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Datasheet for the decision of 30 September 2014

Case Number: T 1556/11 - 3.3.05

Application Number: 99972613.6

Publication Number: 1140730

IPC: C04B35/00

Language of the proceedings: EN

Title of invention:
COMPOSITE MATERIAL

Patent Proprietor:
VESUVIUS CRUCIBLE COMPANY

Opponent:
ESK Ceramics GmbH & Co.KG

Headword:
Vesuvius Crucible/composite material

Relevant legal provisions:
EPC Art. 84, 123(2), 123(3), 56
RPBA Art. 13(1), 13(3)

Keyword:
Late-filed request - admitted (yes)
Amendments - added subject-matter (no)
Claims - clarity (yes)
Inventive step - non-obvious alternative

Decisions cited:

Catchword:

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Case Number: T 1556/11 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 30 September 2014

Appellant: (Opponent)	ESK Ceramics GmbH & Co.KG Max-Schaidhauf-Strasse 25 87437 Kempten (DE)
Representative:	Merkle, Gebhard Ter Meer Steinmeister & Partner Mauerkircherstrasse 45 81679 München (DE)
Respondent: (Patent Proprietor)	VESUVIUS CRUCIBLE COMPANY Suite 200, Foulk Road 103 Wilmington, DE 19803 (US)
Representative:	Debled, Thierry Vesuvius Group S.A. Intellectual Property Department Rue de Douvrain, 17 7011 Ghlin (BE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 23 May 2011 concerning maintenance of the European Patent No. 1140730 in amended form.**

Composition of the Board:

Chairman J.-M. Schwaller
Members: A. Haderlein
D. Prietzel-Funk

Summary of Facts and Submissions

I. This decision concerns the appeal of the opponent (appellant) against the interlocutory decision of the opposition division holding that European patent No. 1 140 730 as amended according to the main request and the invention to which it relates met the requirements of the EPC. The patent in suit concerns a boron-nitride-based composite material.

In the opposition division's decision reference was made *inter alia* to the following documents:

D1: EP 0 447 940 A1
D5: EP 0 396 779 B1 and
D5': US 5 389 587, a patent family member of D5

II. The opposition division found that the claims as amended complied with the requirement of clarity. Also, the claimed subject-matter was held to involve an inventive step since the skilled person would not have combined the teachings of the closest prior art D1 and D5.

III. In the statement setting out the grounds of appeal, the appellant raised objections under Articles 84, 123(2) and (3), Rule 80, and Article 56 EPC. It also filed the following documents:

D6: Sonderdruck aus "*Berichte der Deutschen Keramischen Gesellschaft*", Vol. 56 (1979), No. 1, pages 1 to 4

D7: Reprint Ullmann's Encyclopedia of Industrial Chemistry, Vol. A4 (1985), pages 295 to 307

D8: Hubacek M. et al, "*Pressureless-sintered boron*

nitride with limited content of boric oxide", Materials Science Research International, Vol. 1 (1995), No. 4, pages 209 to 212.

IV. After notification of the summons to oral proceedings, the respondent filed an auxiliary request.

V. At the oral proceedings before the board, which took place on 30 September 2014, the respondent filed *inter alia* a new main request labelled "III" replacing all previously filed requests.

VI. Claims 1 and 3 of the sole request read as follows:

"1. Side dam plate consisting of a refractory composite pressure-sintered material consisting of
- a continuous phase of hexagonal boron nitride and, dispersed therein,
- a second material consisting of
SiAlON ($Si_{6-z}Al_zO_zN_{8-z}$) with z being comprised between 1 and 4.5 wherein the second material does not contain more than 35 % by weight of oxygen, and
- up to 5% by weight of the mixture hexagonal boron nitride/second material of additives selected from yttrium, magnesium, calcium and/or cerium oxides."

"3. Side dam plate consisting of a refractory composite pressure-sintered material consisting of
- from 45 to 80 % by weight of hexagonal boron nitride and
- from 55 to 20 % by weight of a second material consisting of SiAlON ($Si_{6-z}Al_zO_zN_{8-z}$) with z being comprised between 1 and 4.5 wherein the second material does not contain more than 35 % by weight of oxygen, and
- up to 5% by weight of the mixture hexagonal boron

nitride/second material of additives selected from yttrium, magnesium, calcium and/or cerium oxides."

Dependent claims 2, 4 and 5 constitute particular embodiments of the independent claims they refer to.

VII. The appellant argued essentially as follows:

Admissibility of the request

The new main request was filed only at the oral proceedings and was therefore filed late. It was *prima facie* apparent that it did not overcome the objection of lack of inventive step in view of a combination of documents D1 and D5. Furthermore it was *prima facie* objectionable for lack of clarity and because of added subject-matter. The new main request should therefore not be admitted into the proceedings.

Article 123(2) EPC

There was no basis in the application as filed for the feature "Side dam plate consisting of". In particular, claim 14 as filed formed the basis only for a side dam plate "comprising" the composite material, which was not the same as "consisting of". The passage on page 4, lines 21 and 22, of the application as filed was insufficient for supporting the amendment.

Clarity

Claims 1 and 3 lacked clarity. It was not clear to which feature "the mixture hexagonal boron nitride/ second material" referred, since such a mixture was not previously defined in the claims. The expression "mixture" referred to the powder mixture prior to

pressure-sintering and thus referred to the process for manufacturing the side dam plate, whereas claims 1 and 3 in general referred to the side dam plate as the product obtained by the process. Thus, the requirement of clarity set forth in Article 84 EPC was not complied with.

Inventive step

D1 represented the closest prior art. The subject-matter of claims 1 and 3 differed therefrom in that the second material consisted of the SiAlON of the general formula set out in claims 1 and 3 and that the side dam plate consisted of a composite material made of hexagonal boron nitride and the SiAlON, i.e. excluding the presence of other compounds, apart from up to 5% by weight of certain metal oxides. The problem to be solved was the provision of an alternative side dam plate having similar properties. The properties addressed in D1 were corrosion resistance, i.e. chemical wear, resistance to thermal shock and resistance to abrasion. D5 disclosed the SiAlON $Si_3Al_3O_3N_5$ which was covered by the formula set out in claims 1 and 3. This specific SiAlON was said to be excellent in resistance to loss by dissolving, i.e. chemical wear, and in resistance to thermal shock. As evidenced by documents D6 to D8 it was general knowledge to pressure-sinter hexagonal boron nitride in order to increase density and thus mechanical strength. The decision whether to use pressure-sintering or pressureless sintering would essentially depend upon the density and mechanical strength to be achieved. An increase in mechanical strength also increased resistance to abrasion. The fact that D5 taught that the compounds disclosed therein were suitable for pressureless sintering did not prevent the skilled

person from using them in a pressure-sintered material. The possible applications mentioned in D5 were such that the material did not need to have high mechanical strength and density, making it possible to use the less costly pressureless process. Therefore, the skilled person would have replaced the compounds such as zirconium oxide used in D1 as second material with the SiAlON known from D5 and would have used a pressure-sintering process for preparing the side dam plate, expecting to obtain a material having similar resistance to chemical wear, resistance to thermal shock and resistance to abrasion. The requirement of inventive step was therefore not complied with.

VIII. The respondent argued essentially as follows:

Admissibility of the request

The claim request overcame the inventive step objection because it was now restricted to side dam plates that consisted of the composite material, which included only hexagonal boron nitride and SiAlON and minor amounts of specific oxides. There was a basis for the "side dam plate consisting of" in the application as filed. The claims were clear since the expression "the mixture" clearly referred to the sum of the amounts of hexagonal boron nitride and second material.

Article 123(2) EPC

The description as filed disclosed on page 4, lines 21 and 22, that the composite material found its main application as side dam plates. There was therefore a clear basis for a side dam plate consisting of the composite material.

Clarity

The requirement for clarity of the claims was complied with since the expression "mixture hexagonal boron nitride/second material" referred to the sum of the hexagonal boron nitride and the second material which were previously mentioned in the claims.

Inventive step

D1 constituted the closest prior art. The claimed subject-matter differed from D1 in that the compounds of the second material were replaced by a specific SiAlON class. The problem to be solved was to provide further side dam plates having properties similar to those known from D1. This problem was solved by the side dam plates of claims 1 and 3. It was not obvious to replace the essential compounds in the material known from D1 with the aim to achieve similar properties. The skilled person would not consider the teachings of D5 since this document did not mention materials subject to mechanical stress. Moreover, D5 taught that the application of pressure during sintering was not necessary, whereas D1 concerned pressure-sintered composite materials. There was therefore no teaching in D5 that would have motivated the skilled person to expect that replacing the second material of D1 with a SiAlON of D5 would have resulted in a material having similar properties. Even if the skilled person had considered the teachings of D5, it was questionable whether he would have actually replaced only the aluminium nitride or the aluminium borate complex and the zirconium oxide with the specific SiAlON of D5. The tables contained in D5 showed different properties for different materials. Choosing a particular SiAlON among those disclosed in

D5 was therefore not straightforward, let alone arbitrary.

IX. Requests

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

The respondent requested that the appeal be dismissed, or alternatively that the patent be maintained on the basis of the claims of the main request (labelled "III").

Reasons for the Decision

1. Admissibility of the request

1.1 In claims 1 and 3 "comprising" is replaced by "consisting of" twice. It appears therefore that the skilled person would have to omit essential features in D1 when combining it with D5 in order to arrive at the claimed subject-matter. This does not appear, at least on a *prima facie* basis, to be obvious in view of the problem to be solved, on which the parties agree, i.e. the provision of an alternative side dam plate having properties similar to those of the side dam plate of D1.

1.2 A problem of lack of clarity is not *prima facie* apparent since the expression "the mixture hexagonal boron nitride/second material" clearly refers to the the sum of the amounts of hexagonal boron nitride and second material previously defined in the claims.

1.3 Contrary to the assertions of the appellant, there appears to be a clear basis on page 4, lines 21 and 22,

of the application as filed for a side dam plate consisting of the composite material.

1.4 For the above reasons and because the amendments carried out did not raise issues which the board or the appellant could not reasonably have expected to deal with without adjournment of the oral proceedings, the board exercised its discretionary power under Article 13(1),(3) RPBA and admitted the request into the proceedings.

2. Allowability of the amendments

2.1 Claims 1 and 3 are based on claims 1 and 3 as well as claim 12; on page 3, line 37, to page 4, line 2; and on page 4, lines 21 and 22, of the application as filed.

2.2 Dependent claims 2, 4 and 5 find their respective basis in claims 2, 8 and 13 as filed.

2.3 The appellant's argument that page 4, lines 21 and 22, was not a sufficient basis for the feature "dam side plate consisting of" is not convincing. In fact, said passage states that the "composite material according to the invention finds its main application as side dam plates". This means that the composite material can be used as such as a side dam plate, which in turn does not mean anything other than that the side dam plate consists of the composite material.

2.4 The board is therefore satisfied that the claimed subject-matter does not extend beyond the application as filed (Article 123(2) EPC).

2.5 The amendments result in the restriction of the independent claims as granted and, therefore, do not

lead to an extension of the protection conferred (Article 123(3) EPC).

3. Clarity of the claims

3.1 While it is true that the expression "mixture hexagonal boron nitride/second material" is not mentioned before in the claims, this does not necessarily lead to a lack of clarity. Before the above expression is used in the claims, reference is already made in the claims to "hexagonal boron nitride" and to the "second material". Thus, it is clear that the expression "the mixture hexagonal boron nitride/second material" refers to the sum of the amounts of hexagonal boron nitride and of the second material. Consequently, the board fails to see why the expression in question seen in the context of the claims would lack clarity under Article 84 EPC.

3.2 The appellant also argued that the claims were not clear since the expression "mixture" referred to the powder mixture prior to pressure-sintering and thus referred to the process for manufacturing the side dam plate, whereas claim 1 in general referred to the side dam plate as the product obtained by the process.

The board cannot be convinced of a lack of clarity by this argument. It is not plausible that the amounts of the metal oxides change significantly during pressure-sintering with respect to the amounts of the hexagonal boron nitride and the SiAlON; nor has the appellant shown that there would be such a significant change. Therefore, even if one construed the "mixture" to refer to the powder prior to sintering and the other compounds to refer to the composite obtained after sintering, the amount of metal oxides present in the

side dam plate would be clear to the skilled person.

4. Inventive step

4.1 The invention concerns a side dam plate made of a refractory composite pressure-sintered material.

4.2 The board agrees with the parties that D1 constitutes the closest prior art.

D1 discloses a side dam plate (see page 2, lines 5 to 7, wherein the side dam plate is defined as "sheath", and the figures) comprising a refractory composite pressure-sintered material (claim 1; page 5, lines 36 and 37) comprising at least 65% by weight hexagonal boron nitride (claims 1 and 3) and a second material (claim 1). Under these circumstances, the hexagonal boron nitride is present as a continuous phase and the second material is dispersed therein (cf. the patent in suit, paragraph [0011]).

4.3 According to the patent in suit (paragraph [0008]) the problem was the provision of a material which would combine resistance to mechanical and thermal stresses and have excellent resistance against chemical or mechanical wear and would in particular have excellent chemical resistance to liquid metal.

4.4 As a solution to this problem, the invention proposes a side dam plate according to claims 1 and 3 at issue, which is in particular characterised in that:
- the side dam plate **consists of** the composite material
- which **consists of** hexagonal boron nitride and the second material,
- the second material **consisting of SiAlON ($Si_{6-z}Al_zO_zN_{8-z}$), with z being comprised between 1 and**

4.5.

4.5 As to whether the problem identified in the patent in suit has been solved, the parties agree that it was already solved in D1 and that the problem thus resides in the provision of a side dam plate having similar properties to the one known from D1.

4.6 This problem has been credibly solved (see paragraphs [0010] and [0036] of the patent in suit).

4.7 As to obviousness, the question is whether the solution proposed in claims 1 and 3 was obvious in view of D1 and D5/D5'.

4.7.1 D1 teaches that the side dam plate disclosed therein has improved resistance to corrosion, i.e. resistance to chemical wear, improved resistance to thermal shock and improved resistance to abrasion (page 2, lines 43 to 47).

4.7.2 D5/D5' concerns sintered composite materials based on hexagonal boron nitride having excellent resistance to loss by dissolving in a hot melt of metal (column 1, lines 9 to 11, of D5'). D5' teaches to use, among other compounds, the SiAlON $Si_3Al_3O_3N_5$ (see in particular column 2, lines 5 to 10), which is covered by the formula in claims 1 and 3 of the sole request. It is said that this compound would improve resistance to loss by dissolving, unwettability and resistance to thermal shock (*loc. cit.*).

D5/D5' is however silent about resistance to abrasion, and it aims at providing composite materials which can be sintered without the application of pressure (cf.

column 1, lines 49 to 55, of D5').

4.7.3 According to the appellant, in view of the teaching of D5/D5' the skilled person would have replaced the second material in D1, i.e. zirconium oxide and aluminium nitride/aluminium borate, with the SiAlON $Si_3Al_3O_3N_5$. Since he knew, as evidenced by D6 to D8, that pressure-sintering would lead to increased mechanical strength and thus to increased resistance to abrasion, he would have expected the material thus obtained to show improved resistance to abrasion.

The board finds this line of argument unconvincing. It was certainly common general knowledge that the application of pressure during the sintering process leads to an increase in density and thus in mechanical strength. Nevertheless, D1 teaches that it is not sufficient to apply pressure when sintering hexagonal boron nitride in order to improve resistance to abrasion, but that at least the presence of ZrO_2 as an additive is necessary in order to achieve the desired resistance to abrasion (see in particular page 2, lines 48 to 55). In fact, D1 teaches that not less than 9% by weight of ZrO_2 is essential in order to achieve substantial resistance to abrasion (*loc. cit.;* page 3, lines 29 to 34; claim 1).

4.7.4 It follows that, had the skilled person indeed combined the teachings of D1 and D5/D5', he would have used at least 9% by weight of ZrO_2 in order to achieve a similar resistance to abrasion. By doing so, he would not have arrived at the subject-matter of claim 1 or claim 3, which excludes the presence of compounds other than the hexagonal boron nitride, the SiAlON and minor amounts of certain metal oxides not including ZrO_2.

4.7.5 For the above reasons, the board concludes that it was not obvious to arrive at the subject-matter of claim 1. Nor was it obvious to arrive at the subject-matter of claim 3. The requirements of inventive step set forth in Article 56 EPC are therefore complied with.

4.8 The subject-matter of claims 2, 4 and 5 derives its patentability from that of claims 1 and 3, on which said claims depend.

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 on the basis of the claims of the main request (labelled "III") submitted during the oral proceedings and a description to be adapted.

The Registrar: The Chairman:

C. Vodz J.-M. Schwaller

Decision electronically authenticated