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D E C I S I O N
of 21 October 1998

Case Number: T 0348/94 - 3.2.2

Application Number: 88105180.9

Publication Number: 0285999

IPC: C23C 14/08

Language of the proceedings: EN

Title of invention:
A production method of superconductive thin film and a device thereof

Patentee:
Sumitomo Electric Industries Limited

Opponent:
Siemens AG

Headword:
-

Relevant legal provisions:
EPC Art. 56, 104

Keyword:
"Inventive step - after amendment (yes)"
"Publication of conference proceedings after the priority date"
"Apportionment of costs (no)"

Decisions cited:
T 0323/89, T 0086/95

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0348/94 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 21 October 1998

Appellant I: (Opponent)
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Representative:

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Decision under appeal: Interlocutory decision of the Opposition Division of the European Patent Office posted 15 March 1994 concerning maintenance of European patent No. 0 285 999 in amended form.

Composition of the Board:

Chairman: W. D. Weiß
Members: R. Ries
J. C. M. De Preter

Summary of Facts and Submissions

I. European patent No. 0 285 999 was granted with effect from 7 August 91 on the basis of the European patent application No. 88 105 180.9 claiming a priority date of 31 March 1987.

II. An opposition was filed against the grant of the patent on the grounds of lack of inventive step (Articles 100(a), 52 and 56 EPC).

III. In the interlocutory decision dated 15 March 1994, the opposition division held that the grounds of opposition mentioned in the Article 100(a) did not prejudice the maintenance of the patent as amended according to the second auxiliary request filed at the oral proceedings on 1 February 1994.

During the opposition procedure, the following documents were taken into consideration:

(a) "Institute of Physics, Conference Series", (Inst. Phys. Conf. Ser.) No. 38, 1978, Chapter 5, pages 229-235

(b) DE-C-28 13 250

(c) DE-A-28 05 247

(d) Thin solid films, vol. 39, 1976, pages 207-217

(e) Journal of Vacuum Science and Technology, vol. 12, No. 6, Nov/Dec 1975, pages 1128-1134

(f) IEEE Transactions on Magnetics, vol. MAG-11, No. 2, March 1975, pages 201-207

(g) DE-C-30 27 572

(h) Physical Review Letters, vol. 58, No. 9, 2 March 1987, pages 908-910

(i) Science, vol. 235, No. 4796, 27 March 1987, page 1571

(j) Nature, vol. 325, 26 February 1987, page 756

(k) Thin Solid Films, vol. 30, 1975, pages 377-381

(l) US-A-3 655 429

IV. An appeal against this decision was lodged on 20 April 1994 by the opponent SIEMENS (in the following called appellant I) and on 11 May 1994 by the patentee SUMITOMO ELECTRIC INDUSTRIES LIMITED (in the following called appellant II).

Enclosed with its grounds of appeal filed on 23 June 1994, the opponent submitted a further document

(m) High Tech Ceramics, Proceedings of the World Congress on High Tech Ceramics, the 6th International Meeting on Modern Ceramics Technologies, (6th CIMTEC), Milan, Italy, 24-28 June 1986, Part B; Materials Science Monographs 38B, edited by P. Vincenzini, Elsevier, 1 April 1987, pages 1421-1428.

In a communication dated 9 June 1998, the Board informed the parties that document (m) could only be considered as being state of the art, if the opponent could prove that document (m) actually was published before the priority date of the patent at issue.

Enclosed with its response of 21 September 1998 to the official communication, the patentee submitted an information letter of Elsevier Science Publishers confirming that document (m) was published on 1 April 1987.

This publication date corresponds with the information given by Elsevier Science Publishers Amsterdam on enquiry of the library of the EPO about the exact publication date of document (m).

V. Oral proceedings took place on 21 October 1998. At the oral proceedings, the Board handed over a copy of the publisher's response about the publication date of document (m) to the opponent.

VI. Appellant I (the opponent) requests that the decision under appeal be set aside and that the patent be revoked in its entirety.

Appellant II (the patentee) requests that the appeal of the opponent be dismissed and the patent maintained on the basis of amended claims 1 to 5 and a description adapted thereto submitted as main request during the oral proceedings. Appellant II also requests that the opponent be burdened with at least a part of the costs of the patentee incurred by the late filing of document (m).

VII. The independent claims 1 and 5 read as follows:

"1. A method for producing a superconductive thin film including Ba and/or homologue elements, Y and/or homologue elements, and Cu as metal components on a substrate, comprising:
- providing heating crucibles in a vacuum vessel with

.../...

substantially pure metal component elements Ba and/or homologue elements, Y and/or homologue elements, and Cu;
- maintaining the vacuum vessel at a pressure of 1.3 Pa (10^{-2} torr) or less;
- heating the metals in the crucibles so that streams of evaporated metal are spouted from the crucibles as cluster beams;
- ionizing the streams of evaporated metal with electron beams to form at least partially ionized metallic streams;
- accelerating the ionized streams through electric fields so as to impinge onto the substrate while supplying oxygen gas to the ionized streams with a nozzle assembly provided in front of the holding portion for holding the substrate to spout the oxygen toward the substrate; and
- controlling the heating of the crucibles so that the respective amounts of metallic vapor deposition are made in a predetermined mole ratio."

"5. A device for producing superconductive thin film on a substrate in accordance with the method as defined in one of the claims 1 to 4, comprising;
(A) a vacuum vessel having an internal pressure maintained at least lower than 1.3 Pa (10^{-2} torr), provided with
-(a) closed type crucibles including heating devices and at least one discharge opening, the crucibles being provided with substantially pure individual metal components of the superconductive thin film to be made,
-(b) thermionic beam generators for ionizing evaporated metallic elements spouted as cluster beams from the discharge tubes of each of said crucibles,
-(c) accelerating plates for accelerating said ionized cluster beams,

-(d) a nozzle assembly for supplying oxygen gas to the ionized evaporation metallic beam, provided in front of a holding portion for holding a substrate, to spout the oxygen toward the substrate,
-(e) holding means for holding the substrate onto which the superconductive thin film is deposited, and
(B) means for controlling the heating of the crucibles so that the respective amounts of metallic vapor deposition are made in a predetermined mole ratio."

VIII. Appellant I (the opponent) argued as follows:

- Although the publication date 1 April 1987 of document (m) is accepted to be beyond dispute, this document truly reports the lecture presented on the conference in June 1986. Such oral description is, according to the EPC, held to be state of the art. Based on the experience of life, in general no distinction exists between the lecture read to the audience at a conference and the written proceedings of the conference published thereafter on a later date. This is confirmed by the Guidelines for Substantive Examination of the EPO, Part C-IV-5.2, according to which substantive examination should start with the assumption that a document such as conference proceedings gives a true account of the earlier lecture. The earlier event (oral disclosure at the conference) should, therefore, be regarded as forming part of the "state of the art", unless there are sound reasons for contesting the truth of the account given in the document. No such "sound reasons" are, however, discernable in the present case.

- Without taking into account the teaching of document (m), no state of the art showing how to produce thin films of the BaYCu superconductor material was available to the expert on the priority date of the opposed patent. Such a technique for depositing thin films had to satisfy the following requirements:

  - four components must be provided simultaneously,

  - specific stoichiometric ratios must be adhered to,

  - the material must be deposited in a well ordered form, generally known as "epitaxy" (cf. document (j), left hand column, lines 11 to 13 from the bottom).

Given this situation, the person skilled in the art would take into consideration all processes which allow epitaxial thin film deposition of a substance. One of the promising techniques enabling epitaxial deposition of thin films of elemental and compound materials is the Ionized-Cluster Beam Deposition method (**ICBD**) disclosed for example in document (e), (cf. page 1128, right hand column, last paragraph) or in document (g) disclosing the deposition of beryllium oxide films on a substrate by the ICBD technique. Once the skilled person has found the appropriate technique, he will, without inventive thinking, further adapt the method and/or apparatus with particular respect to the results aimed at, e.g. in the present case by providing the nozzle assembly for spouting oxygen in front of the substrate rather than above the crucible as shown in

Figure 1 of document (g). In conclusion, the subject matter of claims 1 and 5 lacks an inventive step with respect to the teaching of documents (j) and (e) or (j) and (g).

IX. Appellant II (the patentee) argued as follows:

- Referring to document (m), the opponent has not shown that the technical information presented at the conference in Milan in fact was identical with the content of document (m). Therefore, document (m) cannot be considered to belong to the state of the art.

- The closest prior art is represented by those documents which deal with the production of superconductive material of the claimed type. These are documents (j), (i), (h) and (f), with document (j) being the closest state of the art which, however, all fail to disclose a process for producing thin films.

- The common denominator of documents (a) to (e) and (g) is that they are all concerned with the ICBD technique for producing thin films of semiconductor material, insulators, or oxides of simple structure. No indication whatsoever is found in these documents to afford a skilled person a prospective that the ICBD technique could be used to advantage for producing thin films of superconductive BaY-cuprate of the type claimed in the disputed patent. Hence, the subject matter of claims 1 and 5 involves an inventive step.

X. At the conclusion of the oral proceedings, the Board's decision was announced.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

The subject matter of present claim 1 is based on claims 1 and 2, in combination with column 2, lines 9/10 and column 4, lines 24 to 27 of the patent as granted. It is also supported by claims 1 and 2 in combination with page 3, lines 3/4 and page 7, lines 13 to 15 of the application as filed.

Present claims 2 to 4 are identical with the respective claims 4 to 6 of the patent as granted and the originally filed patent application.

Present claim 5 corresponds to claim 7 in combination with column 2, lines 9/10 and column 4, lines 24 to 27 of the patent as granted, and claim 6 in combination with page 3, lines 3/4 and page 7, lines 13 to 15 of the originally filed application.

By the feature "to spout the oxygen toward the substrate", present claims 1 and 5 also define the direction in which the nozzle assembly is arranged.

The description has been suitably adapted to the wording of the amended claims.

Thus, having regard to the limitations of independent claims 1 and 5, all claims of the new set of claims comply with the requirements of Articles 123 and 84 EPC.

3. *The prior art*

3.1 It has not been contested that the European application as filed is entitled to claim the priority of the JP priority document of 31 March 1987. Therefore, this is the decisive date for judging whether a public disclosure is to be regarded as prior art or not. Thus in this decision "prior art" refers to documents made available to the public before the priority date of 31 March 1987.

The opponent, in its grounds of appeal, referred to a further document (m), which however, was published on 1 April 1987, i.e. one day after the priority date of the patent at issue. This publication date was confirmed by the publisher independently to the Board and to the patentee and is, therefore, beyond dispute.

3.2 Contrary to the opponent's allegation, it has not been proven beyond any reasonable doubt that the technical contents of the lecture orally presented on the conference actually corresponded in all details to the respective article published 10 month later in the conference proceedings. Unless there is proof to the contrary, a written publication which is supposed to be based on a paper previously read at a public meeting held some time earlier, cannot be assumed to be identical to what was orally disclosed but may contain additional information (see in this context decision T 86/95 point 3 of the reasons). As to the extent of the oral disclosure of the 1986 conference, the burden of prove remains on the opponent. Given that the opponent has not produced any evidence appropriate to overcome these doubts, document (m) does not form state of the art and is, therefore, disregarded.

4. *Novelty*

The subject matter of claims 1 and 5 is novel, because none of the documents under consideration discloses a process or apparatus for producing thin films of the claimed superconductive material. This issue not being in dispute, it is not necessary to give detailed reasons for this finding.

5. *Inventive step*

5.1 The closest state of the art

Documents (h), (i) and (j) are concerned with high-temperature superconductive materials of the type claimed in the disputed patent. More specifically, documents (h) and (i) address a Y-Ba-Cu-O compound superconductive material, but only in document (i), right hand column, second paragraph, the fabrication of 400 nanometre thick superconductive films of Y-Ba-Cu-O material is reported, however, without providing any details for what may be a commercially important fabrication process to produce these films. Hence, document (i) is regarded to be closest prior art.

5.2 The problem to be solved

Starting from this prior art, the problem underlying the opposed patent is, therefore, seen in providing a method and an apparatus for producing a superconductive thin film of the above mentioned material, said film exhibiting good crystallization and adhesion to the substrate.

The solution to this problem consists in the use of the ICBD technique whereby oxygen is spouted toward the substrate and to the ion cluster beams through a nozzle assembly positioned in front of the holding portion for holding the substrate.

5.3 Document (i) is silent about how to produce the superconductive film. It does not even contain any hint to select preferably the ICBD technique from all the other thin film deposition processes known in the art. The prior documents concerned with the ICBD technique describe either the production of films of essentially oxygen free material like metals, semiconductors, isolators etc. (cf. documents (a) to (e)) or the deposition of a stoichiometric beryllium oxide film (cf. document (g)). Therefore, it could not be expected that the ICBD technique would be adaptable to produce films of substoichiometric compounds of the Ba-Y-Cu-O system comprising variable amounts of oxygen. Even if a known ICBD technique actually was chosen, the oxygen nozzle would not yet be in the position as defined by the independent claims. The oxygen supply to the metal vapour in forms of a nozzle disclosed in Figure 1 of document (g) is arranged between the crucible lid opening (2) and the electron emitter or the electron acceleration unit (6)-(9). Contrary to document (g), the claimed process and apparatus set out in claims 1 and 5, respectively, provides an oxygen nozzle assembly in front of the substrate to spout oxygen towards the substrate. It is noted in this context, that - according to the normal understanding of the English language - the term in front of means "close to the front part of something or ahead of it, with nothing in between". Hence, the nozzle arrangement claimed in the patent in suit is clearly distinguished from that shown in document (g).

In its grounds of appeal, the patentee has submitted additional test results, showing that, in the important aspect of the critical temperature T_c, the distance of the nozzle from the substrate proves to have an essential influence. The opponent has not contested the validity of these experimental results submitted by the patentee. It is, therefore, concluded that the position of the oxygen nozzle has been chosen deliberately rather than arbitrarily.

Consequently, the subject matter of claim 1 involves an inventive step. Claims 2 to 4 relate to preferred embodiments of the method defined in claim 1 and are, therefore, also allowable.

The same is true for the apparatus defined in claim 5 which recites all the technical features set out in process claim 1.

6. Apportionment of costs

In its submissions dated 11 November 1994, the patentee requested, in accordance with Article 104 EPC, that the opponent be burdened with at least a part of the costs of the patentee, because the opponent had not given any indication why document (m) was cited for the first time in the grounds of appeal, i.e. long after the expiry of the opposition period. In this context, the patentee pointed to the case T 323/89, in which, during the appeal proceedings, the appellant produced evidence to prove a public prior use by himself, but thereafter withdrew his appeal.

According to Article 104 EPC, each party shall meet the costs it has incurred, unless, for reasons of equity, a different apportionment of costs is appropriate. According to the established case law of the Boards of Appeal (see Case Law of the Boards of Appeal of the European Patent Office, 1996, page 307, 10.3) an apportionment of costs is generally justified if the conduct of one party is not keeping with the care required, that is, if costs arise from culpable actions of an irresponsible or even malicious nature. However, no such culpable action can be recognized in the present case. The opponent cited the additional document in immediate reaction to the arguments of the decision under appeal. The mere fact that the additionally found document(s), pertinent or not, have been submitted late is no basis for concluding that the party has culpably behaved. Any similarity to the case T 323/89 in which the opposition was withdrawn after the late citation of own prior use is not visible. Given this situation, the request for a different apportionment of costs was to be refused.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form with the following documents:

   - claims 1 to 5 filed as main request during the oral proceedings of 21 October 1998;

   - description columns 1 to 5 filed during the oral proceedings of 21 October 1998;

   - Figure 1 as granted;

3. The request for apportionment of costs is rejected.

The Registrar:

S. Fabiani

The Chairman:

W. D. Weiß