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**Datasheet for the decision  
of 6 October 2011**

**Case Number:** T 1740/08 - 3.3.03

**Application Number:** 01904120.1

**Publication Number:** 1263836

**IPC:** C08G 67/00

**Language of the proceedings:** EN

**Title of invention:**  
Aromatic Polyetherketones

**Patentee:**  
VICTREX MANUFACTURING LIMITED

**Opponent:**  
Solvay Advanced Polymers, LLC

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 83  
EPC R. 111(2)

**Relevant legal provisions (EPC 1973):**

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**Keyword:**

"Sufficiency of disclosure (main request and first-sixth  
auxiliary requests) - (no)"

"First instance decision reasoned - (yes)"

**Decisions cited:**

T 0292/85, T 0019/90, T 0698/94, T 0652/97, T 0070/02,  
T 0890/02

**Catchword:**

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Case Number: T 1740/08 - 3.3.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.03  
of 6 October 2011

**Appellant:** VICTREX MANUFACTURING LIMITED  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office announced 12 June 2008  
and posted 7 July 2008 revoking European patent  
No. 1263836 pursuant to Article 101(3)(b) EPC.

**Composition of the Board:**

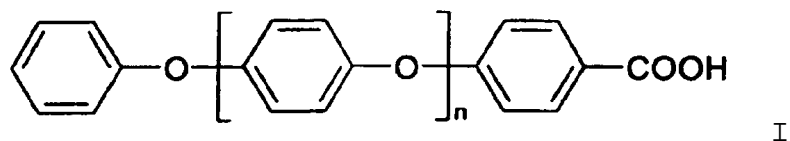
**Chairman:** B. ter Laan  
**Members:** M. C. Gordon  
C.-P. Brandt

## Summary of Facts and Submissions

I. The appeal lies from the decision of the opposition division announced on 12 June 2008 and posted 7 July 2008 revoking European patent number EP-B1-1 263 836 (granted on European patent application 01 904 120.1) on the ground of Article 100(b)/83 EPC.

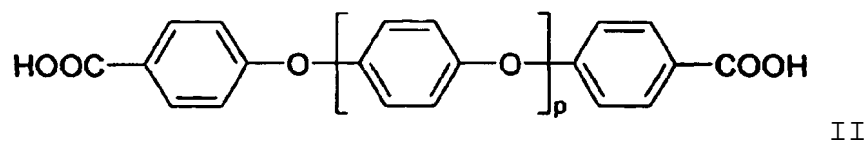
II. The patent was granted with a set of 22 claims, claims 1 and 17 reading as follows:

- "1. A process for the preparation of an aromatic polyetherketone which process comprises:  
a) self-condensing a compound of formula

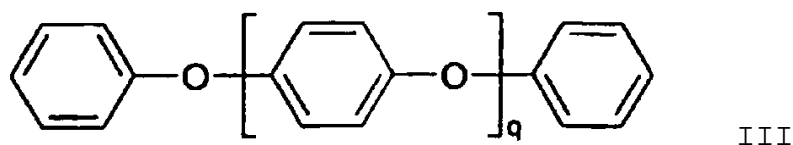


wherein n represents 1 in the presence of an alkyl or optionally substituted aryl sulphonic acid solvent and in the absence of phosphorous pentoxide; or

- b) condensing a compound of general formula



and a compound of general formula



wherein p and q represent 1, in the presence of an alkyl or optionally substituted aryl sulphonic acid solvent and in the absence of phosphorous pentoxide; or

c) a combination of a) and b)."

"17. A process according to any preceding claim wherein said aromatic polyetherketone has an inherent viscosity of at least 0.7".

III. A notice of opposition against the patent was filed on 18 October 2006 in which revocation of the patent on the grounds of Art. 100(a) EPC (lack of novelty, lack of inventive step), Art. 100(b) (insufficiency of disclosure) and Art. 100(c) (extension beyond the content of the application as filed) was requested.

IV. The decision of the opposition division was based on the claims as granted as the main request and six auxiliary requests all filed with a letter dated 14 April 2008. All requests retained a claim corresponding to claim 17 of the patent as granted.

(a) The decision held that the requirements of Art. 83 EPC were not satisfied.

(i) The granted claims encompassed processes for the preparation both of oligomers, i.e. polymers made up of relatively small number of monomers, and polymers made up of a relatively high number of monomers. To determine whether the requirements of Art. 83 EPC were met it had to be decided if the invention could be carried out within the whole range claimed, in particular whether the patent contained enough information in order to provide a process for the one-step preparation of

poly(etheretherketone) - hereinafter "PEEK"  
- with a high molecular weight.

- (ii) Experiments E1\* to E10\* as filed by the opponent with the notice of opposition showed that a process carried out according to example 1 of the patent resulted in oligomeric PEEK. The patent proprietor had agreed with these examples, stating in a letter dated 4 June 2007 that these showed that the process claimed permitted the preparation of PEEK with 5-18 repeating units. The opposition division however held that these examples did not show or render it plausible that PEEK of higher molecular weight could be obtained by the claimed process.
- (iii) Both general knowledge and the prior art taught that a strong dehydrating agent was needed to obtain PEEK of high molecular weight, reference being made in this respect to:
- D6: Ueda, M. and Sato, M., *Macromolecules*, 1987, vol. 20 pp 2675-2678;  
D7: Ueda, M. and Oda, M., *Polymer Journal*, vol. 21, no. 9, 1989, pp 673-679.
- According to
- D13: Colquhoun, H.M. and Lewis, D.F., *Polymer*, 1988, vol. 29, pp 1902-1908  
a superacid such as  $\text{CF}_3\text{CO}_2\text{H}$  could be employed.
- US-A-5 107 029 (D4) confirmed that when a weak dehydrating agent such as an anhydride

was used with a sulphonic acid solvent as claimed the condensation reaction only led to preparation of the dimer and not of the polymer. D4 taught that to get higher molecular weight compounds either a different reaction scheme or more drastic conditions were required.

- (iv) The examples of the patent, resulting in PEEK of high molecular weight, went against the teachings of the prior art and were in contradiction with the examples of the opponent. The patent proprietor had failed to advance any evidence regarding the number of repeating units of the products of the examples of the patent although this aspect had been at stake, and had been disputed by the opponent from the outset of the proceedings.

Consequently the information of the patent and that provided by the patent proprietor was not sufficient to demonstrate that the products of the examples of the patent did exhibit a high molecular weight.

- (v) The patent in suit contained no information as to how the necessary dehydration was to be accomplished and the opposition division did not find it plausible that the relatively weak dehydrating agent such as nitrogen purge used in the examples was sufficient to shift the equilibrium reaction to result in high molecular weight PEEK.

- (vi) The patent proprietor had thus not convincingly demonstrated that a process as claimed did lead to preparation of polymeric PEEK i.e. having such a high molecular weight that they may not be considered as oligomers.
  
- (vii) The opposition division held that the opponent had convincingly demonstrated that the invention could not be carried out within the whole range claimed and in particular that it did not disclose how to obtain PEEK of high molecular weight by the self-condensation of compounds of formula (I) in a sulphonic acid solvent, as defined in claim 1 of the patent in suit, in the absence of  $P_2O_5$ .
  
- (viii) As all auxiliary requests were directed to a process similar to that of the main request these shared the fate of the main request.
  
- (b) The decision further held that the subject matter of the claims as granted was novel.
  
- (c) As *obiter dictum* it was however indicated that the claims of the main request were not founded on an inventive step.
  
- (d) Consequently the patent was revoked.



V. On 4 September 2008 the patent proprietor lodged an appeal against the decision, the prescribed fee being paid on the same date.

VI. Together with their statement of grounds of appeal the patent proprietor, now the appellant, requested as the main request that the patent be maintained as granted.

Alternatively auxiliary requests 1-6 were submitted, each consisting of a single claim. Further it was stated that the existing sub-claims remained.

*Inter alia* the appellant argued that the decision under appeal did not comply with Rule 111 EPC, i.e. that it was not reasoned.

VII. The opponent, now the respondent, replied with a letter of 28 May 2009.

VIII. On 16 May 2011 the Board issued a summons to attend oral proceedings. In a communication dated 27 May 2011 the Board, after setting out the requests of the patent proprietor (see section VI, above) expressed the preliminary opinion that claim 1 did not impose any restriction on the molecular weight of the polymer. Since the evidence of both parties was that a polymer was obtained by the claimed process, it was considered that the subject matter of claim 1 of the main request was sufficiently disclosed. The Board also noted that the patent proprietor had not made any submissions relating to the divergent results of the respondent, but had merely restricted itself to observing that these results confirmed that polymerisation occurred.

IX. The respondent filed further observations with a letter dated 26 August 2011.

X. The appellant filed further submissions with a letter dated 6 September 2011.

With regards to the requests as set out in the communication of the Board it was stated:

*"In addition to the request indicated, we hereby request remission of the case to the Opposition Division".*

XI. In a letter dated 3 October 2011 the appellant informed the Board that it would not be represented at the oral proceedings.

XII. Oral proceedings were held before the Board on 6 October 2011, attended only by the respondent.

XIII. The arguments of the appellant/patent proprietor as far as they are relevant to the present decision may be summarised as follows:

(a) The discussion of sufficiency of disclosure in section 5 of the decision was not sufficiently reasoned for the patent proprietor to understand the case (Rule 111 EPC). According to decisions T 70/02 (15 March 2002, not published in the OJ EPO), T 698/94 (17 February 1997, not published in the OJ EPO) and T 652/97 (16 June 1999, not published in the OJ EPO) it was a general principle of fair and good faith proceedings that reasoned decisions should contain, in addition to the logical chain of facts and reasons on which

they were based, at least some reasoning on a crucial point of dispute in the line of argumentation in order to give the party concerned a fair idea of why its submissions were not considered convincing and so enable it to base its grounds of appeal on relevant issues.

The finding that the claims encompassed "polymers as opposed to oligomers" implied that the claim covered polymers but that oligomers were not polymers, and hence were not covered by the claim. The opposition division had failed to state what an oligomer was, i.e. to explain the difference between PEEK "having a high molecular weight" and PEEK "having a low molecular weight", or what oligomeric PEEK might be.

The reasoning in the decision pursuant to Art. 83 EPC had been based on this unsupportable, artificial and arbitrary distinction between polymers and oligomers. The parties had provided extensive arguments on this matter during the opposition proceedings, focusing on the definition of polyetherketone, polymer and oligomer. The opposition division had however largely ignored this issue.

The conclusion of the opposition division implied that oligomers were not polymers, but there was no reasoning as to how or why the division arrived at this conclusion. In its own preliminary opinion the opposition division had even concluded that oligomers were polymers made up of a relatively small number of units, i.e. concluded that

oligomers fell within the generic term "polymers". In any case, the term "polymer" was not employed in claim 1.

- (b) With regard to Art. 83 EPC, it was necessary to understand the term "polyetherketone". It was clear that this term referred to a material which included more than one ether and more than one ketone moiety.

According to the evidence of the opponent polyketones having between 5 and 18 repeat units were produced when following the protocol of the examples of the patent in suit. These materials clearly fell within the definition of "polyetherketone". An oligomer was thus an example of a polymer. Since - as acknowledged by the opponent - oligomers were produced this meant that the opponent also acknowledged that "polymers" had been produced. Thus on the basis of the arguments of the opponent, there was no insufficiency pursuant to Art. 83 EPC.

The case law supported this position. T 19/90 (OJ EPO 1990, 476) and T 890/02 (OJ EPO 2005, 497) stated that an objection of lack of sufficiency presupposed that there were serious doubts, substantiated by verifiable facts. The experiments of the opponent however proved that a polymer having 5-18 units could be prepared by the process described - hence there was at least "one way" shown (with reference also to T 292/85 - OJ EPO 1989, 275).

XIV. The pertinent arguments of the respondent/opponent may be summarised as follows:

(a) Rule 111 EPC.

The opposition division had held that it was not plausible that PEEK having high molecular weight could be obtained. Further the opposition division had concurred with the position of the patent proprietor that oligomers were examples of polymers. Therefore it rather appeared that the appellant had misinterpreted the reasoning of the opposition division.

(b) Art. 83 EPC.

It was established case law that the invention had to be disclosed such that it could be carried out over the whole claimed scope. However in the case in particular of claim 17 of the main request which set a lower limit on the inherent viscosity of the polyetherketone (see section II, above) there were serious doubts that the invention could be carried out over its whole scope. The attempts of the opponent to reproduce the examples of the patent in suit had not merely failed to produce precisely the same products as reported in the examples of the patent in suit - they had failed completely to produce anything remotely resembling these products, only yielding low molecular weight oligomers.

The patent proprietor had not contested the results of the opponent's experiments or even

argued that PEEKs having a relatively high number of repeating units could be obtained by the process of the patent in suit but restricted itself to arguing that oligomers were examples of polymers.

The reaction of the patent in suit, an equilibrium reaction, was known in the prior art. Water produced had to be removed to drive the reaction towards completion, i.e. a dehydrating agent was required. It was known e.g. from D4 that without a strong dehydrating agent only low molecular weight product could be obtained. It was thus inconsistent with known scientific laws that a polymer with such a high molecular weight as reported in the examples of the patent could be obtained without the use of a dehydrating agent.

Regarding the question of burden of proof, in the present situation the patent states - and shows by examples - that the prior art is incorrect. The respondent however had provided clear evidence that the examples of the patent were not correct. The evidence of the opponent was furthermore in conformity with the teachings of the prior art.

As the evidence of the respondent had at no point been challenged by the appellant, the burden of proof should reside with the appellant.

XV. The appellant/patent proprietor requests:

That the decision under appeal be set aside and the patent be maintained as granted. Auxiliarily, that the

patent be maintained in amended form on the basis of the claims according to the first to sixth auxiliary requests, submitted together with the statement of grounds of appeal, which contain amended first claims while existing sub-claims remained.

Additionally remittal to the first instance is requested.

XVI. The respondent/opponent requests that the appeal be dismissed.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Rule 111 EPC.

Rule 111(2) EPC requires that decisions of the European Patent office that are open to appeal shall be reasoned. The pertinent case law, e.g. as summarised in section VI.J.5.3.4 of "Case Law of the Boards of Appeal of the European Patent Office", 6th edition, 2010 and decision T 70/02 cited by the appellant (see section XIII.(a), above) interprets this Rule as requiring that decisions contain a logical chain of the facts and reasons on which they are based.

In the present case the opposition division acknowledged that the evidence available, i.e. the examples of the opponent, showed that the process claimed permitted the preparation of oligomeric products and explicitly acknowledged that these were

examples of "polymers", namely polymers that were made up of "relatively small number of monomers" (decision under appeal section 5.1). However the opposition division objected that the evidence did not show that the process also permitted the preparation of high molecular weight polymers which were also within the scope of the claims. The opposition division also explained that the preparation of such polymers by the process steps claimed and exemplified in the patent in suit was at odds with the teaching of the prior art but that the results of the opponent were in accordance with what would be expected from prior art teachings (see section IV.(a), above).

Consequently the decision does contain a complete, structured, logical presentation of the considerations - the reasoning - leading to its conclusion that the requirements of Art. 83 EPC were not satisfied.

Accordingly the Board is satisfied that the decision meets the requirements of Rule 111(2) EPC.

3. Main request - Art. 83 EPC.

3.1 According to claim 1 of the main request the invention relates to a process for preparing an aromatic polyetherketone. No restriction is placed on the molecular weight of this material. Hence as far as claim 1 is concerned, all that is required is that the process results in products with a plurality of units, even a very small number.

The evidence of both parties demonstrates that the process claimed is capable of providing such a material.



Accordingly, as indicated in the preliminary communication of the Board, there are no grounds for objection pursuant to Art. 83 EPC in respect of claim 1.

3.2 Claim 17 in contrast requires that the aromatic polyetherketone have an inherent viscosity of at least 0.7 dl/g. In the case of claim 17, compliance with the requirements of Art. 83 EPC thus requires that the patent in suit contain sufficient information in the form of a complete, clear disclosure which would allow the skilled person to obtain not only a polyetherketone in general (as required by claim 1) but one having an inherent viscosity of at least 0.7 dl/g.

3.3 According to the examples of the patent in suit a reaction of:  
4-(4-phenoxyphenoxy)benzoic acid - i.e. formula II of claim 1 as granted - and 1,4-phenoxybenzene - i.e. formula III of claim 1 as granted - with methanesulphonic acid under a nitrogen atmosphere at 120°C for 24 hours with stirring yielded a polymer with an inherent viscosity of 0.93 dl/g (0.1% solution in 95% H<sub>2</sub>SO<sub>4</sub> at 25°C).

In example 2 of the patent in suit benzenesulphonic acid was employed in place of methanesulphonic acid, yielding a polymer with inherent viscosity of 0.86 dl/g.

3.4 The opponent provided together with the notice of opposition examples designated E1\*-E10\*. Experiment E1\* was a direct reproduction of the protocol of example 1 of the patent in suit. However the resulting polymer had an inherent viscosity in of only 0.06 dl/g (0.1% solution in 95% H<sub>2</sub>SO<sub>4</sub> at 25°C).

This was stated to correspond to a degree of polymerisation of ca. 5.

In experiment E2\* the reaction time was extended to 72 hours, yielding a polymer with inherent viscosity of 0.07 dl/g, which was stated to indicate a degree of polymerisation of ca. 6.

Experiments E9\* and E10\* were based on the reaction of example 2 of the patent in suit and similarly failed to yield products with the inherent viscosity reported in the patent in suit, yielding only products with a low inherent viscosity - 0.12 dl/g or 0.19 dl/g respectively. Thus both these examples also failed to produce polymers as reported according to the examples of the patent in suit.

Further experiments by the opponent e.g. to carry out a polymerisation according to the self condensation alternative of claim 1 as granted similarly failed to produce polymers with more than a few units, based on the reported inherent viscosities. The protocols for these examples were developed by the opponent since there was no such example in the patent in suit.

### 3.5 The teachings of the prior art

D6 discloses that the combination of phosphorus pentoxide and methanesulphonic acid ("PPMA") is a useful dehydrating agent for the condensation and self condensation of the monomers as set out in the claims of the patent in suit (D6, section "Introduction", third paragraph). A similar teaching is provided by D7 (paragraph bridging both columns on page 673).

D13 teaches an alternative process, namely the

production of polyetherketones by reaction of aromatic acids in a "superacid", i.e. trifluoromethane sulphonic acid, either in a polycondensation or a self condensation reaction (formulae bridging the two columns of page 1904).

D4 relates, as does the patent in suit, to a process involving reaction of polyaromatic diacids and polyaromatic compounds, with an alkylsulphonic acid (see claim 1, "Summary of the Invention" and col. 5, line 64ff). An organic anhydride is also required, which acts as a dehydrator ("Summary of the Invention" and col. 6, line 60ff).

This process is stated to yield diketones and keto-acids, possibly with small amounts of oligomers (col. 7, line 46ff, col. 8, line 26ff). As explained at column 8 lines 56ff, in order to produce polymers from the product of the reaction of D4 more reactive conditions are required, e.g. with trifluoromethane sulphonic acid/phosphorus pentoxide or  $AlCl_3$ .

- 3.6 The consistent teaching of these documents is that in order to provide a polymer from reaction of the monomers specified in the operative claims a strong dehydrating agent, e.g. one containing phosphorus pentoxide or a superacid solvent, e.g.  $CF_3CO_2H$  is required.

This teaching is confirmed by D4. The process of this document is similar to that of the operative claims since it employs methanesulphonic acid. Although the process of D4 also employs an anhydride, i.e. a dehydrating agent it nevertheless yields only monomeric compounds (ketoacids or diketones), possibly with a

small amount of oligomer, in particular tetraketone, as byproduct (col. 7, lines 43-65, col. 8, lines 25,26, examples 1-3). Furthermore, D4 explicitly states that in order to produce polymers from the formed ketoacid or diketone monomers more reactive conditions, for example using phosphorus pentoxide are required.

These prior art documents are therefore unanimous in teaching that in order to produce high molecular weight polymers from reactants of the type specified in the operative claims of the patent in suit conditions as specified in the claims, e.g. methanesulphonic acid, and the absence of phosphorus pentoxide - are not sufficient. Even the inclusion of a further dehydrating agent, e.g. an anhydride does not lead to high molecular weight polymers, as demonstrated by D4. On the contrary the prior art teaches that a strong dehydrating agent, phosphorus pentoxide being *inter alia* explicitly mentioned is required.

3.7 The Board thus finds itself confronted with inconsistent submissions of the parties, in the form of contradictory evidence, as noted in the foregoing sections 3.3 and 3.4.

3.8 Whilst the results of the opponent are consistent with the teachings of the prior art, the teaching of the patent in suit are inconsistent - indeed directly contradictory to - the teachings of the prior art, in particular D4.

The patent proprietor did not challenge the experiments carried out by the opponent, the results reported and assessment thereof. On the contrary the patent

proprietor explicitly acknowledged the results of the opponent as confirming that the process of the patent resulted in an oligomer which was submitted to be an example of a polymer (see section XIII.(b), above). Further the appellant did not provide any discussion or analysis with respect to the cause of the differing outcomes of the experiments of the two parties. Nor did the appellant present any arguments in respect of the assessment of the teachings of the prior art either as presented by the opponent or underlying the decision under appeal.

3.9 Therefore the appealing patent proprietor has failed to advance any arguments that would cast doubt on the findings of the opposition division, so that it has failed to show that the findings of the decision under appeal with respect to Art. 83 EPC were incorrect.

3.10 In view of the above the Board can come to no conclusion other than that the evidence of the parties and of the prior art supports and confirms the finding of the decision under appeal that the method of the patent in suit only permits the production of low molecular weight polymers (oligomers) but not of high molecular weight materials.

3.11 Consequently insofar as claim 17 defines the invention as being a process to produce polymers of a certain minimum molecular weight (as indicated by the specified inherent viscosity) the invention is not sufficiently disclosed.

3.12 Claim 17 of the main request thus does not meet the requirements of Art. 83 EPC.

3.13 The main request is therefore refused.

4. Auxiliary requests 1-6.

As all of the auxiliary requests have a claim corresponding to claim 17 of the main request (see section VI final paragraph stating that the "existing sub-claims remain"), these requests share the fate of the main request, i.e. do not meet the requirements of Article 83 EPC for the reasons given in section 3, above.

The auxiliary requests 1-6 are therefore refused.

## **Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

D. Hampe

B. ter Laan