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**Datasheet for the decision  
of 5 March 2010**

**Case Number:** T 0112/07 - 3.3.05

**Application Number:** 98110918.4

**Publication Number:** 0884280

**IPC:** C01G 25/02

**Language of the proceedings:** EN

**Title of invention:**

Zirconia powder, method for producing the same, and zirconia ceramics using the same

**Patentee:**

NIPPON SHOKUBAI CO., LTD.

**Opponents:**

- I. UNITEC CERAMICS LIMITED  
II. H.C. STARCK GmbH & Co. KG  
III. Robert Bosch GmbH

**Headword:**

Zirconia sheet/NIPPON SHOKUBAI

**Relevant legal provisions:**

EPC Art. 54(1)(2), 56, 83, 84, 123(2)  
RPBA Art. 12(2)(4), 13(1)

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

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**Keyword:**

"Main request - admissibility (no) - late filed"  
"Novelty (first auxiliary request): yes"  
"Inventive step (first auxiliary request): yes - evidence for the technical solution in the patent in suit"

**Decisions cited:**

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**Catchword:**

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Case Number: T 0112/07 - 3.3.05

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.05**  
**of 5 March 2010**

**Appellant:**  
(Patent Proprietor) NIPPON SHOKUBAI CO., LTD.  
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**Representative:** Müller-Boré & Partner  
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**Respondent I:**  
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**Representative:** Moore, Christopher Mark  
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**Respondent II:**  
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**Representative:** Ackermann, Joachim  
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**Respondent III:** Robert Bosch GmbH  
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**Representative:** -

**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 15 December 2006  
revoking European patent No. 0884280 pursuant  
to Article 102(1) EPC 1973.

**Composition of the Board:**

**Chairman:** G. Raths  
**Members:** J.-M. Schwaller  
S. Hoffmann

## Summary of Facts and Submissions

- I. This appeal was lodged by the patent proprietor (hereinafter "the appellant") against the decision of the opposition division revoking European patent No. 0 884 280.
- II. In the contested decision, the opposition division held in particular claim 1 of the main request then on file - which related to a zirconia powder - not to be novel over either of the documents:
- D1: Sales Brochure of Unitec Ceramics Limited (Foseco Group), or
- D10: Order information from Robert Bosch GmbH to Unitec Ceramics Limited dated 22.08.1996
- III. With the grounds of appeal filed under cover of a letter dated 16 April 2007, the appellant filed two sets of amended claims as a main and an auxiliary request, respectively.

Claim 1 of the main request (called "first auxiliary request" hereinafter) reads as follows:

*"1. A zirconia ceramics sheet for an electrolyte film for solid oxide fuel cells, produced by using a zirconia powder as a raw material in which particles of 90 volume percent of the zirconia powder have a diameter of 1.5  $\mu\text{m}$  or smaller that falls within the range of 1.5 to 2.0 times larger than an average particle diameter of the zirconia powder ranging from*

*larger than 0.5  $\mu\text{m}$  to 0.8  $\mu\text{m}$ , wherein a Weibull modulus (m) of the sheet is higher than 10."*

IV. With the letter dated 2 November 2007, respondent II (also opponent II) raised objections under Articles 56, 84 and 123(2) EPC against the new requests. The lack of inventive step objection was based on documents D1 and D10.

V. Under cover of the letter dated 9 November 2007, respondent I (also Opponent I) filed inter alia the following new documents on the basis of which it raised novelty and inventive step objections against the subject-matter claimed:

D21: Maenner et al., "*Characterization of YSZ Electrolyte Materials with Various Yttria Contents*", Proc. 2<sup>nd</sup> Intl. Symp. on Solid Oxide Fuel Cells, pages 715 to 723 (1991);

D24: SOFC Design Requirements for Planar Zirconia Electrolyte Components; Science & Technology of Zirconia V, pages 713 to 723 (1994).

VI. With the letter dated 20 June 2008, the appellant filed an additional set of amended claims as the second auxiliary request.

VII. With the letter dated 5 February 2010, Respondent I raised objections against the claims of the latter request.

VIII. Oral proceedings took place on 5 March 2010 in the absence of Respondent II, which was announced in its letter dated 3 February 2010.

At the beginning of the oral proceedings, the appellant filed a new main request in addition to those already on file, which were renamed first, second and third auxiliary request, respectively. After discussion of the admissibility of this new main request, the appellant declared that it raised an objection under Rule 106 EPC for the case that its new main request would be rejected as inadmissible.

After discussion of the first auxiliary request under Articles 83, 84, 54 and 56 EPC, the appellant withdrew the first to third auxiliary requests on file and filed an amended first auxiliary request, claim 1 of which reads as follows (amendment underlined by the board):

*"1. A zirconia ceramics sheet including zirconia as a main component for an electrolyte film for solid oxide fuel cells, produced by using a zirconia powder as a raw material in which particles of 90 volume percent of the zirconia powder have a diameter of 1.5  $\mu\text{m}$  or smaller that falls within the range of 1.5 to 2.0 times larger than an average particle diameter of the zirconia powder ranging from larger than 0.5  $\mu\text{m}$  to 0.8  $\mu\text{m}$ , wherein a Weibull modulus ( $m$ ) of the sheet is higher than 10."*

IX. The parties' requests were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be maintained in

amended form on the basis of the claims according to one of the sets of claims filed as main request and first auxiliary request during the oral proceedings.

The respondents requested that the appeal be dismissed.

### **Reasons for the Decision**

1. *Admissibility of the main request filed at the oral proceedings*

1.1 The appellant justified the filing of the request at this stage of the proceedings by the discussions with its client on the eve of the hearing which led to the conclusion that the documents D1 and D10 had been wrongly interpreted by the department of first instance and that these documents therefore were no longer objectionable to the subject-matter claimed.

It also argued that said claims had already been dealt with during the opposition proceedings, so that the respondents were familiar with the claimed subject-matter and substantially no new matter had thus to be discussed.

1.2 The respondents argued that the filing of the request at such a late stage was abusive and would take them by surprise. The request should thus not be admitted into the proceedings.

1.3 The board observes that according to Article 13(1) RPBA, "any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and



considered at the board's discretion. The discretion shall be exercised in view of inter alia the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy".

This obviously means that the admission of a request at a late stage of the appeal proceedings is not a right but is at the board's discretion.

- 1.4 In the present situation, wherein the claims submitted at the beginning of the oral proceedings correspond to those of the main request relied upon in the contested decision, the question of an abusively late filing of requests arises, since none of the requests relied upon in the decision under appeal had been filed with the grounds of appeal.

The fact that the attorney and its client came the eve of the hearing to the conclusion that the documents D1 and D10 had been wrongly interpreted is - according to the board - not a reason sufficient for accepting the late filing of the claims rejected by the opposition division, because the representative and its client had almost three years for discussing the key points of the present case and the claims at issue could have been filed with the grounds of appeal, not almost three years later.

In this context, the board is of the opinion that since it cannot be expected to deal reasonably with late filed subject-matter differing substantially from that submitted for the oral proceedings, the claims are considered ostensibly belated.

1.5 The present situation furthermore raises - as stressed in Article 13(1) RPBA - the questions of the complexity and of procedural efficiency of the case at stake for the following reasons:

1.5.1 First of all, it is to be noted that the claims submitted at the beginning of the oral proceedings raise new problems, in particular those brought up by the appellant for justifying the filing of the request at this stage of the proceedings. In this context, it cannot reasonably be expected from the parties and the board to deal instantly and objectively with these rather complex issues because the risk of overlooking important aspects under the time pressure of the oral proceedings is too high.

1.5.2 The board furthermore draws attention to the fact that since respondent II declared (letter of 3 February 2010) that, in view of the restricted claimed subject-matter, it would not attend the oral proceedings, this means that it was satisfied with the claims proposed for discussion at the hearing before the board. So, in good faith that the subject-matter directed to a ceramic sheet would be discussed during the oral proceedings, respondent II would not have been able to react to the newly submitted subject-matter, namely a zirconia powder. Since the lack of opportunity to react would raise the question as to the violation of the right to be heard by respondent II, the acceptance by the board of the new claims would have prevented a final decision being taken at the oral proceedings.

So, the admission of the late filed request would have had the inevitable consequence of continuing the

proceedings in writing and of delaying unduly the proceedings, which is contrary to the principle of procedural efficiency.

1.6 In view of the above reasons and since according to Art. 12(2)(4) RPBA, the statement of grounds had to contain a party's complete case - which was not the case - the board considered unacceptable the filing of the claims at issue at the beginning of the oral proceedings. The main request was therefore not admitted.

2. *First auxiliary request - allowability of the amendments*

2.1 The respondents argued that claim 1 infringed the requirements of Article 123(2) EPC because there was no basis in the application as filed for a zirconia ceramic sheet as defined in claim 1 and characterised in particular as having a Weibull modulus "higher than 10". The use of the zirconia ceramic sheet as "an electrolyte film for solid oxide fuel cells" was furthermore only disclosed in the description of the background art and so there was no disclosure for such a use for the specific sheet defined in claim 1.

2.2 The board observes that claim 1 results from independent claim 12 (directed to "*a zirconia ceramic produced by using a zirconia powder*" as defined in claim 1 at issue) and claim 13 (dependent on claim 12 and defining said zirconia ceramic as "*having a form of sheet*") in combination with the disclosure at page 25, lines 16 to 18 ("*The ceramics of the present invention has a value of Weibull modulus (m) of 10 or higher*") and at page 1, lines 15 to 20 ("*ceramic sheets*

*including zirconia as main component can be effectively used as sensor parts, electrolyte film for solid oxide fuel cells and setters for calcination because of its excellent oxygen ion conductivity and heat and corrosion resistance").*

2.3 There is no doubt that the zirconia ceramics "*of the present invention*" described as having a value of Weibull modulus (m) of "*10 or higher*" are those having the specific powder distribution presently claimed (application as filed, page 25, lines 16 to 18). This means that the said ceramics, which according to claim 13 as filed were disclosed as "*having a form of sheet*" may either have the value 10 or a value higher than 10. So, there is a direct and unambiguous disclosure in the application as filed of zirconia ceramic sheets as defined in claim 1 at issue and having a Weibull modulus higher than 10.

2.4 Concerning the second point raised by the respondents, the board observes that the use of zirconia ceramics sheet as "*electrolyte film for solid oxide fuel cells*" is described in the second introductory paragraph of the application as filed, which does not describe the background art as alleged by the respondents, but which directly and unambiguously discloses in its second sentence the different potential uses of ceramic sheets including zirconia as a main component. Among other specific uses, the use as "*electrolyte film for solid oxide fuel cells*" is directly and unambiguously disclosed in the sentence bridging the sixth and seventh line of this paragraph.

2.5 Concerning the further objection that the ceramic zirconia sheets described for the use as electrolyte film for solid oxide fuel cells were defined as "including zirconia as a main component", this feature having been inserted into the subject-matter of claim 1, an objection under Article 123(2) EPC concerning this missing feature no longer applies.

2.6 For the above reasons, the board is satisfied that claim 1 does not extend beyond the content of the application as filed.

2.7 The dependent claims 2 to 8 have furthermore the following support in the application as filed:

- claim 2: page 13, lines 10 to 14;
- claim 3: page 10, lines 20 to page 11, line 4;
- claim 4: page 11, lines 13 to 16;
- claim 5: page 12, lines 4 to 7;
- claim 6: page 20, line 24 to page 21, line 1;
- claim 7: page 11, lines 5 to 12;
- claim 8: page 11, lines 13 to 16.

The board is satisfied that the set of claims at issue meets the requirements of Article 123(2) EPC.

3. *First auxiliary request - Disclosure of the invention*

The respondents argued in particular at the oral proceedings that the invention claimed would be insufficiently disclosed. However, in the absence of evidence for such allegations and in view of the multiple examples showing that zirconia ceramics sheets having the properties claimed could be easily produced, the board is satisfied that the requirements of Article 83 EPC are met.

4. *First auxiliary request - Clarity*

4.1 The board does not consider the expression "including zirconia as a main component" as objectionable under Article 84 EPC because the insertion of this feature into claim 1 at issue does not render the scope of protection unclear. It can easily be verified whether a constituent of a composition - here zirconia - is the main component or not.

4.2 Concerning the respondents' objection that there were inconsistencies among the claims owing to the presence of two different "raw" materials, the board agrees that it might be unartful to use the same term - here "raw material" - in a set of claims for defining two different materials. However a lack of clarity does not arise in the present case, because an unambiguous distinction can be made between said two materials:

- the first raw material identified in independent claim 1 as the zirconia powder is used as "raw material" for producing the zirconia ceramics sheet claimed, and

- the second raw material defined in dependent claims 3 to 8, also identified as the "raw material powder" from which is obtained the "zirconia powder", is used in the production of the zirconia ceramics sheet defined in claim 1.
- 4.3 Regarding the objection that essential features (amount of zirconia, amount of other oxide, process features) were missing in claim 1, the board notes that nowhere in the patent have the said features been identified as mandatory to carry out the invention or essential to solve the technical problem underlying the invention.
- 4.4 In view of the above considerations, the board concludes that the claims of the request at issue meet the requirements of Article 84 EPC.
5. *First auxiliary request - Novelty*
- 5.1 The respondents argued at the oral proceedings that the subject-matter of claim 1 was not novel over the content of each one of documents D21 and D24, which both disclosed zirconia ceramics sheets for use as electrolyte for solid oxide fuel cells (SOFC) having a Weibull modulus of 13 and prepared from zirconia powders manufactured by Unitec (respondent I in the present proceedings). Having been questioned regarding the particle size distribution of the powders used in D21 and D24, the respondents conceded that there was no explicit disclosure of the particle size distribution. They argued however that a Weibull modulus of 13 would only be obtained with powders having a distribution as defined in claim 1 at issue. It would follow that the

particle size distribution was implicit from the disclosure of either of D21 and D24.

- 5.2 The board observes that none of the documents D21 and D24 gives any detail about the particle size distribution of the powders used in the preparation of the zirconia ceramics sheets. D21 however indicates in its introductory part that "powder characteristics (impurities content, specific surface area, particle size, powder morphology) were reported elsewhere /1/". The document referenced /1/ in D21 however has not been provided by the respondents.

Concerning the disclosure in D21, on the one hand under the heading "Results Sintering Behavior, Microstructure and Electrical Properties" that "TZP retains a fine grain structure even at high firing temperatures" (TZP means *tetragonal stabilized zirconia*) and, on the other hand in Tables 1 and 2, that the Unitec bulk material used for preparing the zirconia sheet with a Weibull modulus of 13 has a grain size of  $< 1 \mu\text{m}$  after sintering at  $1550^{\circ}\text{C}$  for 1 hour, this disclosure does not permit to conclude directly and unambiguously that a zirconia powder falling under the terms of claim 1 at issue had been used for preparing the zirconia ceramics sheet disclosed in D21 as having a Weibull modulus of 13.

- 5.3 Since according to established jurisprudence of the Boards of Appeal, each party to proceedings before the EPO carries the burden of proof for the facts it alleges, in the present case the respondents had the burden to provide the necessary evidence for the allegation that a Weibull modulus of 13 would only be



- obtained with powders having a distribution falling under the terms of claim 1 at issue. In the absence of any evidence in this respect, the board cannot accept the argument that the feature was implicit.
- 5.4 Concerning the other documents, in particular D1 and D10, which had been considered as novelty-destroying by the opposition division, none of them discloses in combination all the features of claim 1 at issue. The latter having furthermore been restricted from the subject-matter of the claims underlying the contested decision in particular in that the ceramic now claimed is in the form of a "sheet" and in that said sheet has "a Weibull modulus (m) of higher than 10", the board observes that none of these restrictive features is disclosed either in document D1 or in document D10.
- 5.5 For the above reasons, the subject-matter of claim 1 (and of claims 2 to 8, which all depend on claim 1) is novel over the cited state of the art documents. Claims 1 to 8 therefore meet the requirements of Article 54(1) and (2) EPC.
6. *First auxiliary request - Inventive step*
- 6.1 The contested patent concerns a zirconia powder having uniform quality and being suitable for producing a zirconia ceramics with high reliability, its method for production and a zirconia ceramics having uniform quality and high reliability produced by using the zirconia powder. The subject-matter of claim 1 at issue relates to the zirconia ceramics in the form of a sheet for an electrolyte film for solid oxide fuel cells.

- 6.2 Concerning the choice of the closest state of the art, the parties considered that the assessment of the inventive step could be started from either of documents D1, D10, D21 or D24.
- 6.2.1 Document D1 discloses zirconia powders made by UNITEC CERAMICS and their distribution curves. The technical data sheet for UNITEC PSZ-Y8 (partially stabilised zirconia with 8 wt.%  $Y_2O_3$ ), which according to respondent I is part of document D1, discloses a powder denoted "-2  $\mu m$ " having an average particle diameter  $d_{50}$  of 0.65  $\mu m$  and 95% of the particles of which had a particle size of 1.5  $\mu m$  or less, i.e. a  $d_{95}$  value of 1.5  $\mu m$  or less.
- 6.2.2 Document D10 - which was supposed to give evidence for a prior use of a zirconia powder falling under the terms of the powder used as raw material in claim 1 at issue - discloses three different batches (#UCZ576; #UCZ580; #UCZ573) of zirconia powders having the specifications of the powder defined in claim 1 at issue and having been shipped on 10 January 1997 by respondent I to respondent III.
- 6.2.3 D21 and D24 both disclose - as indicated in items 5.1 and 5.2 - zirconia ceramics sheets for use as electrolyte for solid oxide fuel cells (SOFC), said sheets having a Weibull modulus of 13 and having been prepared from zirconia powders manufactured by Unitec.
- 6.2.4 The board observes that according to established jurisprudence of the boards of appeal, the closest state of the art is supposed to disclose subject-matter aiming at the same objectives as the claimed invention

and having the most relevant technical features in common, i.e. requiring the minimum of structural modifications.

6.2.5 In the present case, neither D1 nor D10 discloses the use of zirconia powders for the production of zirconia ceramics sheets, nor the use of such sheets as an electrolyte film for solid oxide fuel cells.

6.2.6 So, since D21 and D24 are the sole documents aiming at the same objective as the subject-matter defined in claim 1 - namely the provision of a zirconia ceramics sheet for an electrolyte film for solid oxide fuel cells - the closest state of the art is to be chosen among these documents.

D24 is silent as to the particle size of the zirconia used.

D21 discloses - see also item 5.2 - that the Unitec bulk material used for preparing the zirconia sheet with a Weibull modulus of 13 had a grain size after sintering at 1550°C for 1 hour of < 1 µm.

So, according to the board, document D21 has the most relevant technical features in common and requires the minimum of structural modifications for arriving at the subject-matter defined in claim 1 at issue.

6.3 The problem underlying the patent in suit in the light of document D21 is to provide a zirconia ceramic sheet having a uniform mechanical strength and which could be manufactured with high reliability without warping or waviness.

This problem is in line with the objective disclosed at paragraphs [0006] and [0009] of the patent in suit and with the problem as established by the appellant at the oral proceedings.

- 6.4 As a solution to this problem, the patent in suit proposes the zirconia ceramic sheet according to claim 1 which has a Weibull modulus ( $m$ ) higher than 10 and is characterised in that it is produced by using a zirconia powder as a raw material in which particles of 90 volume percent of the zirconia powder have a diameter of 1.5  $\mu\text{m}$  or smaller that falls within the range of 1.5 to 2.0 times larger than an average particle diameter of the zirconia powder ranging from larger than 0.5  $\mu\text{m}$  to 0.8  $\mu\text{m}$ .
- 6.5 The respondents did not contest that the problem identified under item 6.3 had effectively been solved; and the examples in the contested patent confirm that ceramic zirconia sheets produced by using a zirconia powder having the specifications defined in claim 1 at issue have a Weibull modulus ( $m$ ) of 11 (see table IV).
- 6.6 As regards the question whether the above proposed solution is obvious or not in view of the state of the art, the board comes to the following conclusions:
- 6.6.1 Since neither D1 nor D10 discloses the use of zirconia powders for the production of zirconia ceramic sheets, nor that such sheets might be used as an electrolyte film for solid oxide fuel cells, the skilled person faced with the problem identified in item 6.3 has no reason to take into consideration the zirconia powders

disclosed in these documents in order to solve his problem.

6.6.2 As neither D24 nor the further documents cited in these proceedings disclose that a zirconia powder falling under the terms of the powder defined in claim 1 at issue would permit the manufacturing with high reliability of a zirconia sheet with a uniform mechanical strength and without warping or waviness, the skilled person has also no reason to take into consideration these documents in order to solve the problem identified in item 6.3.

6.6.3 Concerning the respondents' argument that the skilled person aware of the disclosure of document D21 (that the powders used in the production of the zirconia sheet with a Weibull modulus (m) of 13 were from Unitec, also respondent I in these proceedings) would phone Mr Evans (technical expert of respondent I) and ask him to purchase a zirconia powder with which it would be possible to manufacture a zirconia sheet having a Weibull modulus (m) of 13, the board observes that Mr Evans cannot be considered as being state of the art according to Article 54(2) EPC. Furthermore, there is no evidence that Mr Evans was aware at the priority date of the contested patent that powders fulfilling the criteria set in claim 1 at issue were able to solve the problem indicated in item 6.3 above.

6.6.4 It follows from the above reasoning that, having regard to the state of the art, the subject-matter of claim 1 at issue cannot be considered as obvious to a person skilled in the art and therefore it involves an inventive step within the meaning of Article 56 EPC.

Claims 2 to 8, which represent particular embodiments of independent claim 1, derive their patentability from claim 1 on which they 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 first auxiliary request filed during the oral proceedings and a description to be adapted.

The Registrar:

The Chairman:

C. Vodz

G. Rath