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D E C I S I O N
of 25 August 1999

Case Number: T 0215/95 - 3.4.1

Application Number: 88302733.6

Publication Number: 0284438

IPC: H011 39/12

Language of the proceedings: EN

Title of invention:

Superconducting materials and methods of manufacturing the same

Applicant:

Semiconductor Energy Laboratory Co., Ltd.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 52(1), 83, 123(2), 84, 54, 56

Keyword:

-

Decisions cited:

-

Catchword:

-



Case Number: T 0215/95 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 25 August 1999

Appellant: Semiconductor Energy Laboratory Co., Ltd.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 10 October 1994
refusing European patent application
No. 88 302 733.6 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: G. Davies
Members: G. Assi
U. G. O. Himmler

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal, received on 20 December 1994, against the decision of the Examining Division, dispatched on 10 October 1994, refusing the European patent application No. 88 302 733.6 (EP-A-0 284 438). The fee for the appeal was paid on 20 December 1994. The statement setting out the grounds of appeal was received on 20 February 1995.

In its decision, the Examining Division held that

- (i) the subject-matter of claims 1 to 19 could not be considered as an invention (Article 52(1) EPC),
- (ii) the subject-matter of claims 1 to 19 did not involve an inventive step (Article 52(1) and 56 EPC),
- (iii) the application had not been disclosed in a manner sufficiently clear and complete for it to be carried out by a skilled person (Article 83 EPC).

Moreover, "for the sake of completeness", the Examining Division also raised an objection of lack of clarity (Article 84) against claims 1 to 19.

The following documents were cited in the decision under appeal:

- (D1) Physics Today, April 1988, pages 21-25,

- (D2) Zeitschrift für Physik B - Condensed Matter, Vol. 66., No. 2, 10 March 1987, pages 141-146 (The publication date is hand-written at the top of page 141. This date is not contested by the appellant.),
- (D3) Physical Review Letters, Vol. 58, No. 9, 2 March 1987, pages 908-910,
- (D4) World Congress on Superconductivity, Proceedings of the third International Conference and Exhibition, 15-18 September 1992, Munich, DE, Part I, pages 607-625, and
- (D5) Applied Physics Letters, Vol. 51, No. 8, 24 August 1987, pages 622-624.

The following documents were cited by the appellant in the statement setting out the grounds of appeal:

- (D6) Bull. Korean Chem. Soc., Vol. 13, No. 4, 1992, pages 425-428, and
- (D7) Physika C 195, 1992, pages 177-184.

II. At the oral proceedings before the Examining Division held on 26 July 1994, the appellant filed an affidavit, dated 25 July 1994, signed by the inventor of the present application.

III. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the following application documents:

Claims: Nos. 1 to 11 as filed with the letter of

2 March 1999,

Description: Pages 1,5 to 15 as originally filed,
Page 2 as filed with the
letter of 4 January 1994,
Pages 3,4 as filed with the
letter of 2 March 1999,

Drawings: Sheet 1/1 as filed with the letter of
29 April 1988.

Moreover, as an auxiliary request, the appellant
requested oral proceedings.

IV. The wording of claim 1 reads as follows:

"A process for producing a copper oxide superconducting material having a critical temperature T_{c0} of 77°K or greater, said process comprising selecting raw materials of a purity of 99.99% or higher for forming said copper oxide superconducting material, washing said materials in very high purity water, and thereafter processing the washed materials to form the copper oxide superconducting material under conditions such as to limit contamination thereof with alkali metal impurities to no more than 0.2% by weight."

Claim 11 refers to "a superconducting composition formed by the process of any preceding claim."

Claims 2 to 10 depend on claim 1.

V. The appellant argued essentially as follows:

As to the objection under Article 52(1):

the Examining Division took the position that doubts existed as to the capability of the invention to achieve the technical effect described in the application. Its position was based on the argument that, if the invention produced the effect mentioned, then it would have been reported in the technical literature. The Examining Division's justification of its position was contrived and illogical and resulted more from prejudice than from scientific facts. The Examining Division had no means at its disposal to establish any valid technical grounds for disputing the credibility of the invention, and should give the benefit of any doubt to the applicant. Moreover, contrary to the Examining Division's opinion, the burden of proof could not be shifted to the applicant.

As to the objection under Article 83:

an inconsistency existed between the Article 83 EPC objection and the Article 56 EPC objection. The Examining Division did not believe that the invention was capable of achieving such high T_{c0} levels as reported in the application. This argument was unconvincing. The present application included an object statement which was to achieve a T_{c0} of 77K or greater as well as examples which clearly were stated to achieve this object. In the documents cited, clear indications that T_{c0} levels above 77K, and indeed above 100K, were considered to be possible. The Examining Division requested proof of the increase in T_c and T_{c0} reported in the application. However, it was not empowered to demand such proof. The burden of proof in the present situation rested with the Examining Division.

As to the objection under Article 56:

the Examining Division argued that it was evident to the skilled person to reduce the amount of impurities while producing a given compound. In particular, the skilled person would regard it as a normal design option to include the features of D2 concerning the use of ultra pure starting materials for the major components in the processing of a superconductor as described in D3. This argument was unconvincing. Indeed, according to D2, only the La_2O_3 and CuO raw materials were of at least 99.99% purity, whereas the other materials SrO , BaO_2 and BaO were only 99.5% pure. Moreover, D2 did not teach the limitation of the amount of alkali metal impurities. In the prior art, it had been customary not to pay too much attention to impurity levels. Thus, there was no teaching or suggestion in any of the cited documents that the use of high purity starting materials and their processing to reduce alkali metal impurities could enable an increase of T_{c0} . Such an increase was surprising. The arguments advanced by the Examining Division resulted from an improper *ex post facto* analysis.

Reasons for the Decision

1. The appeal is admissible.
2. *Article 52(1) EPC*

The present invention is based on the finding that a substantial improvement in T_c with values between 80K and 124K can be obtained by use of highly purified starting materials and by processing such materials so

as to avoid contamination by alkali metals, in particular Li, Na and K.

- 2.1 In the decision under appeal, the Examining Division takes the view that doubts exist as to the capability of the invention to achieve the technical effect mentioned. The doubts rely on the fact that the (cited) technical literature consistently reports T_c values not higher than 93K for YBaCuO systems, so that the increase in T_c as reported in the application does not appear to be reproducible. The Examining Division thus comes to the conclusion that the subject-matter of the claims cannot be considered to define an invention under Article 52(1) EPC, since the features claimed do not produce the technical effect that solves the problem (see the appealed decision, point II.1.5). In this respect, in the communication dated 9 March 1993, the Examining Division took the view that the application did not fulfil the requirement of industrial application (see page 2, last paragraph).

The objection is not well-founded. Article 52, paragraph (1), EPC expresses the principle that a patent shall be granted for an invention which fulfils the requirements set out in this paragraph. In particular, the application must relate to an invention which is susceptible of industrial application, is novel and involves an inventive step. As regards the meaning of "invention" and technical advance, attention is drawn to paragraphs 52.04 and 52.05 in Singer's commentary "The European Patent Convention", revised English edition by Raph Lunzer, 1995. In summary, <<the meaning of "invention" can be derived from the provisions of the EPC and the Implementing Regulations. According to Articles 54(1) and 56, the evaluation of

both novelty and inventiveness starts with a proper evaluation of the state of the art. Such an evaluation is only possible for creative ideas in the area of technology>>. The Implementing Regulations are also based on the premise that an invention must have a "technical" character. Indeed, <<the applicant is required to specify the technical field to which his invention relates (Rule 27(1)(a)) and to disclose the invention in such terms that the technical problem and its solution can be understood (Rule 27(1)(c)). Finally, the claims are required to define the matter for which protection is sought by the applicant in terms of the technical features of the invention (Rule 29(1)). (See also Articles 69 and 84.)>> It should be noted that the meaning of the word "technical" is not explicitly defined in either the EPC or the Implementing Regulations. As to the utility of the invention, <<the EPC does not require an invention to afford any technical advance as a pre-condition of patentability. However, if the invention does in fact have some practically advantageous effects when compared with the prior art, this can often be significant when assessing inventiveness and should be indicated in the description (Rule 27(1)(c)).>>

In the present case, the application specifies the field of superconducting compositions to which the invention relates (Rule 27(1)(a) EPC). It discloses the invention in such terms that the technical problem (improvement of T_c and T_{c0}) and its solution (using starting materials of a greater than usual level of purity and processing the materials in a way which avoids contamination by alkali metals, in particular Li, Na and K) can be understood (Rule 27(1)(c) EPC). The claims define the process (and the composition) for

which protection is sought in terms of the technical steps to be carried out (Rule 29(1) EPC). Moreover, the description mentions the advantageous effect achieved (greater T_c and T_{c0}), when compared with the prior art (Rule 27(1)(c) EPC).

The Examining Division may well doubt whether the claimed invention solves the problem, in other words take the view that an improvement of T_c is not achieved. However, this would simply mean that the claimed invention leads to values of T_c which do not depart from those known in the state of the art. In such a case, there would be no technical advance, which is not required by the EPC as a condition of patentability (see above).

Attention is also drawn to paragraph 57.03 in the above-mentioned commentary on the EPC, as far as industrial application and sufficiency of disclosure are concerned. In the present case, there is no reasonable overlap between objections under Article 57 EPC and Article 83 EPC, which would make both objections possible (see also point 3 below).

- 2.2 According to the Examining Division, the appellant should provide proof that the invention achieves the technical effect described in the application. In taking this view, the Examining Division relies on the EPO Guidelines, paragraph D-V, 4.3.

This argument is not well-founded. The principle mentioned in the cited paragraph concerns opposition proceedings and cannot be applied to the present case, even *mutatis mutandis*, because of the different nature of the examination procedure. Paragraph C-VI, 14.2 is

more relevant, according to which the Examining Division would not, as a general rule, require evidence to be produced. The primary function of the Examining Division in proceedings before grant is to examine whether or not the application meets the requirements of the Convention (Article 96(2) EPC). "If the applicant does not accept the view of the examiner, then it is for the applicant to decide whether he wishes to produce evidence in support of his case and, if so, what form that evidence should take." According to paragraph C-VI, 14.3, written evidence could be the production of a sworn statement. In the present case, the appellant produced the inventor's affidavit dated 25 July 1994, although he did not have any obligation in this respect.

3. *Article 83 EPC*

The Examining Division motivates the objection of insufficiency of the disclosure essentially as follows:

(j) The comparative study of Examples 1 (according to the invention) and 3 (according to a conventional method) shows that it is the washing step which is responsible for the increase in T_c , because it is the sole difference between both examples. The washing step, however, is not sufficiently disclosed.

(jj) The value of the preferred impurity concentration in the finished material (see the application, page 8, line 14) is in contradiction with the impurity concentrations as mentioned on page 9,

line 21, to page 10, line 4.

(jjj) The effect referred to in the application is unknown in the technical literature, even after publication of the application.

These reasons are not convincing. As to (j), in the grounds of appeal, point 14, the appellant draws attention to the fact that there is a difference between the English text of the application as originally filed and the Japanese priority document. In the Japanese text, the starting materials in Example 1 have a purity of 99.99% (i.e. 4N) or higher, whereas in Example 3 they are said to be 3N, which means only 99.9%. In the original application, Example 3 mentions a purity 4N, i.e. the same as that of Example 1. In the decision under appeal, the Examining Division does not take position on this problem. However, if due attention is paid to the presence of the said mistake in the English version of the application, the argument (j) is devoid of any basis.

With regard to argument (jj), there is no contradictory information in the description. In fact, on page 8, lines 8 to 11, it is stated that alkali metal elements like Li, Na or K could be adequately washed out. The following sentence (see lines 11 to 14) reads "It was therefore possible to reduce the concentration of impurities throughout the finished material to 0.2% by weight, or preferably 0.005% by weight or less." Because of the presence of the adverb "therefore", which implies that a conclusion is drawn with regard to what precedes, this sentence is understood as referring to alkali impurities. The range 0.2% by weight or less thus corresponds to that mentioned on page 10, lines 2

and 3. Moreover, the value 0.001% cited on page 10, line 4, falls within the preferred interval 0.005% or less reported on page 8, line 14.

Moreover, at the end of point II.3.1 of the decision under appeal, the Examining Division concludes that "faced to this contradictory information, the man skilled in the art is unable to determine which impurity concentration is in fact essential to achieve the effect reported in the application." This conclusion is irrelevant. Whether or not the effect reported in the application is achieved is a problem which does not necessarily imply that the application does not disclose the invention in such a manner that the skilled person can carry it out.

As to (jjj), this argument could only throw a doubt on the achievement of the effect, but not on the fact that the invention can be carried out. With regard to the technical literature published after the priority date of the present application, it reports superconductivity in a Y-Ba-Cu-O system at a temperature T_c of 90K (see D5, page 622, left-hand column, line 5, and D1, page 21, central column, first sentence of second paragraph) which falls within the range between 80K and 124K referred to on page 3, lines 2 to 8, of the original application. It also reports the negative effect of Na and Li on the temperature T_c (see D6 and D7).

Thus, the application meets the requirements of Article 83 EPC.

4. *Article 123(2) EPC*

The Board is satisfied that the requirements of Articles 123(2) EPC are met. Indeed, the application has not been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed.

5. *Article 84 EPC*

The claim language is clear. As the appellant points out in the letter of 2 March 1999 (see page 2, last paragraph), "a skilled person who was told that the starting materials should be of high purity, should be washed in high purity water and thereafter processed to form the high temperature superconducting material such as to limit alkali metal contamination might try a range of starting material purities and water purity levels but, given that he would know how to avoid alkali metal contamination, it would not take him long to realise what would give the desired results. Any further particularisation of the claim language would unnecessarily limit the scope of protection for the invention."

The Board is aware of the fact that the feature "very high purity water" in claim 1 may, at first sight, appear unclear because it has no well-recognised meaning in the art, as is the case, for instance, for "high-frequency" in relation to an amplifier. However, the feature should be seen in the context of the claim, in particular having regard to the fact that a critical temperature T_{c0} of 77K or greater has to be achieved and that contamination with alkali metal impurities has to be limited to no more than 0.2% by weight. Moreover, the claim should be seen in the light of the description (see, in particular, the feature concerning

the specific resistance of the water to be used for the washing step within the frame of Example 1 on page 8, lines 5 to 8, this feature being also mentioned in present claim 3). Similar considerations are also valid for the functional feature "processing the washed materials ... such as to limit ...". In the present case, a balanced compromise has been found between the requirement of Article 84 EPC that a claim shall be clear and the appellant's interest to obtain the optimal scope of protection for his invention.

6. *Article 54 EPC*

Of the documents cited, only D2 and D3 belong to the state of the art according to Article 54(2) EPC. None of these documents discloses a process for producing a copper oxide superconducting material comprising all the features of claim 1.

Therefore, the subject-matter of claim 1 is novel. The same conclusion applies to claim 11.

7. *Article 56 EPC*

7.1 As far as the decision under appeal is concerned, the Board agrees with the appellant (see the grounds of appeal, point 11) that an inconsistency exists between the objection under Article 83 EPC and that under Article 56 EPC. Indeed, if the application does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art, it makes no sense to discuss whether the invention involves an inventive step or not.

7.2 The Examining Division essentially argues as follows. Document D3, which is considered to represent the closest state of the art, discloses a Y-Ba-Cu-O system with a superconducting transition between 80K (T_{C0}) and 93K (T_C) (see Figure 1, page 908, left-hand column, first paragraph, page 909, left-hand column, sentence "The temperature dependence of R ..."). D3 does not disclose the level of impurities in the starting materials and does not consider the risk of contamination during the manufacturing process. Defining the problem to be solved as merely providing a method for achieving a high T_C value, it is a usual feature of the skilled person's work to maintain the impurity concentration as low as possible when producing a given compound. Indeed, D2 discloses the use of ultra pure starting materials (99.999%) for the major components of the final compound La-Sr-Cu-O. Thus, it is a normal design option to include the features of D2 in the processing of a superconductor as described in D3.

There is an *ex post facto* analysis in this reasoning. D3 simply shows that a superconducting state can be attained in Y-Ba-Cu-O systems with a transition temperature between 80K and 93K. There is no mention of the use of ultra-high purity raw materials or of the avoidance of alkali metal impurities. As regards D2, it discloses superconductivity at 40K in a La-Sr-Cu-O system. High purity La_2O_3 (99.999%) and CuO (99.999%), and low purity SrO (99.5%), BaO_2 (99.5%) and BaO (99.5%) are used as starting materials. Thus, not all the starting materials have the purity required by the invention as claimed. Moreover, in the process according to D2 (see point II.1), an agate vial is used which is a possible source of contamination, as the

appellant points out in the grounds of appeal, point 12, page 11.

In conclusion, the cited prior art documents, taken alone or in combination, do not disclose or suggest essential features of the invention, in particular that superconductivity at high temperatures can be achieved by using all starting materials of a greater than usual level of purity and by processing these materials so as to avoid any source of impurity contamination. In other words, the prior art does not stress the importance of keeping a low impurity level both at the stage of selecting the raw materials and during the manufacturing process.

The subject-matter of claim 1 thus involves an inventive step. The same conclusion applies to claim 11.

8. The application and the invention to which it relates meet the requirements of the EPC.

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 the first instance with the order to grant a patent on the basis of the following documents:

Claims: Nos. 1 to 11 as filed with the letter of

2 March 1999,

Description: Pages 1, 5 to 15 as originally filed,
Page 2 as filed with the
letter of 4 January 1994,
Pages 3, 4 as filed with the
letter of 2 March 1999,

Drawings: Sheet 1/1 as filed with the letter of
29 April 1988.

The Registrar:

The Chairman:

M. Beer

G. Davies