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Datasheet for the decision of 23 March 2020

Case Number: T 1136/15 - 3.5.02

Application Number: 08705506.7

Publication Number: 2122639

IPC: H01B3/52, C08K3/36, C08K3/38

Language of the proceedings: EN

Title of invention:
Insulating Tape having a Multi-layered Platelet Structure

Patent Proprietor:
Siemens Energy, Inc.

Opponent:
General Electric Technology GmbH

Relevant legal provisions:
EPC Art. 100(a), 56

Keyword:
Inventive step - (no)

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Case Number: T 1136/15 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 23 March 2020

Appellant: (Opponent)	General Electric Technology GmbH Brown Boveri Strasse 7 5400 Baden (CH)
Representative:	Openshaw, Paul Malcolm Openshaw & Co. 8 Castle Street GB-Farnham, Surrey GU9 7HR (GB)
Respondent: (Patent Proprietor)	Siemens Energy, Inc. 4400 Alafaya Trail Orlando, FL 32826-2399 (US)
Representative:	Maier, Daniel Oliver Siemens AG Postfach 22 16 34 80506 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 27 April 2015 concerning maintenance of the European Patent No. 2122639 in amended form.**

Composition of the Board:

Chairman	R. Lord
Members:	F. Giesen
	W. Ungler

Summary of Facts and Submissions

I. This appeal by the opponent (appellant) lies from the interlocutory decision of the Opposition Division posted on 27 April 2015 concerning maintenance of the European Patent No. 2122639 in amended form.

II. In the statement of grounds of appeal, the appellant referred to the following documents of the state of the art:

D1: EP 0 266 602 A1

D7: Lutz, A. et al., "New High Voltage Insulation with Increased Thermal Conductivity", in Proceedings: Electrical Electronics Insulation Conference And Electrical Manufacturing & Coil Winding Conference, p. 323 to 327

and argued that claim 13 and claim 1 as maintained by the Opposition Division lacked novelty over document D1 and inventive step over document D1 in combination with document D7, respectively. No reply to the grounds of appeal was received from the patent proprietor (respondent).

The contents of D7 were made publicly available at a conference in 1993. The respondent did not contest this.

III. In a communication pursuant to Rule 100(2) EPC the Board informed the parties of their preliminary opinion, which was favourable for the appellant. In response, the respondent requested oral proceedings by facsimile dated 17 January 2020. Upon receiving the summons to oral proceedings, the respondent announced

that they would not be represented at the oral proceedings and withdrew their request for oral proceedings by facsimile received 13 March 2020.

IV. The final requests relevant for this decision were as follows.

In their letter dated 10 January 2020 the appellant requested that the impugned decision be set aside and the opposed patent be revoked.

In their facsimile received on 17 January 2020 the respondent requested that the appeal be dismissed and that any submission in the statement of grounds of appeal extending beyond the submissions already made during the opposition proceedings be held inadmissible.

V. Claim 1 according to the sole request, i.e. as maintained by the Opposition Division, reads as follows:

> *"An electrical insulation component comprising:*
> *mica flakelets, wherein said mica flakelets have an average size range of 0.01 to 0.05 mm in their thinnest dimension;*
> *platelet hexagonal boron nitride, wherein said hexagonal boron nitride has an average size range of 10 to 10,000 nm in their longest dimension;*
> *and a resin matrix;*
> *wherein said mica flakelets and said hexagonal boron nitride are mixed;*
> *wherein the ratio by weight of said hexagonal boron nitride to said mica flakelets is directly proportional to the average size of said hexagonal boron nitride in the longest dimension compared to the average size of said mica flakelets in the*

thinnest dimension, within an adjustment factor of 0.5 to 2;
wherein the ratio by weight of said hexagonal boron nitride to said mica flakelets is never greater than approximately 1:1 by weight."

Claim 13 according to the sole request reads as follows:

"An electrical insulation composite comprising:
a mixture of platelet boron nitride and mica flakelets, wherein the ratio of said platelet boron nitride to said mica flakelets is directly proportional to the average size ranges within a factor of 0.5 to 2;
wherein said platelet boron nitride has an average size range of 10 to 10,000 nm in their longest dimension;
wherein said electrical insulation composite is combined with a resin matrix."

VI. The appellant's arguments were essentially as follows:

The insulation component or composite of claims 1 and 13 did not involve an inventive step.

D1 used a mixture of mica flakes and boron nitride (BN). Although D1 used the term grains, this term included the term "platelet" of D1. One form of BN, namely hexagonal BN always assumed a platelet shape. This assertion was consistent with the disclosure of the opposed patent. Hence, D1 implicitly disclosed platelet hBN.

The choice of one out of three existing crystal structures of BN could not support an inventive step.

The technical problem consisted merely in choosing a suitable form of BN. There were only three known forms of BN, namely hexagonal, diamond-like cubic and a further one. hBN was a known insulator and always came in the form of platelets. Diamond-like cubic was not a suitable choice because it was the second hardest material after diamond and would therefore damage the mica flakes. A choice from three options, one of which was unsuitable and the other a well known suitable choice for an insulation component did not require an inventive step.

The Opposition Division erred in finding that D1 taught away from using platelet hBN because D1 disclosed on page 5, lines 30 to 32 that, during impregnation, resin with BN penetrated into spaces between the mica layers. There was no disclosure supporting the Opposition Division's argument that the mica layer should remain free from the filler (hBN), a goal which could only be achieved if the structure of the BN was dissimilar from the flake morphology of the mica.

VII. The respondent's arguments were essentially as follows:

The appellant's submissions did not justify overturning the impugned decision. All submissions including all newly filed documents in as far as they went beyond those made during the opposition proceedings were late filed and hence not to be admitted to the appeal proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. *Admittance of respondent's request not to admit appellant's submissions*

2.1 The Board does not accede to the respondent's request not to admit any submission from the appellant going beyond what was submitted in the opposition proceedings.

2.2 Rule 99(2) EPC stipulates that in the statement of grounds of appeal the appellant shall indicate the reasons for setting aside the decision impugned, or the extent to which it is to be amended, and the facts and evidence on which the appeal is based.

In setting out the reasons why, in the appellant's opinion, the impugned decision was wrong they complied with the requirements of Rule 99(2) EPC. It will under normal circumstances not be possible for an appellant to deal with the reasons for an impugned decision in detail before being informed of them. If all that an appealing party was allowed to do was to repeat what they had already said in the first instance proceedings, the requirements of Rule 99(2) EPC would be meaningless.

For these reasons alone, an unsubstantiated request not to consider any submissions going beyond those made in the first instance proceedings is not allowable in view of the requirements of Rule 99(2) EPC.

2.3 It rather appears to the Board that under the circumstances of the present case, i.e. in the absence of a reply by the respondent to the statement of grounds of appeal and since the request was made only after a communication was issued by the Board, the request itself is an amendment to the respondent's case and its admittance is at the discretion of the Board. However, in view of the above finding that the request is not allowable, the Board does not have to take a decision on its admittance.

2.4 The Board's reasoning in this decision is based only on documents which had already been submitted during the opposition proceedings. Hence, no decision is necessary concerning the respondent's request not to admit the documents filed with the statement of grounds of appeal.

3. *Inventive step*

3.1 The subject-matter of claims 1 and 13 does not involve an inventive step within the meaning of Article 56 EPC in view of documents D1 in combination with D7.

3.2 Closest prior art

The Board is satisfied that the electrical insulation component according to Example 1 of D1 is a suitable choice as closest prior art for the assessment of inventive step.

D1 discloses an electrical insulation component, namely an insulating tape, see column 4, lines 55 to 57 ("micaeous main insulation 14"). The tape contains thin mica flakes, which is synonymous to flakelets, see

column 4, line 57 to column 5, line 6. The mica flakes overlap and form a layer of 0.09 mm total thickness. The maximum thickness of individual mica flakelets follows from the total thickness if only two flakelets overlap and must therefore be less than 0.09/2 = 0.045 mm. Therefore in their thinnest dimension they are less than 0.05 mm thick as required by claim 1.

According to column 5, lines 10 to 18 of D1, the mica tape is then impregnated with a resin containing boron nitride (BN) having a grain size of 0.5 to 1.5 µm. According to column 5, lines 30 to 33, during the impregnation at "least the resin" penetrates into the mica layers, thus suggesting that also boron nitride filler grains can penetrate into the mica layers. It is not apparent why the BN filler grains should separate from the resin and not penetrate into the mica layer during impregnation. This is confirmed by column 3, lines 1 to 4 of D1, which states that the filler may be distributed both in the part of the resin which is arranged in spaces between the mica layers and in the part of the resin which is arranged in mica layers. As a consequence, boron nitride grains and mica flakelets are disclosed to be mixed in D1. It is noted that claim 1 is not limited to any homogeneity of the mica flakelet and hBN platelet mixture. After impregnation, the mica flakelets and boron nitride grains will be surrounded by a resin matrix.

3.3 Distinguishing features

The appellant is correct in pointing out that boron nitride exists in three different crystal structures, namely hexagonal, cubic and wurtzite. The appellant's arguments concerning the alleged implicit disclosure of "platelet boron nitride" in D1 appear to be predicated

on the assumption that hexagonal boron nitride always forms platelets. While this appears to be correct, D1 does not directly and unambiguously disclose the hexagonal form of BN.

The subject-matter of claims 1 and 13 therefore differs from the insulating component of D1 in comprising platelet hexagonal boron nitride (claim 1), and platelet boron nitride (claim 13), respectively.

D1 furthermore does not disclose that the hexagonal boron nitride platelets have an average size range of 10 to 10,000 nm in their longest dimension and that the ratio by weight of said hexagonal boron nitride to said mica flakelets is directly proportional to the average size of said hexagonal boron nitride in the longest dimension compared to the average size of said mica flakelets in the thinnest dimension, within an adjustment factor of 0.5 to 2; and that the ratio by weight of said hexagonal boron nitride to said mica flakelets is never greater than approximately 1:1 by weight.

3.4 Objective technical problem

No disclosure is apparent to the Board which would explain the technical effect of the selection of the hexagonal form of boron nitride and the claimed size and weight ranges. The respondent did not make any submissions in this respect.

In view of this, the technical problem is to make a suitable choice of boron nitride filler to put the teaching of D1 into practice.

3.5 Assessment of the solution

3.5.1 When putting the disclosure of D1 into practice, a skilled person has to choose the appropriate crystal structure of boron nitride for the filler grains from three possible crystal structures. Wurtzite BN is fairly uncommon and rather unstable. Cubic BN is similar to diamond and abrasive. Both therefore seem unsuitable for this use. Hexagonal BN is therefore the most obvious choice.

In addition to that, document D7 discloses that while expensive, hexagonal boron nitride has a very high thermal conductivity and is thus a suitable material for electrical insulation components using mica tapes, see D7, title and page 324, left column, third paragraph, i.e. the type of insulation used in D1. D7 clearly discloses a trade-off between higher thermal conductivity and higher cost. A skilled person merely accepting such a trade-off, as in the opposed patent, does not show any inventive activity.

The Board is convinced that if, as suggested in D7, hexagonal boron nitride were to be used as a filler for an impregnating resin as required by D1, it would form small particles that have an aspect ratio where the in-plane dimensions are significantly larger than the out of plane dimension, i.e. platelets within the meaning of claim 1, because hexagonal BN is formed of layers of graphite-like hexagons with strong covalent bonds. The layers themselves are only weakly bonded by van-der-Waals forces.

This is consistent with the disclosure of the opposed patent itself according to which hexagonal BN intrinsically forms platelets, see for example column

3, line 57 to column 4, line 1, which states "combination of platelet boron nitride, and in particular hexagonal boron nitride", which means that hexagonal boron nitride is a species of the genus platelet boron nitride. In column 4, lines 44 to 46, the opposed patent states "[a]lthough hBN is an ideal type of platelet BN", again suggesting that hBN is a particular form of platelet BN. In column 6, lines 25 to 26, the opposed patent states "[p]latelet BN, such as hBN 26 serves a similar function", thus again confirming that hexagonal BN is a form of platelet BN. See also column 7, lines 31 to 32 for confirmation. In fact, the opposed patent as a whole appears to use hexagonal BN and platelet BN as synonyms.

3.5.2 When putting the teaching of D1 into practice the other claimed requirements concerning the size and weight ranges would also be fulfilled.

D1 requires the BN filler grains to have a size of 0.5 to 1.5 µm, which is equivalent to 500 to 1,500 nm. It would therefore follow that the hexagonal boron nitride platelets suggested by D7 would be limited to that size range, their longest dimension thus falling in the very broad claimed range of 10 to 10,000 nm.

3.5.3 According to D1, column 5, lines 46 to 49, the finished coil contains 27% of total volume of mica and 20% of boron nitride. In the notice of opposition on page 6, the appellant calculated the weight ratio following from the disclosed volume ratio of D1 to be 1:1.8 or 0.56. The respondent did not contest this. This volume ratio is less then 1:1 as required by claim 1.

3.5.4 The proportionality factor for the direct proportionality between the weight and size ratios in

claim 1 is not defined, so that in fact the weight ratio could assume any value larger than zero and smaller than approximately 1. The weight ratio of 0.56 of D1 thus falls in the claimed range.

The respondent appears to have argued in their reply to the notice of opposition dated 10 December 2013, on page 3, fifth paragraph, that the adjustment factor of 0.5 to 2 defined in claim 1 was actually to be understood to be the proportionality constant. The claim wording is clearly not limited in this way. However, even assuming, in favor of the respondent, that claim 1 had to be understood in this way, it appears that the claimed ranges follow in an obvious way from D1 and D7.

The weight ratio (WR) of hBN platelets and mica flakelets according to this claim feature should be greater than

$$0.5 \cdot \mathrm{Min}[(1\text{-}10^{4})\cdot 10^{-9}\mathrm{m}/(1\text{-}5)\cdot 10^{-5}\mathrm{m}]$$

and smaller than

$$2 \cdot \mathrm{Max}[(1\text{-}10^{4})\cdot 10^{-9}\mathrm{m}/(1\text{-}5)\cdot 10^{-5}\mathrm{m}],$$

where Min and Max indicate the minimum and maximum of the expression in brackets, respectively, and the size ranges are those defined in claim 1. From this, taken together with the last feature, that the weight ratio must never be greater than "approximately 1", it follows that, since $\mathrm{Min}[(1\text{-}10^{4})\cdot 10^{-9}\mathrm{m}/(1\text{-}5)\cdot 10^{-5}\mathrm{m}] = 1/5\cdot 10^{-4}$, and since $0.5\cdot 1/5\cdot 10^{-4} = 10^{-5}$,

$$10^{-5} < \mathrm{WR} < \sim 1.$$

The ratio disclosed in D1 as calculated by the appellant in their notice of opposition amounts to 1:1.8 = 0.56, which falls within the above range.

The Board wishes to note that even the above range for a weight ratio, to which claim 1 is not clearly limited, spans five orders of magnitude. For this reason alone the Board finds it doubtful that inventive activity is required to specify such a broad range.

3.6 The Board is not convinced by the arguments of the Opposition Division and the respondent according to which D1 taught away from platelet hexagonal boron nitride.

According to the reasoning in the impugned decision on page 7, D1 supposedly stated that the mica layer "should remain free from boron nitride". This goal could only be achieved if the structure of the boron nitride was dissimilar to the flake morphology of the mica.

D1 states in column 3, lines 1 to 4 in general, and in the most relevant Example 1, in column 5, line 30 to 33 in particular, that "at least the resin also penetrates into the mica layers themselves." This means that also the boron nitride filler partially penetrates into the mica layers. Consistently, claim 1 of D1 is clearly directed to both cases, confinement of BN filler between the mica layers and penetration of the BN filler into the mica layers. There is therefore no reason to conclude from D1 that the boron nitride "should not" mix with the mica layer. D1 merely discloses both possibilities without preferring one over the other.

Furthermore, comparing Example 3 of D1 with the remaining examples, it appears that it is not the shape of the filler grains which is decisive for the filler penetration into the mica layer, but whether the impregnating resin is mixed with the filler grains before impregnating, as in Example 1, or whether the insulating tape is first impregnated with a resin without a filler, and the filler is subsequently coated on the surface of the insulating tape before curing, as in Example 3, see column 6, lines 52 to 55. In the latter case, the filler will not penetrate into the mica layers, see column 7, lines 5 to 8.

It is therefore neither correct to conclude that D1 teaches that the mica layer should remain free from boron nitride, nor that in order to achieve this, boron nitride should be in a form different from the flake morphology, i.e. not be in the form of platelets.

3.7 Given these considerations, the subject-matter of claim 1 of the sole request does not involve an inventive step in view of documents D1 and D7.

3.8 Claim 13 according to the sole request is directed to very similar subject-matter to that of claim 1, only with a slight differences in limitation. It reads "the ratio of said platelet boron nitride to said mica flakelets is directly proportional to the average size ranges within a factor of 0.5 to 2" but claim 13 fails to specify a size range of mica flakelets and what the proportionality constant is. Therefore, there is no apparent limitation on the weight ratio.

Claim 13 is directed to an electrical insulation composite and recites that said electrical insulation composite is combined with a resin matrix. Therefore,

the resin matrix is not part of the claimed subject-matter.

It thus follows, that the subject-matter of claim 13 is significantly less limited than that of claim 1 and therefore, consequently, that it is obvious in view of D1 and D7 for the same reasons as claim 1.

4. *Right to be heard*

The Board notified the above reasons and conclusions concerning inventive step to the parties in a written communication along with the preliminary conclusion that the Board was likely to accede to the appellant's request. The parties were invited to file their observations within four months.

The parties thus were given an opportunity to comment on them, which in particular the respondent did not make use of.

The respondent withdrew their request for oral proceedings explicitly with facsimile dated 13 March 2020. The appellant requested oral proceedings only if the Board could not accede to their request based on the written submissions.

Under these circumstances there is no need to hold oral proceedings.

Regarding the reasons for not allowing the respondent's request not to admit any submissions by the appellant going beyond those made in the opposition proceedings, since the respondent, despite being duly summoned, has withdrawn their request for oral proceedings they can

be treated as relying on their written case concerning this request, in analogy to Article 15(3) RPBA 2020.

5. In view of the foregoing, the Board accedes to the appellant's request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

U. Bultmann R. Lord

Decision electronically authenticated