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Case Number: T 0415/95 - 3.2.2

D E C I S I O N
of 9 November 1999 correcting errors in the decision of the Technical Board of Appeal 3.2.2 of 22 July 1999

Appellant: (Proprietor of the patent)
Sumitomo Electric Industries Limited
No. 15, Kitahama 5-chome
Higashi-ku
Osaka-shi
Osaka 541 (JP)

Representative:
Warren, Anthony Robert
Baron & Warren
18 South End
Kensington
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Respondent: (Opponent)
Plansee TIZIT Aktiengesellschaft
6600 Reutte/Tirol (AT)

Representative:
Lohnert, Wolfgang, Dr.
Plansee TIZIT Aktiengesellschaft
6600 Reutte (AT)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 7 April 1995 concerning maintenance of European patent No. 0 254 560 in amended form.**

Composition of the Board:

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

In application of Rule 89 EPC, the decision of the Technical Board of Appeal given on 22 July 199 is hereby corrected as follows:

on page 9, **Order,** point 2, the paragraph:

Description: page 3, received at the oral proceedings
pages 2 and 4 to 17 according to EP-B-0 254 560

is replaced by:

Description: page 3, received at the oral proceedings
pages 2 and 4 to 16 according to EP-B-0 254 560

The Registrar: The Chairman:

S. Fabiani W. D. Weiß

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D E C I S I O N
of 22 July 1999

Case Number: T 0415/95 - 3.2.2

Application Number: 87306501.5

Publication Number: 0254560

IPC: C30B 25/02

Language of the proceedings: EN

Title of invention:
Gaseous phase synthesized diamond and method for synthesizing same

Patentee:
Sumitomo Electric Industries Limited

Opponent:
Plansee TIZIT Aktiengesellschaft

Headword:
-

Relevant legal provisions:
EPC Art. 54, 100(a)

Keyword:
"Novelty (yes) after amendment"

Decisions cited:
T 0793/93, T 0173/89

Catchword:
-

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 7 April 1995 concerning maintenance of European patent No. 0 254 560 in amended form.**

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Summary of Facts and Submissions

I. European patent No. 0 254 560 was granted on 4 March 1992 on the basis of European patent application No. 87 306 501.5.

II. The granted patent was opposed by the present respondents on the ground that the subject matter of claim 1 lacked novelty with respect to the state of the art (Article 100(a) and Article 54 EPC).

Of the prepublished documents cited in the opposition proceedings, the following were considered:

D1: Japanese Journal of Applied Physics, vol. 25, No. 6, June 1986, pages L519-521;

D2: Japanese Journal of Applied Physics, vol. 21, No. 4, April 1982, pages L183-185;

D3: Proc. of the 9th Symp. on ISAT '85, Tokyo 1985, pages 233-236;

D5: Proc. of the 9th Symp. on ISAT '85, Tokyo 1985, pages 232-228;

III. With its interlocutory decision posted on 7 April 1995 the Opposition Division held that the patent could be maintained in amended form on the basis of a set of claims 1 to 3 (based on claims 2 to 4 as granted) submitted at the oral proceedings held on 13 December 1994 and filed as a fair copy on 11 February 1995.

IV. An appeal against this decision was filed on 2 May 1995 by the patentee (appellant). The statement of grounds filed on 7 August 1995 enclosed amended sets of claims according to a first and a second auxiliary request.

In view of the comments contained in the Board's communication of 19 June 1998, the first auxiliary request was withdrawn and replaced by the second auxiliary request.

Claim 1 as granted (main request) reads a follows:

"1. A diamond film coated on a substrate, characterized in that an average particle size of diamond is 2 μm or less and a half-width of a peak of 1344 cm^{-1} measured by the Raman spectrometric method is 50 cm^{-1} or less; in that the surface of the diamond film is mainly a (111)-plane and in that the coated diamond has an electric resistivity of 10^8 Ohm·cm or more."

Claim 1 of the auxiliary request reads as follows:

"1. A diamond film coated on a substrate, characterized in that an average particle size of diamond is 2 μm or less and a half-width of a peak of 1344 cm^{-1} measured by the Raman spectrometric method is 50 cm^{-1} or less; in that the surface of the diamond film is mainly a (111)-plane and in that the coated diamond has an electric resistivity of 10^{10} Ohm·cm or more."

V. Oral proceedings were held before the Board on 22 July 1999.

VI. The appellants (patentees) requested that the decision be set aside and that the European patent be maintained as granted or on the basis of the auxiliary request submitted at the oral proceedings.

The respondents (opponents) requested that the appeal be dismissed.

VII. The appellants argued as follows:

The process for fabricating a diamond film disclosed in document D3 fails to specify the claimed Raman half-width of a 1334 cm-1 peak, the electrical resistivity and the orientation of the crystal faces on the surface of the deposited diamond structure. Thus, the claimed diamond film is novel with respect to D3.

The claimed diamond film is not inevitably obtained when putting into practice the technical teaching given in document D3, as alleged by the opponents. In this connection, reference is made to the decisions T 173/89 and T 793/93 which specify that, in order to prove an inevitable result of a known process, it is necessary to follow the teaching of a prior art document as closely as possible and to justify any deviation therefrom or the choice of any parameters not specified in that document. If reasonable doubts exist as to what may be the result of carrying out the literal disclosure or instructions of a prior art document, then the objection of anticipation based on such a document has to fail.

In their experiments, the opponents did not follow the teaching of D3 and the practice at that time closely enough for the results to be considered as proving that a diamond film having the properties defined in claim 1 would inevitably have been produced. Although the filament temperature of 2200°C may be considered as realistically chosen and the selection of a tungsten alloy instead of (pure) tungsten may have no impact on the result, the deposition rate of 0.25 µm/h selected in the opponent's experiments is not acceptable, since it is only half the deposition rate of 0.5 µm/h used in D3. The experimental results submitted by the appellants on 21 December 1998 prove that the deposition rate represents an important parameter. In

this experiment the growth speed of the deposited diamond layer was 0.3-0.4 µm/h, i.e. higher than that achieved in the opponent's experiment and closer to that used in D3. The diamond coating comprised substantial gaps and, therefore, such a coating cannot be regarded as being a complete "film" as required in claim 1. Moreover, it remains questionable whether or not the deposited diamond crystals predominantly exhibit a (111) orientation. It is, therefore, requested to re-establish claim 1 of the patent as granted.

As to the auxiliary request, the opponent's experiments failed to show that a diamond film having a resistivity of 10^{10} Ω•cm or more actually is achieved, a value achieved in samples 4 to 10 of the patent at issue. The subject matter of claim 1 of the auxiliary request is, therefore, novel.

VIII. The respondent argued as follows:

As is apparent from method claim 2, the claimed diamond film can be produced by selecting within broad ranges the various process parameters, for instance the surface temperature of the substrate, the temperature of the filament, the plasma current density and the pressure in the reaction vessel. Hence, these parameters are of minor relevance. The key feature for depositing a diamond film is the composition of the gas which is dissociated by the hot filament. In particular, the hydrogen/methane ratio of 100/1 as chosen in D3 and the opponent's experiments following D3 have to be adhered to in order to successfully deposit a diamond film which exhibits a crystal orientation mainly in the (111) plane. Once a diamond has formed, the typical physical properties of the film like the (111) orientation of the crystals, a resistivity of 10^{8} Ohm·cm or more and a sharp peak at

about 1334 cm^{-1} close to the value for the natural diamond are inevitably achieved. Contrary to the patentee's allegation, the deposition rate is not critical but is selected merely in order to obtain a substantially complete film. Depending on the deposition time, a film thickness of 5 µm or 15 µm can be achieved. However, as long as the film thickness is restricted to less than 5 µm, the particle size of the diamond crystals will always be 2 µm or less, as can be seen from D3 and confirmed by the experiment of the patentees.

In consequence thereof, the subject matter of claim 1 of the main request and of the auxiliary request lacks novelty.

Reasons for the Decision

1. The appeal is admissible.

2. Novelty of claim 1 of the main request

To support their objection to the novelty of the subject matter of claim 1, the opponents submitted reports of experiments aiming at repeating the technical process disclosed in document D3. According to these reports, a diamond layer of about 1.5 µm thickness and an average diamond particle size of about 1 µm had formed after a 6 hours reaction time, which layer had a resistivity of 5×10^9 Ohm·cm. The half width of a peak at 1334 cm^{-1} was found to be 12-17 cm^{-1} and the crystals forming the diamond film had a "mainly (111)" orientation as can be seen from the SEM-OF micrographs enclosed with the opponent's letter of 09 November 1993.

It is furthermore apparent from the comparative Table on page 4 of the opponent's letter that the selected process parameters - except those for

- the filament temperature,

- the filament material,

- the deposition rate and the diamond film thickness obtained -

exactly correspond to those given in paragraph 2 "Experimental" and Table 1 of document D3.

It has, therefore, to be examined whether or not the deviations had an impact on the results and whether the use of conditions not specified in D3 and chosen in the opponent's experiment were justified.

The patentee had acknowledged at the oral proceedings that the filament temperature of 2200°C used in the opponent's experiment and not disclosed in D3 had been chosen by the opponent according to the normal skill in the art. This estimation is corroborated by document D1, page L530, left hand column, point (5) disclosing a W-filament temperature of 2000°C for diamond deposition in a hot filament CVD reactor, a temperature which - according to the opponents - brings about an even smaller diamond particle size compared to a temperature of 2200°C. The patent itself allows a filament operating temperature between 1600°C and 2500°C (cf. claim 2 and Table 2). Therefore, the selection of the filament temperature is not challenged.

Turning to the filament material, a "refractory material" was used which was specified by the opponent to be a "tungsten alloy consisting mainly of tungsten" (cf. minutes of the oral proceedings before the

opposition division). Pure tungsten is used according to document D3. The particular filament material per se is, however, not critical, whenever it is apt to tolerate the temperature of 2200°C necessary to dissociate the hydrogen/methane gas mixture.

An major difference between the test performed by the respondent and the process disclosed in D3 is that the deposition rate of the test is 0.25 µm/h compared to 0.5 µm/h disclosed in D3. Based on its own test results submitted on 17 December 1998, the appellant argued that a deposition rate of 0.3 to 0.4 µm/h brings about a diamond film having "substantial gaps over the whole layer" and consequently, a "film" as required in claim 1 could not be obtained with a deposition rate as low as 0.25 µm/h.

The merit of this argument has, however, to be assessed bearing in mind that claim 1 is not confined to the deposition of a "complete film without any gaps" or a "substantially complete film", and consequently, this argument is not convincing. Moreover, the test results of the appellant reveal that also for a deposition rate lower than that given in D3, a diamond particle size of 2 µm or less and exhibiting predominantly a (111) orientation can be successfully achieved.

In view of the above reasons, the deviations of the test parameters from the teaching given in document D3 had no decisive impact on the test results and the parameters freely selected in the respondent's experiment comply with those ranges a person skilled in the art would have resorted to at the publication date of document D3.

Based on these considerations it is, therefore, concluded that a diamond film having all the properties referred to in claim 1 of the patent at issue is

inevitably obtained when putting into practice the process disclosed in D3. Consequently, the subject matter of claim 1 of the main request lacks novelty.

3. Novelty of the subject matter of claim 1 of the auxiliary request

Claim 1 of the auxiliary request specifies "a diamond film having an electrical resistivity of 10^{10} Ohm·cm or more". In the appellant's view, an electrical resistivity in the range of 10^{10} Ohm·cm to 10^{13} Ohm·cm set out in Table 1 of the disputed patent implicitly stands for a substantially complete layer of diamond crystals covering the substrate.

The electrical resistivity of the diamond film produced by the respondent's experiment was measured to be $5 \cdot 10^{9}$ Ohm·cm which is below the value of $\geq 10^{10}$ Ohm·cm specified in claim 1 of the auxiliary request. At the oral proceedings before the Board, the respondent argued - for the first time in the proceedings - that it is extremely complicated or even impossible to determine exactly the electrical resistivity of this dimension and that the measured values very much depend on the specific method selected to determine the electrical resistivity. It has, however, not been produced any evidence in this respect, although claim 1 according to the auxiliary request was already filed in August 1995. The burden of prove for an argument intended to affect the validity of a claim, however, lies with the opposing party, and thus this argument cannot be taken into consideration if no evidence is offered (cf. T 793/93, Special Edition of the OJ EPO 1996, page 75).

Given that it has not been proven unambiguously that an electrical resistivity as high as 10^{10} Ohm·cm or more is inevitably brought about by the method given in D3, the subject matter of claim 1 of the auxiliary request is novel.

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 on the following basis:

Claims: 1 to 4 according to the auxiliary request submitted at the oral proceedings;

Description: page 3, received at the oral proceedings
pages 2 and 4 to 17 according to EP-B-0 254 560;

Figures: 1 to 4 according to EP-B-0 254 560.

The Registrar: The Chairman:

M. Maslin W. D. Weiß