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Datasheet for the decision of 22 January 2015

Case Number: T 0981/10 - 3.4.03

Application Number: 99943468.1

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IPC: H05K3/46, H05K3/38

Language of the proceedings: EN

Title of invention:
PRINTED WIRING BOARD AND METHOD FOR PRODUCING THE SAME

Patent Proprietor:
IBIDEN CO., LTD.

Opponent:
ZEON CORPORATION

Headword:

Relevant legal provisions:
EPC 1973 Art. 54(1), 56
RPBA Art. 13(1)

Keyword:
Novelty -
(no) main request, first and second auxiliary requests
Inventive step - (no) third to sixth auxiliary requests
Late-filed auxiliary requests - admitted (yes)

Decisions cited:

Catchword:

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Case Number: T 0981/10 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 22 January 2015

Appellant: (Opponent)	ZEON CORPORATION 1-6-2 Marunouchi Chiyoda-ku Tokyo 100-8246 (JP)
Representative:	Beckmann, Claus Kraus & Weisert Patentanwälte PartGmbB Thomas-Wimmer-Ring 15 80539 München (DE)
Respondent: (Patent Proprietor)	IBIDEN CO., LTD. 1, Kanda-cho 2-chome Ogaki-shi, Gifu-ken 503-0917 (JP)
Representative:	TBK Bavariaring 4-6 80336 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 3 March 2010 concerning maintenance of the European Patent No. 1119227 in amended form.**

Composition of the Board:

Chairman	G. Eliasson
Members:	T. M. Häusser
	T. Bokor

Summary of Facts and Submissions

I. The appeal of the opponent concerns the interlocutory decision of the opposition division that, account being taken of the amendments made by the proprietor during the opposition proceedings, the European patent No. 1 119 227 and the corresponding invention meet the requirements of the Convention (Article 101(3)(a) EPC).

II. The opposition had been filed against the patent as a whole. Grounds of opposition were lack of novelty and lack of inventive step (Articles 100(a), 54(1) and 56 EPC 1973).

III. At the oral proceedings before the board the appellant (opponent) requested that the decision under appeal be set aside and that the European patent No. 1 119 227 be revoked.

The respondent (patent proprietor) requested that the decision under appeal be set aside and the patent be maintained in an amended form on the basis of the claims as held allowable by the opposition division, and with an amended description, reinstating comparative examples 14 and 15 as inventive examples as submitted with letter dated 29 June 2011 (main request), or alternatively the appeal be dismissed, i. e. the patent be maintained as amended before the opposition division (first auxiliary request), or the decision under appeal be set aside and the patent be maintained in an amended form on the basis of claim sets filed as 1st to 4th auxiliary requests with letter dated 18 November 2011 (second to fifth auxiliary requests) or on the basis of claims 1-3 filed as 5th auxiliary request with letter dated 12 June 2012 (sixth auxiliary request).

IV. The board admitted the sets of claims according to the second to sixth auxiliary requests into the appeal proceedings.

V. Reference is made to the following documents:

D4: WO 98/56011 A1,
D4a: EP 0 987 719 A1 corresponding to the International application D4,
D10: US 5 388 328 A,
D13: JP 11-145621 A,
D13a: English translation of document D13,
D15: JP 2004-14848 A,
D15a: partial English translation of document D15,
D16: JP 7-235768 A,
D16a: English translation of document D16,
D17: KAGAKU DAI JITEN (Great Chemical Dictionary), Vol. 1, pages 942, 943, 952, and 953, edited by Michinori Ohki et al., Tokyo, 1989,
D17a: partial English translation of document D17,
D18: WO 00/58322 A1,
D19: Römpp Chemie Lexikon, 9th edition, pages 830 and 836, edited by Jürgen Falbe et al., Stuttgart, 1989,
D20: German Wikipedia article for "Benzocyclo-buten",
D26: Compendium of Chemical Terminology, Gold Book, pages 59 and 1024, Version 2.3.3, 24 February 2014

VI. The wording of independent claims of the main request and of the first to sixth auxiliary requests is as follows (board's labelling "(a)", ..., "(e)"):

Main request and first auxiliary request:

"1. A multilayer printed circuit board comprising a substrate board and,
(a) as built up on said substrate board successively and alternately, a conductor circuit (104, 105) and a resin insulating layer (102) at a plurality of levels,
(b) with said conductor circuits (104, 105) being interconnected by way of via holes (107),
(c) wherein said resin insulating layer (102) comprises a cycloolefin resin,
(d) characterized in that said via holes are composed of filled via holes which are filled up by electroplating."

Second auxiliary request:

Claim 1 of the second auxiliary request differs from claim 1 of the main request in that features (a) and (d) are replaced by the following features $(a)_2$ and $(d)_2$, respectively:

$(a)_2$ "as built up on said substrate board successively and alternately, a conductor circuit (104, 105) and a resin insulating layer (102) having openings for via holes at a plurality of levels,",
$(d)_2$ "characterized in that said via holes are composed of filled via holes which are made of an electroplating film filling up the openings."

Third auxiliary request:

Claim 1 of the third auxiliary request differs from claim 1 of the main request in that feature (c) is deleted and features (a) and (d) are replaced by the following features $(a)_3$ and $(d)_3$, respectively:

$(a)_3$ "as built up on said substrate board successively and alternately, a conductor circuit (104, 105) and a resin insulating layer (102) composed of cycloolefin resin at a plurality of levels,",
$(d)_3$ "wherein the via holes of the resin insulating layer of each level are filled up by electroplating the conductor circuit of the successive level."

Fourth auxiliary request:

Claim 1 of the fourth auxiliary request differs from claim 1 of the main request in that the following feature (e) is added:

(e) "and wherein said cycloolefin resin is a homopolymer or copolymer of 2-norbornene, 5-ethylidene-2-norbornene and/or any of their derivatives, the derivates including said cycloolefins to which an amino group, a maleic anhydride residue or a maleic acid-modified group for crosslinking has been attached."

Fifth auxiliary request:

Claim 1 of the fifth auxiliary request differs from claim 1 of the third auxiliary request in that feature (e) above is added.

Sixth auxiliary request:

"1. A process for manufacturing a multilayer printed circuit board comprising a substrate board and, as built up on said substrate board successively and alternately, a conductor circuit (104, 105) and a resin insulating layer (102) composed of a cycloolefin resin at a plurality of levels, with said conductor circuits

(104, 105) being interconnected by way of via holes (107),

whereby the process is characterized by

laminating a film comprising cycloolefin resin on a conductor circuit (104) formed on said substrate board by press lamination of an interlayer resin insulating layer (102) under vacuum or reduced pressure;

providing openings for via holes in the interlayer resin insulating layer;

forming a thin-film metal layer by physical vapor deposition, chemical vapor deposition or electroless plating; and

performing electroplating to construct a conductor circuit and to fill up the via holes by said electroplating."

VII. The parties argued essentially as follows:

a) Main request and first auxiliary request - novelty

The appellant refers to document D10, in particular to column 1, lines 28-53, column 50, lines 9-47 (Example 21), column 57, lines 23-26 (Example 43), and Figures 9(a) to 9(e), 12, and 16(a) to 16(c). In relation to the Examples 21 and 43 of document D10 it was disclosed to perform electroplating of through-holes implying that feature (d) of claim 1 of the main request and first auxiliary request was disclosed in D10. Furthermore, the steps described in relation to Example 21 were to be repeated to fabricate modules similar to those shown in Figure 12. It was also evident for the skilled person that such modules had to comprise vias in order to connect the conductors of the different layers. Moreover, "cycloolefin resin" as claimed meant that the resin was derived from a cycloolefin monomer. In document D10 it was described that the polymer used

for the insulating layer was made from 4,4'-bisbenzo-cyclobutene, which was a cycloolefin as could be seen from documents D15 and D18. The subject-matter of claim 1 of the main request and the first auxiliary request was therefore not new over document D10.

The respondent argues that in the module of Examples 21 and 43 of document D10 there was no one-to-one correspondence between conducting layers and insulating layers, which was however implied by the wording of claim 1 of the main request and the first auxiliary request. Furthermore, the via holes were not filled up by electroplating as claimed, but the insulation material was instead pressed down to surround the via hole conductors. This led to a different microstructure of the vias. Moreover, according to the convention accepted in chemistry - see documents D17, D19 and D26 - the term "cycloolefin" had a well-defined technical meaning, namely a non-aromatic unsaturated cyclic hydrocarbon. However, as could be seen from document D20, benzocyclobutene was a polycyclic aromatic hydrocarbon and was not encompassed by the well-defined term "cycloolefin". Furthermore, in Example 21 of D10 an oligomer was used which was not a resin. The subject-matter of claim 1 of the main request and the first auxiliary request was therefore new over document D10.

b) Admission of the sets of claims according to the second to sixth auxiliary requests

The appellant argues that according to Article 12 RPBA the time to file the auxiliary requests was with the reply to the grounds of appeal. The auxiliary requests were thus filed late. Furthermore, the amendments made in relation to these requests raised new issues, such

as whether they were properly supported or whether the claimed subject-matter was broadened, which would not be allowable due to the prohibition of *reformation in peius*. The sets of claims according to the second to sixth auxiliary requests should therefore not be admitted to the proceedings.

The respondent argues that the filing of the auxiliary requests were a reaction to the amendments of the appellant's case. Furthermore, since the appellant still had the possibility to pursue national nullity proceedings, whereas the respondent had no further legal means for reviving a patent after it had been revoked, the auxiliary requests should be admitted in order to ensure a fair balance between the parties.

c) Second auxiliary request - novelty

The appellant is of the opinion that subject-matter of claim 1 of the second auxiliary request was still not new over document D10.

The respondent argues that the features $(a)_2$ and $(d)_2$ of claim 1 of the second auxiliary request were not disclosed in document D10.

d) Third auxiliary request - inventive step

The appellant is of the opinion that the subject-matter of claim 1 of the third auxiliary request differed from the device of document D13 in that the insulating layer was composed of a cycloolefin resin. There was no evidence for a significant effect of the distinguishing feature; in particular, Table 1 of the opposed patent provided no such evidence as the first two Examples (Examples 12 and 13 in the patent as granted) were not

according to the invention and the insulating layer used for the last Example (Comparative Example 3 in the patent as granted), namely polyolefin resin, was different from the preferred insulating layer used in D13, namely polyimide. Any technical effect of the distinguishing feature derivable from Table 2 of document D4, in particular concerning the values of the dielectric constant and loss tangent was known and not unexpected and could not contribute to inventive step. The objective technical problem was therefore to provide an alternative insulating layer. In document D13 it was stated that an insulating layer with good properties with respect to insulation and heat resistance was preferred (see paragraphs [0044] and [0048]). Document D4 disclosed an insulating layer made of cycloolefin resin which also had these properties and would therefore be considered by the skilled person for use in the device of document D13. The subject-matter of claim 1 of the third auxiliary request lacked therefore an inventive step.

The respondent agrees with the appellant in that the distinguishing feature of the claimed subject-matter over document D13 was that the insulating layer was made of a cycloolefin resin. Table 1 of the opposed patent showed that the claimed invention achieved an increased peeling strength and also a reduced resistance change. Even though in the last Example in that Table (Comparative Example 3 in the patent as granted), a thermosetting linear polyolefin resin was used, it was evident from the patent that the advantages also resulted in comparison to other insulating materials, epoxy resin being mentioned explicitly in paragraph [0067] of the patent. The objective technical problem was therefore to increase the peeling strength and the reliability of the device.

As document D13 provided suitable insulating materials, there was no motivation for the skilled person to combine the teaching of document D13 with that of document D4. Furthermore, the skilled person would not have isolated the feature of the insulating layer being made of a cycloolefin resin from the other characteristics of the device disclosed in document D4, in particular the via holes being not filled. The claimed subject-matter involved therefore an inventive step.

e) Fourth and fifth auxiliary requests - inventive step

The appellant argues that document D4 disclosed the specific resins claimed in claim 1 according to the fourth and fifth auxiliary request. Therefore, the subject-matter of that claim did not involve an inventive step over the combination of documents D13 and D4, either.

The respondent does not dispute that document D4 disclosed the specific claimed resins.

f) Sixth auxiliary request - inventive step

The appellant argues that hot lamination was already known from document D4 (paragraph [0132]) and was furthermore one of the simplest possibilities to attach the insulating layer to the conductor circuit. The skilled person would therefore use hot lamination in order to manufacture the device resulting from the combination of documents D13 and D4.

The respondent argues that document D13 disclosed various ways of attaching the insulating layer such as

spin coating and that there was no motivation to use the hot lamination method disclosed in document D4 for producing the device of document D13.

Reasons for the Decision

1. The appeal is admissible.

2. Main request and first auxiliary request - novelty

2.1 The appellant argues that the subject-matter of claim 1 of the main request and the first auxiliary request was not new over document D10.

2.2 Document D10 discloses (see column 1, lines 24-53; Figures 9(a) to 9(e)) that a metallic under-conductor layer 92 which serves as an electrode for plating, is formed over the entire area of an upper surface of a substrate 91 (Figure 9(a)). A resist 93 patterned to define a desired conductor line pattern is formed on the upper surface of the metallic layer 92 (Figure 9(b)). Plating is then conducted using the metallic layer 92 as electrode so that the openings 94 in the resist 93 are filled with a conductor 95 to form conductors, via-hole conductors, glands, or through-hole conductors (Figure 9(c)). After the resist 93 is removed (Figure 9(d)), the under-conductor layer 92 is removed at portions not covered by the conductors 95 (Figure 9(e)).

In relation to Example 21 it is disclosed in document D10 (see column 4, lines 7-11; column 50, lines 7-47; Figures 16(a) to 16(c)) that after conductor lines had been fabricated in advance following the steps of Figures 9(a) through 9(e) a hot plate was coated with a

coating of a 4,4'-bisbenzocyclobutene oligomer and pressed down against the conductor lines 404. A load was then applied to the hot plate 401 and the oligomer 402 was caused to melt and flow into the spaces 405 to fill them out. The hot plate was heated and the oligomer was cured resulting in a polymer. After the hot plate was removed, the surface of the conductor layer was etched off by dry-etching. Conductor layers were overlaid one by one in this manner, whereby a desired, interconnected 10-layer board was fabricated.

Finally, in relation to Example 43 it is disclosed in document D10 (see column 57, lines 21-32; Figure 12) that using the interconnected multilayer boards fabricated in Examples 21-42, modules similar to that shown in Figure 12 was fabricated.

2.3 The opposition division held in the appealed decision that document D10 did not show the feature that a conductor circuit and a resin insulating layer were built up on a substrate board successively and alternately at a plurality of levels (see Reason 3.1 of the decision).

The respondent remarks that in the device of Examples 21 and 43 there was no one-to-one correspondence between conducting layers and insulating layers, which was however implied by feature (a) of claim 1 of the main request and the first auxiliary request.

2.4 As mentioned above it is explicitly mentioned in relation to Example 21 of document D10 that the method of fabrication of conductor lines embedded in the insulating layer described with reference to Figures 9(a) to 9(e) and 16(a) to 16(c) is to be repeated so that a desired, interconnected 10-layer board was

fabricated (D10, column 50, lines 42-47). Furthermore, in relation to example 43 it is mentioned that by using the interconnected multilayer boards fabricated in Examples 21-42, modules similar to that shown in Figure 12 are fabricated, in which a multilayer structure is shown with reference sign 106. A multilayer board comprising alternating insulating and conducting layers is therefore disclosed in document D10.

The stated one-to-one correspondence between conducting layers and insulating layers is not considered to be implied by the wording of the claim, e. g. a structure in which there are two insulating layers for each conducting layer is still regarded to fall under the wording of the claim. Hence, when the polymer insulating layer of the multilayer board of Examples 21 and 43 which separates two conductor circuits is identified as the claimed "resin insulating layer", such a board is considered to exhibit the claimed structure of alternating and successive conducting and insulating layers.

Hence, document D10 discloses, using the wording of claim 1 of the main request and the first auxiliary request, a multilayer printed circuit board (multilayer board) comprising a substrate board (substrate 403) and, as built up on said substrate board successively and alternately, a conductor circuit (conductor lines 404) and a resin insulating layer (polymer layer 402 between successive conductor lines 404) at a plurality of levels, with said conductor circuits (conductor lines 404) being interconnected by way of via holes (via holes connecting the successive conductor lines 404).

2.5 In the decision under appeal the opposition division was of the opinion that document D10 described via holes which were filled up by electroplating (*ibid.*).

The respondent argues that in the module of Examples 21 and 43 of document D10 the via holes were not filled up by electroplating, but the insulation material was instead pressed down to surround the via hole conductors. This led to a different microstructure of the vias.

2.6 In the description of Example 21 of document D10 explicit reference is made to Figures 9(a) through 9(e) in relation to the fabrication of the conductor lines of the interconnected multilayer board (D10, column 50, lines 9-13). As it is described in relation to these Figures that not only conductors, but also via-hole conductors and through-hole conductors are fabricated by electroplating (column 1, lines 34-39), it is considered to be implicitly disclosed in document D10 that the vias of the interconnected multilayer board of Example 21 are also fabricated by electroplating. The vias of this known multilayer board are therefore regarded to exhibit the microstructure implied by the wording of feature (d) of claim 1 of the main request and the first auxiliary request.

Feature (d) of claim 1 of the main request and the first auxiliary request defines the device in terms of process features relating to how it was produced. Judging from the finished device the board is convinced that it is possible to establish whether or not the vias were produced by electroplating. However, the method feature "filled up by electroplating" does not distinguish between a device where the insulating layer is formed prior to forming the vias or *vice versa*.

Hence, it is irrelevant for the purposes of the assessment of novelty that the vias in the insulating layer of example 21 of document D10 are in fact fabricated by pressing down insulation material to surround the via conductors.

Document D10 is therefore also considered to disclose in combination with the features mentioned under point 2.4 above that the via holes are composed of filled via holes which are filled up by electroplating.

2.7 Finally, the opposition division held in the appealed decision that document D10 disclosed a resin insulating layer which comprised a cycloolefin resin (*ibid.*).

It is common ground between the parties that the expression "cycloolefin resin" denotes a resin obtained by a cycloolefin compound.

The respondent argues that in Example 21 of D10 an oligomer was used to produce the insulating layer and that this was not a resin. However, the board notes that in the description of that Example it is stated that the oligomer was heated and cured under pressure thus resulting in a polymer (D10, column 50, lines 31-42), which corresponds to the manner in which the claimed resin is produced (see the opposed patent, page 18, lines 24-27). Therefore the board holds that the polymer layer of document D10 is to be considered a resin within the meaning of that term in claim 1 of the main request and the first auxiliary request.

The respondent argued further that "cycloolefin" had a well-defined technical meaning as could be seen from documents D17, D19 and D26, namely that of a non-aromatic unsaturated cyclic hydrocarbon. On the other

hand, document D20 showed that benzocyclobutene was a polycyclic aromatic hydrocarbon and was therefore not encompassed by the term "cycloolefin".

However, the board is satisfied that - as can be seen from document D15, which belongs to the technical field of circuit boards - the expression "cycloolefin resin" is used by the person skilled in the art of circuit boards as encompassing those resins based on benzocyclobutene. This is not regarded to be in contradiction to the definitions contained in documents D17, D19, D20 and D26, which relate to the respective *compounds*.

In document D10 it is disclosed that the polymer of Example 21 is obtained from a 4,4'-bisbenzocyclobutene oligomer (D10, column 50, lines 14-19). The resulting resin is thus considered to be a cycloolefin resin within the meaning of claim 1 of the main request and the first auxiliary request (feature (c) of that claim).

Consequently, the subject-matter of claim 1 of the main request and the first auxiliary request is not new (Article 52(1) EPC and Article 54(1) EPC 1973).

3. Admission of the sets of claims according to the second to sixth auxiliary requests

The respondent filed new sets of claims according to the second to sixth auxiliary requests after having filed the reply to the appellant's letter setting out the grounds of appeal. The question thus arises whether these sets of claims should be admitted into the appeal proceedings (Article 13(1) RPBA).

The appellant argues that the new sets of claims raised new issues, such as whether they were properly supported or whether the claimed subject-matter was broadened, which would not be allowable due to the prohibition of *reformation in peius*. However, even though the new sets of claims were not filed in direct response to the filing of the new document D16, which was filed by the appellant with the letter setting out the grounds of appeal, the board accepts that these new sets of claims were induced by the filing of that document. Furthermore, the amendments effected in relation to the claims are relatively minor and partly based on the dependent claims. Finally, the appellant had ample opportunities to deal with these issues in letters filed after the new sets of claims had been filed and the board sees no reasons why the board should not be in a position to deal with these sets of claims.

Therefore, the board exercised its discretion under Article 13(1) RPBA to admit these sets of claims into the proceedings.

4. Second auxiliary request - novelty

Claim 1 of the second auxiliary request differs from claim 1 of the main request in that features (a) and (d) are replaced by features $(a)_2$ and $(d)_2$, respectively (see point VI above). The respondent argues that these new features were not disclosed in document D10.

In the replacement features $(a)_2$ and $(d)_2$ it is specified that the resin insulating layer has openings for via holes and that the via holes are made up of an electroplating film filling up the openings. However, the polymer insulating layer of the multilayer board of

document D10's Examples 21 and 43 which separates two conductor circuits necessarily has openings for the vias of the interconnected multilayer board. These vias are fabricated by electroplating as pointed out under point 2.6 above and are thus inevitably made up of an electroplating film.

Consequently, the subject-matter of claim 1 of the second auxiliary request is not new, either (Article 52(1) EPC and Article 54(1) EPC 1973).

5. Third auxiliary request - inventive step

5.1 Documents D13 and D4

5.1.1 Document D13 discloses (see paragraphs [0039]-[0042], [0051], [0054], [0056], [0072]-[0074] and Figures 6 and 7(a) to 7(g) in the corresponding English translation D13a) a multilayer interconnection board having an insulating substrate 1, second and third insulating layers 2 and 3, a first wiring layer composed of conductive pattern 4 and land 5, a second wiring layer composed of conductive pattern 8 and land on the via 7 and third wiring layer composed of conductive pattern 12 and the land on the via 10. The conductive pattern 8 and the via 7 with the corresponding land are formed on the second insulating layer 2 by electroless copper plating and subsequent copper electroplating. The multilayer wiring board of Figure 6 can be formed by repeating the steps shown in Figures 7(b) to 7(g).

5.1.2 The opposition division held that document D4 was published before the valid priority date of claims 1 to 6 of the main request then on file, which correspond to claims 1 to 6 of the main and first auxiliary requests, and was therefore relevant for the assessment of

novelty and inventive step (see Reason 4.1 of the decision). This was not challenged by the respondent and the board sees no reasons to differ in this respect from the opposition division's finding, which also holds for the more restricted sets of claims according to the third to sixth auxiliary requests (Articles 54(2) and 89 EPC 1973).

Document D4 relates to (see the corresponding European application D4a, paragraphs [0001], [0129]-[0138]) insulating materials containing a cycloolefin polymer and their uses. In particular, the production of a multi-layer laminate comprising a substrate with alternating metal wiring layers and interlayer insulating layers made of such insulating material is described. Such a multi-layer laminate can be used, for example, as a high-density assembly board.

5.2 Closest state of the art

In the decision under appeal the opposition division considered document D4 the closest state of the art and was of the opinion that the claimed invention involved an inventive step *inter alia* in view of document D13.

During the appeal proceedings both parties agreed that document D13 should be considered the closest state of the art. This document discloses subject-matter that is conceived for the same purpose as the invention, namely for providing a multilayer printed circuit board, has many relevant technical features in common with it, as detailed below, and is regarded to be a realistic starting point when considering obviousness. Document D13 is therefore regarded as the closest state of the art.

5.3 Distinguishing features

5.3.1 Both parties agree that the subject-matter of claim 1 of the second auxiliary request differs from the device of document D13 in that the insulating layer is composed of a cycloolefin resin.

5.3.2 Using the wording of claim 1 of the third auxiliary request, document D13 discloses a multilayer printed circuit board (multilayer interconnection board) comprising a substrate board (insulating substrate 1) and, as built up on said substrate board successively and alternately, a conductor circuit (second and third wiring layers) and a resin insulating layer (second and third insulating layers 2 and 3) at a plurality of levels, with said conductor circuits (second and third wiring layers) being interconnected by way of via holes (vias 7 and 10), wherein the via holes (of vias 7 and 10) of the resin insulating layer of each level (second insulating layer 2, respectively third insulating layer 3) are filled up by electroplating the conductor circuit of the successive level (second wiring layer, respectively third wiring layer).

5.3.3 Document D13 discloses that the resin of the insulating layers may be chosen from various resins, one preferred resin being polyimide (paragraphs [0048]-[0049]).

The subject-matter of claim 1 of the third auxiliary request differs therefore indeed from the device of document 13 in that the resin insulating layer is composed of a cycloolefin resin (part of feature $(a)_3$, see point VI above).

5.4 Objective technical problem

5.4.1 The respondent argues that Table 1 of the opposed patent showed that the claimed invention achieved an increased peeling strength and a reduced resistance change.

The appellant argues that the first two Examples of Table 1 of the opposed patent (Examples 12 and 13 in the patent as granted) were not according to the invention as they did not have the feature of via holes that were filled up by electroplating.

5.4.2 However, in the board's opinion the only difference of the third Example in Table 1 of the opposed patent with respect to the first two Examples is the composition of the insulating material (see paragraph [0122] of the opposed patent). The effects reported in the Table are thus due to this difference and are unrelated to the feature of via holes filled up by electroplating.

On the other hand, in the last Example a thermosetting linear polyolefin resin is used as the resin for construction of the insulating layer, whereas in the device according to document D13 the insulating layer is made of a different material, e. g. polyimide. Furthermore, as only a single type of cycloolefin resin is used in the first two Examples of Table 1 of the opposed patent (see paragraph [0121] of the opposed patent), doubts are raised whether the reported effects occur for all cycloolefin resins.

It is therefore not convincingly shown that an increased peeling strength and a reduced resistance change are effects that are actually achieved in relation to the closest state of the art by the distinguishing features over the entire claimed range.

5.4.3 Table 2 of document D4 shows various properties of eight laminated wiring circuit boards having different cycloolefin insulating layers and of three Comparative Examples (see D4a, paragraphs [0172]-[0183]; Table 2). In Comparative Example 1 a photosensitive polyimide interlayer insulating film is used and exposed to ultraviolet light using a test pattern mask for the formation of via holes (D4a, paragraph [0180]). Polyimide is also mentioned in document D13 as a material for making the insulating layer, even though it is stated that this is the preferred material when it is *not* required that the resin is photosensitive and the via holes can thus be formed by laser processing or the like (D13a, paragraphs [0049]-[0050]). The other materials usable for the insulating layer mentioned in document D13, namely urethane acrylate, epoxy acrylate and aliphatic acrylate (D13a, paragraph [0049]) are not mentioned in document D4 and it does therefore not emerge from that document what properties wiring circuit boards with insulating layers made of these materials would have.

Moreover, the cycloolefin compounds of Examples 1 to 8 of Table 2 of document D4 are of limited diversity, for example those of Examples 1 to 5 all comprise 2-norbornene. It is therefore doubtful whether the properties of Examples 1 to 8 listed in Table 2 are representative for wiring circuit boards having insulating layers comprising *any* cycloolefin compound.

In view of the above the board is not convinced that any effect deduced from the properties provided in Table 2 of document D4 is actually achieved in relation to the closest state of the art by the distinguishing features over the entire claimed range.

5.4.4 The board concludes therefore that the objective technical problem must be formulated in a less ambitious way and agrees with the appellant that the objective technical problem is to provide an alternative insulating layer.

5.5 Obviousness over D13 and D4

Document D4 belongs to the technical field of circuit boards and would therefore be consulted by the skilled person in that field when attempting to solve the posed objective technical problem.

The appellant points out that it is stated in document D13 that an insulating layer with good properties in insulation and heat resistance was preferred (see D13a, paragraphs [0044] and [0048]). Document D4 discloses insulating layers for circuit boards made of cycloolefin resin which also has these properties (see D4a, Table 2 and also paragraphs [0017], [0024] and [0107]). The board agrees thus with the appellant that the skilled person would consider an insulating layer composed of a cycloolefin resin when attempting to provide an alternative insulating layer.

The respondent argues that the skilled person would not have isolated the feature of the insulating layer being made of a cycloolefin resin from the other characteristics of the device of document D4, in particular the via holes being not filled. The insulating layer being made of a cycloolefin resin is however not considered to be technically related to the via holes being not filled. The skilled person would thus have considered replacing the insulating layer of the device of document D13 by the cycloolefin layer without changing any other of its features.

Finally, the respondent argues that there was no motivation for the skilled person to combine the teaching of document D13 with that of document D4. The board considers however that for the above reasons the skilled person would in fact be motivated to combine the teachings of these documents even in the absence of any explicit pointers to that effect in any document.

Therefore, the subject-matter of claim 1 of the third auxiliary request does not involve an inventive step (Article 52(1) EPC and Article 56 EPC 1973).

6. Fourth and fifth auxiliary requests - inventive step

6.1 Claim 1 of the fifth auxiliary request differs from claim 1 of the third auxiliary request in that it comprises additionally feature (e), in which it is specified that the cycloolefin resin is a homopolymer or copolymer of 2-norbornene, 5-ethylidene-2-norbornene and/or any of their derivatives, the derivates including said cycloolefins to which an amino group, a maleic anhydride residue or a maleic acid-modified group for crosslinking has been attached (see point VI above).

The parties agree that specific cycloolefin resins falling under the list specified in feature (e) have already been disclosed in document D4. The board sees no reason to differ (see D4a, paragraphs [0154]-[0161]).

For the reasons mentioned under point 5 above the skilled person would have considered such a specific cycloolefin resin as disclosed in document D4 when attempting to provide an alternative insulating layer.

Therefore, the subject-matter of claim 1 of the fifth auxiliary request does not involve an inventive step (Article 52(1) EPC and Article 56 EPC 1973).

6.2 Claim 1 of the fourth auxiliary request is worded in somewhat broader terms than claim 1 of the fifth auxiliary request. For reasons corresponding to those under points 5 and 6.1 above, the subject-matter of that claim does not involve an inventive step, either (Article 52(1) EPC and Article 56 EPC 1973).

7. Sixth auxiliary request - inventive step

7.1 Closest state of the art, distinguishing features

As for claim 1 of the third auxiliary request, document D13 is considered the closest state of the art.

That document discloses (see the translation D13a), using the wording of claim 1 of the sixth auxiliary request, a process for manufacturing a multilayer printed circuit board (multilayer interconnection board) comprising a substrate board (insulating substrate 1) and, as built up on said substrate board successively and alternately, a conductor circuit (second and third wiring layers) and a resin insulating layer (second and third insulating layers 2 and 3) at a plurality of levels, with said conductor circuits (second and third wiring layers) being interconnected by way of via holes (vias 7 and 10), whereby the process comprises

providing openings (through-holes) for via holes in the interlayer resin insulating layer (second and third insulating layers 2 and 3) (paragraph [0050]);

forming a thin-film metal layer (thin metal layer

6) by physical vapor deposition, chemical vapor deposition or electroless plating (paragraph [0051]); and

performing electroplating to construct a conductor circuit (second and third wiring layers) and to fill up the via holes by said electroplating (paragraph [0056]).

The subject-matter of claim 1 of the sixth auxiliary request differs - as both parties agree - from the process known from document D13 in that

- the resin insulating layer is composed of a cycloolefin resin

and in comprising the step of

- laminating a film comprising cycloolefin resin on a conductor circuit formed on said substrate board by press lamination of an interlayer resin insulating layer under vacuum or reduced pressure.

7.2 Objective technical problem

The two distinguishing features are evidently related as they both concern the cycloolefin insulating layer. In view of the considerations under point 5.4 above the objective technical problem is to implement a process for manufacturing a multilayer printed circuit board comprising an alternative insulating layer.

7.3 Obviousness over D13 and D4

The respondent argues that document D13 disclosed various ways of attaching the insulating layer such as spin coating and that there was no motivation to use the hot lamination method disclosed in document D4 for producing the device of document D13.

However, in order to implement the process for manufacturing the circuit board comprising an alternative insulating layer the skilled person would naturally consider using the process steps most suited for fabricating the alternative insulating layer. With respect to the cycloolefin insulating layer document D4 teaches to use lamination by hot pressing or press bonding under reduced pressure (see document D4a, paragraph [0132]). It would therefore be obvious for the skilled person to implement the desired process using such a lamination step. Therefore and for the reasons under point 5 above, it would be obvious for the skilled person to arrive at the claimed subject-matter.

Consequently, the subject-matter of claim 1 of the sixth auxiliary request does not involve an inventive step (Article 52(1) EPC and Article 56 EPC 1973).

8. Conclusion

As none of the requests contains an allowable set of claims the patent has to be revoked (Article 101(3)(b) EPC and Article 111(1) EPC 1973).

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:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated