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Datasheet for the decision of 27 June 2013

Case Number: T 0349/11 - 3.2.08

Application Number: 97909591.6

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Language of the proceedings: EN

Title of invention:
Process for preparing polycrystalline thin film, process for preparing oxide superconductor, and apparatus therefore

Patent Proprietor:
Fujikura, Ltd.

Opponent:
Bruker HTS GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2), 84, 100(c)
RPBA Art. 13(3)

Keyword:
"Late filed submissions under Art. 123(2), 84 (not admitted)"
"Novelty and inventive step main request (yes)"

Decisions cited:
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Catchword:
-

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Case Number: T 0349/11 - 3.2.08

D E C I S I O N
of the Technical Board of Appeal 3.2.08
of 27 June 2013

Appellant: (Opponent)
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 7 December 2010 concerning maintenance of the European patent No. 872579 in amended form.

Composition of the Board:

Chairman: T. Kriner
Members: R. Ries
D. T. Keeling

Summary of Facts and Submissions

I. By its interlocutory decision dispatched on 7 December 2010, the opposition division held that the subject matter of the claims according to the first auxiliary request then on file met the requirements of the EPC and that the patent could be maintained in amended form on the basis of this request.

II. The appellant (opponent) lodged an appeal against this decision on 11 February 2011, paying the appeal fee on the same date. The statement setting out the grounds of appeal was filed on 12 April 2011.

III. On appeal, the parties essentially referred to the following documents:

D1: J. Wiesmann et al.: "Biaxially textured YSZ and CeO_2 buffer layers on technical substrates for large-current HTS-applications"; Applied Superconductivity 1995, Proceedings of EUCAS 1995, the second European Conference on Applied Superconductivity, held in Edinburgh, Scotland, 3-6 July 1995, Volume 1, Institute of Physics Conference Series No 148, ISBN 0 7503 0370 0, pages 503 to 506; and

D5: Patent Abstracts of Japan, Publication number 08250773 A

IV. Oral proceedings took place before the Board on 27 June 2013. The following requests were made:

– The appellant requested that the decision under appeal be set aside and the European patent No. 872579 be revoked.

– The respondent (patent proprietor) requested that the appeal be dismissed (main request) or that the patent be maintained on the basis of the auxiliary requests 1 to 7, all filed with letter of 27 May 2013.

V. Claim 1 of the main request reads as follows:

"A method of making a polycrystalline thin film (B) on a metal substrate base (A), said polycrystalline thin film (B) being comprised of a plurality of grains (20) of a cubic crystal structure defined by a-, b- and c-axes, said polycrystalline thin film (B) being formed such that the intergranular misorientation, defined by a range of orientation of said a-axes or said b-axes, is less than 35 degrees, and said c-axes are perpendicular to a surface of said metal substrate base (A), comprising the step of depositing the particles emitted from a target material on a metal substrate base (A) so as to form said polycrystalline thin film (B); wherein the surface of said polycrystalline thin film (B) being formed on said metal substrate base (A) is irradiated with an ion beam at an angle of incidence in a range of 50 to 60 degrees to a normal (H) to a film surface,
characterized in that the metal substrate base (A) is cooled by a cooling device through the base holder and maintained at a temperature within the range of from

-150 degree C to less than + 100°C degree C, and the polycrystalline thin film (B) is chosen from yttrium stabilized zirconia, CeO_2, MgO, and $SrTiO_3$."

VI. The arguments of the appellant relevant to the present decision can be summarized as follows:

Clarity; Article 84 EPC; original disclosure Article 123(2) EPC;

Method claim 1 as upheld by the opposition division (main request) required that "active" cooling through the base holder was performed in order to keep the metal substrate base within a temperature ranging from -150°C to +100°C. However, holding the substrate base at +100°C was only disclosed in combination with the step of keeping the base holder at room temperature, i.e. without any "active" auxiliary heating or cooling, as described in the patent specification in paragraphs [0022], [0028] and [0041]. This embodiment (100°C, no cooling) was shown in the example depicted in Figure 8 of the patent specification. According to the respondent's explanations in its letter of 27 May 2013, page 4, third paragraph, this example was no longer encompassed by the scope of claim 1. Hence, a gap existed between +100°C and 0°C, a range in which no cooling was carried out. The patent specification was therefore unclear and contradictory to present claim 1 which, in addition thereto, had no support in the description. The patent as upheld by the opposition division therefore did not meet the requirements of Articles 84 and 123(2) EPC.

The objections raised under Articles 84 and 123(2) EPC came up as a reaction to the respondent's arguments submitted in its letter of 27 May 2013. For this reason, they were presented for the first time at the oral proceedings before the Board.

Novelty; Article 100(a) EPC

The feature of maintaining the metal base substrate at a temperature ranging from -150°C to less than +100°C was disclosed in document D1, page 504, point 3. Results: "The YSZ (Yttria Stabilized Zirconia) layers grown by this IBAD (Ion Beam Assisted Deposition) deposition technique reveal a (100) texture with a FWHM (in plane alignment with half widths) of the rocking-curve of about 6° for deposition temperatures lower than 100°C." Accordingly, the requirement of keeping the deposition temperature, which corresponded to the base temperature of the substrate, below 100°C was assessed in D1 as being a relevant means for achieving the desired texture in the YSZ layers.

It could be duly assumed that in the known process the heat transferred by the ion source to the base substrate was removed by the substrate holder and via its attachment to the wall of the vacuum chamber of the IBAD apparatus. Hence, according to D1, the base substrate was cooled via the thermal bridge between the substrate holder and the wall of the vacuum chamber. Consequently, the feature set out in claim 1 of cooling the base substrate by a cooling device through the base holder was inherently disclosed in document D1.

Hence, the subject matter of claim 1 lacked novelty.

Inventive step

Even if novelty was accepted, the subject matter of claim 1 did not involve an inventive step. As disclosed in D1, cooling the substrate holder was a necessary step to achieve the desired fine structure. To solve the problem of providing effective cooling of the substrate in order to keep the deposition temperature below 100°C, the skilled person would turn to D5. This document disclosed cooling of a substrate and the thin film on it through a cooling copper block serving as a substrate holder in a vacuum chamber e.g. by helium gas evaporated from liquid helium.

VII. The arguments of the respondent relevant to the present decision can be summarized as follows:

Objections under Articles 123(2); 84 EPC

None of he appellant's objections under Articles 123(2) and 84 EPC were presented in the grounds of appeal or in a further letter. The patentee was highly surprised to be confronted with these objections for the first time during the oral proceedings. Besides, the feature of cooling the substrate base to a temperature ranging from -150°C to less than +100°C was already present in claim 1 as granted and it was never objected to under Articles 84 and 123(3) EPC before. It was therefore requested that the objections under Articles 123(2) and 84 EPC be disregarded by the Board.

Novelty; Article 100(a) EPC

Document D1 mentioned water-cooling of the target but it disclosed neither cooling the substrate nor cooling the substrate holder. D1 only described that the deposition temperature was lower than 100°C. The subject matter claim 1 was therefore novel over D1.

Inventive step; Article 100(a) EPC

Starting from document D1 as the closest prior art, the problem to be solved by the patent was how to improve significantly the grain alignment in the polycrystalline thin film. The solution to this problem was cooling the substrate base through the substrate base holder to a temperature range between -150°C and +100°C, as shown in the examples. D1 did not describe that a relationship existed between the deposition temperature for the thin film and the grain orientation and neither did D5.

The subject matter of claim 1 therefore also involved an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. Objections under Articles 123(2); 84 EPC

In the opposition proceedings, the patent was objected to on the ground of opposition under Article 100(c) EPC (or 123(2) EPC, respectively). During the oral

proceedings before the opposition division, however, the appellant (opponent) withdrew this ground of opposition (see decision of the opposition division, points 2.1 and 11.2).

Having regard to this situation and to the fact that the appellant submitted its objections under Article 123(2) and 84 EPC at a very late stage at the oral proceedings before the Board rather than raising them in advance together with its statement of grounds of appeal or in a further letter the respondent was taken by surprise during the oral proceedings, when it was confronted with new objections. Admitting the newly raised objections would have required that the respondent be given adequate time and opportunity to react and comment on the opposing submissions. That would have necessitated interrupting the oral proceedings for a lengthy period of time or even adjourning them, if requested by the respondent. Acting in that way would certainly have contravened the requirement of procedural economy.

In view of these considerations and in application of Article 13(3) of the Rule of Procedure of Boards of Appeal (RPBA), the appellant's late introduced objections raised under Articles 123(2) and 84 EPC are disregarded and not admitted into the proceedings.

3. Novelty

Like the patent in issue, document D1 discloses a process of making a polycrystalline thin film (YSZ and CeO_2 buffer layers) being formed such that the intergranular misorientation is less than 35 degrees

or, as expressed in D1 that an in-plane alignment with half width (FWHM)) below 35° or 30° can be obtained; (D1, page 503, Synopsis; page 505, first paragraph, lines 9 to 12; Table 1). As in the claimed method, the angle between the ion beam and the substrate normal is fixed at 55°C and the deposition temperature is lower than 100°C (D1, page 504, line 9; point 3, Results).

However, document D1 does not disclose clearly and unambiguously that the metal substrate base is cooled by a cooling device through the substrate holder. D1 only mentions that the deposition temperature in the IBAD process was lower than 100°C without giving any further explanations as to how this temperature level is achieved (D1, page 504, point 3. Results). Whether there is actually a heat transfer - and therefore a cooling effect on the substrate holder - via a thermal bridge between the substrate holder and the wall of the vacuum chamber, as assumed by the appellant, or not is speculative.

Consequently, the subject matter of claim 1 is novel over the disclosure of document D1.

4. Inventive step

Starting from the technical disclosure of document D1 as the closest prior art, the problem underlying the patent at issue resides in providing a method for making a highly oriented polycrystalline substrate base and then forming an oxide superconductor of controlled crystal orientation on the substrate base, so that not only the c-axes of the polycrystals are oriented at right angles to the film surface but the a- and b-axes

are also well aligned in a horizontal direction parallel to the film surface and that the planar alignment angle K is less than 35° (the patent specification, paragraph [0009]).

The solution to this problem is achieved in particular by controlling the deposition temperature within the claimed temperature range. To this end, the metal substrate base (A) is cooled by a cooling device through the base holder. As defined in claim 1 of the main request, the superior grain alignment is achieved when the polycrystalline thin film B is formed at a deposition temperature below +100°C to -150°C (see also the patent (the patent specification, paragraph [0039], lines 29 to 31; [0043]; page 10, Table in lines 30 to 40).

When carrying out the claimed process in that way, the a-axes or b-axes in one grain and the a-axes or b-axes in its neighbouring grain are oriented to each other at an angle of less than 35° expressed by the planar alignment angle K. This angle K can be controlled by adjusting the film deposition temperature within the claimed temperature range (the patent specification, paragraphs [0013]; [0020]; [0031], lines 5 and 6; [0039], lines 10, 11). Specifically it has been found in the patent that the lower the base temperature, the better is the grain alignment in the film B.

This teaching was not available in the prior art D1 and D5. In particular, the problem of controlling the planar alignment angle K is not addressed in either of documents D1 or D5.

In the case of D1, the skilled reader is only taught that the deposition temperature was lower than 100°C and that on all used substrate materials an in-plane alignment (FWHM) below 35° could be obtained (D1, page 505, lines 9, 10). Furthermore, D1 teaches that a reduction of the surface roughness of the substrates significantly improves the in-plane texture (D1, page 506, 4. Discussion and conclusion, lines 4 to 6).

Document D5 is concerned with controlling the critical temperature of a superconducting thin film by a cooling device without mentioning the grain alignment problem. Hence D5 is further from giving any suggestion towards the problem solved by the present patent and, contrary to the appellant's view, there is no reason to transfer this disclosure to the teaching of D1.

Therefore, since the problem addressed by the patent in issue is not realised in either of documents D1 and D5 and any combination thereof is not obvious, the subject matter of claim 1 is considered to involve an inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

V. Commare T. Kriner