and the SCL. Again the Board can concur.

The objective problem to be solved was formulated as being to provide a homopolymer having an increased crystallisation temperature (section 10.6 of the decision).

With this the Board disagrees. This formulation of the problem anticipates an element of the solution as claimed because the claim relies on the crystallisation temperature as a characterising feature in the form of the SCL, i.e. the inequality.

This approach is therefore not in compliance with the problem solution approach which requires that the problem not be formulated such that it contains a pointer to the solution (Case Law of the Boards of Appeal of the European Patent Office, 9th Edition I.D. 4.3.1).

In the following part of the decision (section 10.6, second paragraph), the opposition division formulated the solution with reference to the process conditions used.

The claim however is directed to a product, not a process. Nor are there any features in claim 1 which could be construed as relating to process conditions. Hence similarly this aspect of the decision cannot be followed.

2.2 Closest prior art

It is not disputed by the parties that the closest prior art is represented by the teachings of D2, in particular examples 26, 28, 30. As noted above, the Board is also satisfied that this assessment is correct.

2.3 Distinguishing feature

D2 does not disclose the SCL, i.e. the relationship between melting and crystallisation temperatures as expressed by the inequality, as is also not disputed by the parties. This condition therefore represents the distinguishing feature.

As to the melting temperature and the heat of fusion, while the respondent disputed that these features had necessarily values according to the ranges of claim 1, it was not submitted that they played a role in the assessment of inventive step. In particular, it was accepted that they do not provide a technical effect and that the ranges given correspond to usual values. On this basis, as these features do not play a role in the conclusion reached it can be left open whether the examples of D2 necessarily possess values within the ranges.

2.4 Technical effect

It is submitted by the respondent that the defined set of features, including in particular the relationship between melting and crystallisation temperatures, results in more rapid crystallisation in particular under non-isothermal conditions.

There is however no evidence that this is the case, although this statement could appear logical since a higher crystallisation temperature means a more rapid onset of crystallisation as the composition cools after moulding.

Moreover, the melting/crystallisation behaviour is not an (entirely) intrinsic property of the polymers but depends on extrinsic factors, i.e. the conditions under which the measurement is carried out, for example rate of heating/cooling.

The claim does contain a number of features relating to intrinsic properties, e.g. molecular weight, level of regio defects and pentad content.

The evidence of the patent is however that the polymers exhibiting the required intrinsic properties do not inevitably exhibit the extrinsic properties, in particular the SCL as expressed by the inequality.

This emerges from the data of the patent, and in particular from the summary thereof presented as D16. Thus, taking as an illustration example S2, prepared under supercritical conditions, results in a polymer which meets all the requirements of the claim in terms of the intrinsic properties, i.e. structure of the polymer (regio defects, pentad MMMM fraction), heat of fusion and molecular weight. However the condition specified in terms of the inequality is not satisfied.

Insofar as the relationship between melting and crystallisation temperatures is not, on the strength of the available evidence, a direct and necessary consequence of, and hence does not inevitably relate to

factors intrinsic to the polymers, the definition thereof must be seen as simply the intended or required outcome, i.e. a desideratum going beyond and not a consequence of, the consequence of the defined structural features.

It is also not the case that a specific method of preparation (supercritical conditions) is necessary to obtain the polymers or will necessarily and inevitably lead to the required property profile. Indeed, examples SO21 (under solution conditions) and SL5 (slurry conditions) of the patent show that not operating under super critical conditions but complying with the conditions falling within the scope of D2 nevertheless resulted in polymers meeting the requirements of the claim.

Furthermore as observed by the appellant with letter of 11 November 2019 on page 8, examples S48 (supercritical) and SL5 (slurry) of the patent employ the same catalyst and activator and both yield polymers with very similar properties in terms of the SCL and falling within the definition of the claim but only S48 is carried out under supercritical conditions:

Sample	Metallocene Catalyst	Activator	Supercritical conditions?	Tmp	Tcp
S48	4 (Table 1b)	B1 (Table 1b)	Yes	156.6°C (Table 2b)	114.7°C (Table 2b)
SL5	4 (Table 5)	B1 (Table 5)	No	157.6°C (Table 7)	115.0°C (Table 7)

Further as shown by the summary submitted as D16 a number of examples carried out under the required conditions do not result in the required property profile, no explanation for this being offered.

As demonstrated above, the evidence is that the set of

properties as defined in the claim is not shown to be associated with any particular structural features of the polymer, or indeed any other aspects intrinsic to the polymers, nor with a particular technical effect supported by evidence. In addition, it does not appear to be even associated with a specific method of production.

This analysis confirms that, based on the available evidence the claim can only be seen as amounting to a desideratum, in that a series of experiments was carried out and based on the results thereof an arbitrary delimitation between polymers in terms of a particular property was specified, and those polymers lying predominantly on one side of this delimitation were defined in the claim.

2.5 The objective technical problem

Under these circumstances where the claim defines a desideratum in terms of a combination of properties and it is shown that the achievement of the required outcome as expressed by the SCL is to an extent arbitrary and not associated with the other features of the claim, or any particular method of manufacture, the objective technical problem can be formulated only as the provision of further polymers.

2.6 Obviousness

Polymers of the general type as defined are known from D2, and D6 provides details of how different catalyst influence the structure of the polymer in terms of regio- and stereoerrors. In addition the examples in the patent show that polymers according to claim 1 can be obtained by operating within the teaching of D2

(point 2.4, above).

The arbitrary imposition of a limitation in order to provide a definition of subject-matter thus deemed as belonging to the claim is trivial and an obvious solution to the problem of providing merely further polymers.

Thus for the skilled person seeking to provide further polymers based on those known from D2 it would be obvious in the light of the teaching of this document alone, or possibly with further reference to D6 to identify manners in which further polymers according to claim 1 could be produced. Similarly D14 provides teachings relating to the effect of the same category of catalysts on the microstructure and crystallisation behaviour of the polymers. Once this was done, the step of carrying out a series of trials and on the basis of the results thereof arbitrarily defining some of the resulting polymers as belonging to "the invention" whilst excluding others on the basis of certain properties, was trivial, in particular in the light of the evidence that polymers with the required properties were accessible by all of the polymerisation methods investigated.

3. Auxiliary request (Set A)

As no additional arguments were provided by the respondent, the Board can only conclude that the amendments made to claim 1 of the auxiliary request do not change the above assessment in terms of inventive step.

4. In view of the foregoing conclusions in respect of inventive step it is not necessary for the Board to address any other issue for either request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



B. ter Heijden

D. Semino

Decision electronically authenticated