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**Datasheet for the decision  
of 10 November 2016**

**Case Number:** T 1330/13 - 3.3.05

**Application Number:** 06808476.3

**Publication Number:** 1945584

**IPC:** C03C13/00, C04B35/624

**Language of the proceedings:** EN

**Title of invention:**  
HIGH TEMPERATURE RESISTANT FIBRES

**Patent Proprietor:**  
Morgan Advanced Materials PLC

**Opponent:**  
Bachelin, Martin, Dr.

**Headword:**

**Relevant legal provisions:**  
EPC Art. 123(2), 123(3), 84, 54, 56

**Keyword:**

Amendments - allowable (yes)

Claims - clarity - main request (yes)

Novelty - (yes)

Inventive step - (yes)

**Decisions cited:**

G 0004/92

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
**Chambres de recours**

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Case Number: T 1330/13 - 3.3.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.05**  
**of 10 November 2016**

**Appellant:** Morgan Advanced Materials PLC  
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**Decision under appeal:** **Interlocutory decision of the Opposition**  
**Division of the European Patent Office posted on**  
**2 April 2013 concerning maintenance of the**  
**European Patent No. 1945584 in amended form.**

**Composition of the Board:**

**Chairman** A. Haderlein  
**Members:** G. Glod  
O. Loizou

## Summary of Facts and Submissions

I. The appeal of the patent proprietor (appellant) lies from the interlocutory decision of the opposition division finding that the European patent EP-B-1 945 584 as amended with the then ninth auxiliary request met the requirements of the EPC.

The documents cited in the decision under appeal included the following:

D1: DE-C1-4 228 355  
D2: WO-A-96 04214  
D3: US 4 348 341  
D4: WO-A-92 09541  
D6: WO-A-00 75496  
D7: JP-A-0 6316815  
D7a: Machine translation of D7  
D8: Declaration of Gary Anthony Jubb (GAJ)  
D9: Exhibit GAJ 1  
D10: Exhibit GAJ 2  
D11: Exhibit GAJ 3  
D12: Exhibit GAJ 4  
D13: Declaration of John Dinwoodie  
D19: WO-A-9946028

The main request and auxiliary requests 2 to 5 were found not to meet the requirements of Article 123(2) EPC. In addition, the main request and auxiliary request 6 did not meet the requirements of Article 54 EPC in view of D2, while the subject-matter of claim 1 of auxiliary requests 1, 7 and 8 lacked inventive step when starting from D2 or D3 as closest prior art.

II. With the statement setting out the grounds of appeal, the following documents were submitted:

D21: Declaration of Laura Mawdsley with exhibits LM1 & LM2

D23: JP 2004-183153 & PAJ abstract & machine translation

III. In its letter dated 19 June 2013, the opponent (respondent) requested that the appeal be dismissed and announced that it would file a reply to the grounds of appeal "in due course". However, no such reply was received by the board.

IV. The board issued a communication dated 9 June 2016 pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA) containing its preliminary opinion, in particular its view that the main request did not fulfil the requirements of Articles 84 and 56 EPC.

V. With letter dated 10 October 2016, the appellant filed amended main, first and second auxiliary requests.

VI. Oral proceedings took place on 10 November 2016. The respondent (opponent) did not attend them, as announced by letter dated 10 October 2016. In accordance with Rule 115(2) EPC and Article 15(3) RPBA the proceedings were continued in its absence. During oral proceedings, the appellant submitted a new set of claims 1-23 as main request, claim 1 of which corresponded to claim 1 of the main request dated 10 October 2016.

Claim 1 of that request is as follows:

*"1. Sol-gel formed fibres comprising in mol%:*

- $Al_2O_3$  and  $SiO_2$  in such amounts that  $Al_2O_3 + SiO_2$  is in the range 65% to 95% and in which  $Al_2O_3$  is present in amounts of at least 25mol% and
- 5% - 35mol% in total, of a component consisting of one or more alkaline earth oxides and/or alkali metal oxides and in which where present the alkaline earth metal oxide comprises one or more of calcium oxide, strontium oxide, barium oxide or a mixture thereof, and in which said component is or comprises CaO, SrO, or a mixture thereof and CaO is less than 25mol%;

or

- $Al_2O_3$  and  $SiO_2$  in such amounts that  $Al_2O_3 + SiO_2 > 65\%$  and in which  $Al_2O_3 > 25mol\%$  and
- 5% - 30mol% in total of a component consisting of one or more alkaline earth oxides and/or alkali metal oxides and in which where present the alkaline earth metal oxide comprises one or more of calcium oxide, strontium oxide, barium oxide or a mixture thereof."

VII. The arguments of the appellant relevant to the present decision can be summarised as follows:

Article 123(2) EPC

A basis for the first limb of claim 1 of the main request could be found in claims 13 and 14 in combination with page 8, line 25 to page 9, line 2 and page 25, lines 7 to 10 and 15 to 19 of the application as filed. The second limb was based on claim 15 as filed.

Claim 22 was based on claim 30 and page 10, lines 5 to 11 of the application as filed.

Article 54 EPC

Some of the compositions of the melt-formed fibres of D2 fell inside the compositional range of claim 1. Document D21 presented information relating to fibres having the composition of D2.

The evidence of D21 showed that sol-gel fibres with a composition taken from D2 and falling within both limbs of claim 1 had different characteristics from the melt-formed fibres of D2.

Article 56 EPC

Sol-gel and soluble melt-formed fibres were treated as distinct entities by persons skilled in the art and by regulatory authorities.

D23 was the closest prior art. D23 sought to provide a polycrystalline fibre having enhanced biosolubility, but did not consider changing the composition, and instead changed the firing regime or sol viscosity to provide a porous fibre. These fibres had poor mechanical properties.

The present invention provided a fibre of moderate biopersistence with a high temperature capacity. It permitted the formation of respirable fibres that had moderate biopersistence and yet the enhanced thermal stability and mechanical properties of sol-gel fibres. A new class of fibres was provided to meet the regulatory environment relating to health aspects of inorganic fibres.

D2 taught away from compositions containing less than

35wt% SrO in view of poor shrinkage characteristics. Therefore D2 was not a suitable starting point for assessing inventive step.

Even when starting from D2 the problem was to provide fibres that had not only a moderate biopersistence with high temperature stability, but also resilience and the capacity to be formed into useful insulation.

To arrive at a fibre having such properties, the skilled person would have to start from fibres not considered useful in D2, deshot them and anneal them to get adequate resilience. Such a procedure was completely based on hindsight. In addition, deshotting had an influence on the quality of the fibres.

D19 clearly recognised the differences between sol-gel fibres and melt formed fibres, but there was still no suggestion to make the compositions of the melt-formed fibres by a sol-gel route.

The subject-matter of claim 1 was also not obvious when starting from D3. The subject-matter of claim 1 was also inventive over D23 as closest prior art, since D23 did not indicate that changing chemistry could have any positive effect on solubility.

Since the subject-matter of claim 1 was based on inventive step, the sol-gel process leading to the product of claim 1 also had to involve an inventive step.

VIII. The appellant (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the set of claims of the main request as filed during oral



proceedings before the board or, in the alternative, on the basis of the set of claims of one of the first or second auxiliary requests, both filed with letter dated 10 October 2016, or on the basis of the set of claims of one of the third, fourth, sixth and seventh auxiliary requests submitted with its statement of grounds of appeal dated 6 August 2013 or, in the alternative, on the basis of the set of claims of the fifth auxiliary request filed with letter dated 6 October 2014.

The respondent (opponent) requested in writing that the appeal be dismissed.

### **Reasons for the Decision**

#### 1. Admissibility of the main request

The main request was filed during oral proceedings before the board in order to overcome an objection under Article 84 EPC raised by the board in its communication with respect to dependent claims 2, 10 and 24 of the main request dated 10 October 2016. It differs from the latter request only in that claim 2 has been deleted and the numbers of the dependencies adapted accordingly. Thus the amendments are straightforward and very simple, so there is no reason to not admit the request (Article 13(1) and (3) RPBA). In addition, the request cannot be considered as a new fact, since it does not contain a new claim (cf. G 4/92, Reasons 8).

#### 2. Article 123(3) EPC

Claim 1 contains two limbs, each of which is restricted compared to claim 1 of the patent as granted by the

ranges present in the claim. All the other claims refer back, directly or indirectly, to claim 1. Therefore the requirements of Article 123(3) EPC are fulfilled.

3. Article 123(2) EPC

The requirements of Article 123(2) EPC are also fulfilled, for the following reasons:

3.1 The subject-matter of claim 1 is based on claims 13 and 15 and page 8, line 24 and page 8, line 27 to page 9, line 5 of the description of the application as filed.

3.2 The deletion of features from claim 30 as filed is based on page 10, lines 5 and 6 of the application as filed, making it clear that the sol-gel process suitable for producing the fibres is not restricted to a specific process. Therefore, the subject-matter of claim 20 is directly and unambiguously derivable from the application as filed.

3.3 Claim 2 to 19 and 21 to 23 correspond to their counterparts in the request which the opposition division found allowable and in particular not objectionable under Article 123(2) EPC (see point 11.1 of the reasons). The board sees no reason to take a different stance.

4. Article 84 EPC

4.1 The objection under Article 84 EPC raised by the board in its communication under Article 15(1) RPBA has been overcome by the addition of the expression "where present" in the first limb of claim 1. This clarifies that the presence of alkaline earth metal oxide is only one option out of two (alkaline earth oxides and/or

alkali metal oxides).

- 4.2 Furthermore, claim 2 of the main request dated 10 October 2016 related to features already present in the first limb of claim 1. Since claim 2 of that request is no longer present in the current main request, this clarity problem has been overcome. The same applies to the change in the dependencies of what are now claims 9 and 23.

The clarity requirements set forth in Article 84 EPC are fulfilled.

5. Article 54 EPC

The requirements of Article 54 EPC are fulfilled for the following reasons:

- 5.1 The board agrees with the reasons given by the opposition division in its decision regarding novelty vis-à-vis D1, since the examples of D1 fall outside the ranges claimed (cf. point 5.3.1.2 of the impugned decision). In addition, it is not unambiguously derivable from D1 that SiO<sub>2</sub> is present in the composition. Furthermore, D1 does not relate to sol-gel formed fibres (see also next point).
- 5.2 D2 discloses (see page 20, Table 2 - Part 1) several compositions (i.e. SA8b, SA7b, SA7a, SA6b, SA6d, SA6a) falling within the compositional range of claim 1. However, the fibres of D2 are not formed by a sol-gel process, but are melt-formed fibres (see page 2, last two lines). It needs to be decided whether the feature "sol-gel formed" implies product characteristics that are not obtained by a melt-forming process.

Although the feature "sol-gel formed" does not contain any details on the sol-gel process and although the characteristics of the final product are dependent on the sol-gel process conditions, the board accepts that the information provided by the appellant (D8 to D13 and especially D21) convincingly show that sol-gel processes lead to products with a lower shot content than products obtained by melt forming. In particular, D21 shows that fibres prepared with a chemical composition of 25.68 wt% SrO, 64.63 wt% Al<sub>2</sub>O<sub>3</sub> and 9.54 wt% SiO<sub>2</sub> - similar to the compositions SA8b, SA7b and SA7a of D2 - prepared by a sol-gel process had a shot content of 1.01 wt% for all shot > 53 µm, which is very low compared to what is usually obtained by a melt-forming process (see D8, paragraphs 15 to 17, and D13, page 3, second and third paragraphs). Therefore and in view of the lack of evidence to the contrary, it cannot be concluded that the melt-formed fibres of D2 have the same properties as sol-gel formed fibres with the same chemical composition. The subject-matter of claim 1 is thus not directly and unambiguously derivable from D2.

5.3 The board agrees with the conclusion of the opposition division regarding novelty over D7, since the SiO<sub>2</sub> + Al<sub>2</sub>O<sub>3</sub> content and the alkaline earth oxide content fall outside the scope of claim 1 (see impugned decision, point 5.3.1.2). In addition, D7 does not relate to sol-gel formed fibres, but to melt-formed fibres.

6. Article 56 EPC

The subject-matter of claims 1 to 23 is considered to involve an inventive step for the following reasons:

6.1 Invention

The invention relates to high-temperature-resistant fibres.

## 6.2 Closest prior art

It is established jurisprudence that the closest prior art is normally a prior-art document disclosing the same purpose or aiming at the same objective as the claimed invention and having the most features in common with the claimed subject-matter.

D2 relates to the solubility and shrinkage of fibres (page 1, paragraphs 5 and 6; page 2, paragraph 3 and page 3, paragraph 3). The fibres with the chemical compositions according to SA8b, SA7b, SA7a, SA6b, SA6d and SA6a fall within the compositional range of claim 1 (see page 2, Table 2 - Part 1). However, D2 states that these fibres "show poor shrinkage characteristics", meaning that the shrinkage is above the desired range of 3.5% and below (see claim 1 of D2). The shrinkage of these fibres measured at different temperatures is in the range of 3.62 to 12.1 (page 10, Table 2, part 1). The board is of the opinion that the skilled person would not simply discard these examples as a starting point, since they might still be suitable, depending on his intended purpose. Therefore these compositions, and especially composition SA7a that has a shrinkage of between 4.4% and 9.94 % depending on the testing temperature, are considered to be a suitable starting point for the assessment of inventive step.

On the other hand, D3, D4 and D7 are silent about solubility and biopersistence and do not appear to qualify as closest prior art.

It can be left open whether D23 is more appropriate

closest prior art, as submitted by the appellant, since even when starting from D2, which the board considers as the most promising "springboard", inventive step is recognised (see below).

### 6.3 Problem

The problem underlying the patent is to provide fibres having low shrinkage at elevated temperature, a high resilience and a degree of solubility significantly higher than the solubility of pure mullite fibres (paragraph 22). The appellant also contends that the resilience of the claimed fibres is not only high but also better than that of the fibres of D2.

### 6.4 Solution

As a solution to the problem, the patent proposes a fibre according to claim 1 characterised in that it is sol-gel formed.

### 6.5 Success of the solution

It needs to be decided whether the problem is credibly solved over the whole range claimed. D21 shows that sol-gel fibres with a chemical composition similar to composition SA7a of D2 even show an expansion, i.e. negative shrinkage, at 1000°C of 3.09% and at 1260°C of 0.39% in the shrinkage testing according to ISO 10635. In contrast, the shrinkage of fibres SA7a of D2 is at least 4.4% (see page 20, Table 2 - Part 1). This can be considered as an indication that the sol-gel process used in D21, including firing at 1300°C, leads to fibres with better shrinkage properties than meltblown fibres.

However, the fibres of claim 1 are not limited to fibres produced by a specific sol-gel process such as the one of claim 20, but also encompass fibres produced by any type of sol-gel process, independently of the sol composition and the firing temperature. The patent indicates that the firing temperature is of importance for the shrinkage (see in particular paragraphs 62 and 66 and figures 4 to 6). Therefore there remains some doubt whether the improvement shown with D21 applies to the whole scope of the claim. However, in view of the data presented in the patent (see in particular Table 5), the board accepts that the fibres according to claim 1 have low shrinkage, even if not lower than that of the fibres of D2.

The problem underlying the patent relates to obtaining fibres having not only low shrinkage, but high resilience, i.e. the ability to recover their initial shape after deformation (see paragraph 14 of the patent). Sol-gel processes tend to lead to higher resilience than processes including melt forming. In particular, the patent indicates that sol-gel formed alumina and/or mullite fibres have the desired degree of resilience (paragraph 14) and D8 mentions that sol-gel fibres maintain resilience better than non-heat-treated aluminosilicate fibres (paragraphs 18 to 20). It is also apparent from D6 that melt-formed fibres require an annealing step for improving resilience (page 3, lines 13 and 14).

Therefore, the board accepts that sol-gel formed fibres generally have a better resilience than fibres obtained by melt forming.

D21 also shows that the sol-gel fibres with a chemical composition similar to composition SA7a of D2 have good

solubility, measured in a 4.5 pH solution (see paragraph 8: 59 ppm). Although an improvement in solubility with respect to D2 has not been shown, there is enough data in the patent (see Table 7) showing that the solubility of the sol-gel fibres claimed is better than that of pure mullite fibres.

In view of the foregoing and in view of the lack of evidence to the contrary, the board accepts that the problem of providing fibres with improved resilience which show low shrinkage and a degree of solubility is solved with respect to D2.

#### 6.6 Obviousness

It needs to be decided whether the prior art provides any teaching towards the proposed solution.

6.6.1 D2 itself is completely silent about sol-gel processes. Although D2 indicates that fibres made by any process are encompassed by the invention, there is no mention of sol-gel processes, let alone any advantages thereof.

6.6.2 D3 discloses a sol-gel process for the production of a precursor of a polycrystalline alumina fibre (claim 1). It indicates that the fibres have outstanding heat resistance and mechanical properties (column 6, lines 28 and 29). The fibre according to D3 contains 80 to 100% by weight of an  $\text{Al}_2\text{O}_3$  component, with  $\text{SiO}_2$ ,  $\text{MgO}$ ,  $\text{Fe}_2\text{O}_3$  and  $\text{Na}_2\text{O}$  accounting for the balance to make up 100% by weight (column 2, lines 7 to 10). The skilled person starting from D2 and trying to solve the posed problem would not turn to D3, which is completely silent about the solubility of the fibres and whose fibres have a substantially different chemical composition from those of D2. The goal of the skilled



person is to improve resilience while maintaining the shrinkage properties and a degree of solubility. D2 already provides the desired shrinkage and solubility for chemical fibres comprising a high amount of SrO. D3 is completely silent about SrO, and therefore does not teach the skilled person how to improve resilience of the composition of D2 while maintaining solubility and shrinkage.

6.6.3 D4 discloses a sol-gel process for the production of mullite (claim 1). The skilled person starting from D2 would not consider D4 when trying to solve the posed problem, since the chemical composition of the fibres is different from those disclosed in D2 in that it does not include alkaline earth/alkali metal oxides, and D4 does not contain any indications about the solubility and mechanical properties of the fibres.

6.6.4 D19 relates to a support element that has improved resilience and handling properties as well as increased support pressure characteristics and comprises an integral, substantially non-expanding ply or layer of melt-formed ceramic fibres for mounting and supporting the fragile structure (page 1, lines 9 to 12). D19 discloses that ceramic fibres formed by sol-gel processes can have a high degree of resilience, but that due to their high cost, manufacturers have sought less expensive solutions (page 4, lines 3 to 6). The preferred fibres are those selected from the group consisting of aluminosilicates such as those having from about 47 to about 53 percent alumina and from about 47 to about 53 percent silica (page 12, line 25 to page 13, line 2). The fibres utilised are melt-formed and beneficiated (page 13, lines 4 to 9). The skilled person starting from D2 would not turn to D19 when trying to solve the posed problem, since D19

relates to a different chemical composition in that it does disclose the use of alkaline metal/alkali earth metal oxides and is silent about the solubility of the fibres and does not explicitly mention shrinkage properties. Although D19 mentions the possible benefit of a sol-gel process with respect to resilience, the process to which D19 relates is a melt-forming process with subsequent beneficiation to remove shot. D19 clearly does not provide any indication that the fibres of D2 could be improved with respect to resilience while maintaining solubility and shrinkage when using a sol-gel process.

- 6.6.5 The board concludes that the prior art does not provide any teaching towards the proposed solution. The subject-matter of claim 1 involves an inventive step. Since claims 2 to 23 all refer back to claim 1, directly or indirectly, the same conclusion applies also to those claims.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent in amended form on the basis of claims 1-23 according to the main request filed during the oral proceedings of 10 November 2016, and a description and drawings to be adapted thereto where necessary.

The Registrar:

The Chairman:



C. Vodz

A. Haderlein

Decision electronically authenticated