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D E C I S I O N
of 20 January 2005

Case Number: T 0168/01 - 3.3.7

Application Number: 95932964.0

Publication Number: 0733683

IPC: C09D 11/10

Language of the proceedings: EN

Title of invention:

Photosolder resist ink, printed circuit board, and process for producing the same

Applicant:

Goo Chemical Co., Ltd.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 87, 123(2)

Keyword:

"Amendments - allowable (yes) "

"First application - (no) "

"Novelty - (no) "

Decisions cited:

T 0198/84, T 0666/89

Catchword:

-



Case Number: T 0168/01 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 20 January 2005

Appellants:

Goo Chemical Co., Ltd.
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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 12 September 2000
refusing European patent application
No. 95932964.0 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. E. Teschemacher
Members: G. Santavicca
B. J. M. Struif

Summary of Facts and Submissions

I. European patent application 95 932 964.0 was filed as international patent application PCT/JP95/02017 on 2 October 1995 (published as WO-A-96/11239), claiming a priority of 5 October 1994 based on application JP 26831/94. The translation of the international application filed in accordance with Article 158(2) EPC contained the following independent claims:

"1. A photosensitive solder resist ink capable of development with a dilute alkaline solution which comprises:

- (A) an ultraviolet-curable resin containing 0-20 wt% of aromatic ring moiety which is obtained by reacting a polymer composed of (a) 40-100 mol% of ethylenically unsaturated monomer having an epoxy group and (b) 0-60 mol% of ethylenically unsaturated monomer capable of copolymerization therewith, with (meth)acrylic acid in an amount of 0.7-1.2 equivalents per epoxy equivalent of said polymer and with a saturated or unsaturated polybasic acid anhydride;
- (B) an epoxy compound soluble in a diluent;
- (C) a photopolymerization initiator; and
- (D) a diluent.";

"5. A printed circuit board on which a prescribed solder resist pattern is formed from the photosensitive resist ink defined in any of Claims 1 to 4.";

"6. A process for producing a printed circuit board which comprises forming on the board a prescribed

solder resist pattern from the photosensitive resist ink defined in any of Claims 1 to 4."

II. In a decision posted on 12 September 2000, the Examining Division refused the application. That decision was based on Claim 1 enclosed in the applicants' letter dated 22 June 1999 and Claims 2 to 7 as filed. Claim 1 read as follows (amendments to Claim 1 as filed in bold):

"1. A photosensitive solder resist ink capable of development with a dilute alkaline solution which comprises:

- (A) an ultraviolet-curable resin **having a weight-average molecular weight of 5,000 to 100,000 and an acid value in the range of 25 to 150** containing 0-20 wt% of **an aromatic ring moiety wherein said resin** is obtained by reacting a polymer composed of (a) 40-100 mol% of ethylenically unsaturated monomer having an epoxy group and (b) 0-60 mol% of ethylenically unsaturated monomer capable of copolymerisation therewith, with (meth)acrylic acid in an amount of 0.7-1.2 equivalents per epoxy equivalent of said polymer and with a saturated or unsaturated polybasic acid anhydride;
- (B) an epoxy compound soluble in **the following (D)** diluent;
- (C) a photopolymerisation initiator; and
- (D) a diluent."

The Examining Division held that:

- (a) Amended Claim 1 fulfilled the requirements of Article 123(2) EPC.

- (b) D1 (JP-A-7 072 624, in the form of an English translation filed by the applicants with letter dated 22 June 1999 and of Derwent Abstract AN: 95-149890), assigned to the same applicant, was filed before the priority date of the application under examination. However, it was published between the priority and the filing dates of the application under examination.

- (c) D1 disclosed the subject-matter of amended Claims 1 to 7. The argument that the claimed subject-matter was a selection over the subject-matter of D1 could not be followed, since specific technical teachings of D1 fell within the definition of the amended claims. Therefore, Japanese application JP 268310/94, from which priority was claimed, was not the first application within the meaning of Article 87 EPC. Consequently, Claims 1 to 7 only enjoyed the effective filing date of 2 October 1995.

- (d) Since D1 was published on 17 March 1995, it belonged to the state of the art under Article 54(2) EPC. Since D1 also disclosed the subject-matter of Claims 1 to 7 under examination, the claimed subject-matter therefore lacked novelty.

- (e) Consequently, the application should be refused.

III. On 21 November 2000, the applicants lodged an appeal against that decision and paid the fee for appeal on

22 November 2000. Their statement setting out the grounds of appeal was received on 11 December 2000.

- IV. On 27 October 2004, in an annex to the summons to oral proceedings, the Board gave a preliminary view on the points to be discussed during the oral proceedings.
- V. The appellants replied that they would not attend oral proceedings (letter dated 3 December 2004). In their final submissions on the matter dated 10 December 2004, the appellants mentioned a new document (EP-A-0 323 563, hereinafter D4) and enclosed an amended Claim 1, which, together with granted Claims 2 to 7, constituted a first and sole auxiliary request. Claim 1 according to that auxiliary request reads as follows (Amendments to Claim 1 as filed in bold):

"1. A photosensitive solder resist ink capable of development with a dilute alkaline solution which comprises:

- (A) an ultraviolet-curable resin **having a weight-average molecular weight of 5,000 to 100,000, as measured by GPC, and an acid value in the range of 25 to 150** containing 0-20 wt% of **an** aromatic ring moiety, **wherein said resin** is obtained by reacting a polymer composed of (a) 40-100 mol% of ethylenically unsaturated monomer having an epoxy group and (b) 0-60 mol% of ethylenically unsaturated monomer capable of copolymerisation therewith, with (meth)acrylic acid in an amount of 0.7-1.2 equivalents per epoxy equivalent of said polymer and with a saturated or unsaturated polybasic acid anhydride;

- (B) an epoxy compound soluble in **the following (D)** diluent;
- (C) a photopolymerisation initiator; and
- (D) a diluent."

VI. Oral proceedings were held on 20 January 2005 in the absence of the appellants, in compliance with Rule 71(2) EPC.

VII. The arguments of the appellants can be summarised as follows:

- (a) The term "soluble in a diluent" applied to epoxy compound (B) in Claim 1 was distinct from the term "slightly soluble in a diluent" disclosed in the prior art. This was well known and well understood by the person skilled in the art. In fact, D4 showed that epoxy compounds which were "sparingly soluble", i.e. "slightly soluble in a diluent", were distinct from epoxy compounds which were "soluble in a diluent". Therefore, the two terms clearly referred to distinct compounds.
- (b) D1 used thermosetting compounds in form of a fine powder which was slightly soluble in the diluent. D4 disclosed that only a part of the sparingly soluble epoxy compound could be replaced by a soluble epoxy compound in order to maintain the desired properties. In contrast thereto, the present invention allowed the "soluble" epoxy compound to be used alone, without producing problems such as poor development and resolution. Thus, the claimed subject-matter went against the common practice in the industry.

- (c) There were significant differences between the claimed subject-matter and the disclosure of D1:
- (i) The content of the aromatic constituent, which should not be higher than 20%, was narrow compared to up to 100% in D1;
 - (ii) An aromatic compound such as an epoxy compound should be used as the thermosetting component in order to give a more satisfactory product than that obtained in D1;
 - (iii) Since that epoxy compound should be "soluble" in the diluent, this considerably limited the number of suitable thermosetting compounds mentioned in D1;
 - (iv) Although D1 listed both of the "sparingly soluble" and the "soluble" epoxy compounds as suitable thermosetting components, the examples in D1 only used a thermosetting compound such as TEPIC-S, i.e. a fine-powder epoxy-compound being only slightly soluble in the diluent. In contrast thereto, the examples of the priority application used epoxy-compound such as EPICRON N-695, EON-503H, EXA-7200H, EPIKOTE 828, DENACOL EX-212, none of which was disclosed in D1. Thus, the examples in D1 were far removed from the claimed subject-matter;

- (v) Also, the weight-average molecular weight of the ultraviolet curable resin could be much greater than that taught in D1 and nevertheless resulted in a satisfactory resin.

It followed from those distinctions that the subject-matter claimed in the present application as well as in the priority application was a purposive selection invention over D1.

- (d) Since all the conditions for a selection invention as established in T 198/84 (OJ EPO 1985, 209) were fulfilled, the priority application of the present application was the first application which disclosed the claimed subject-matter.
- (e) Therefore, D1, which was published after the priority date of the application, was no prior art under the EPC.
- (f) As regards the auxiliary request, Claim 1 made clear how to determine the molecular weight, i.e. by GPC (Gel Permeation Chromatography).

VIII. The appellants requested that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims underlying the decision under appeal, auxiliarily on the basis of an amended Claim 1 submitted with letter dated 10 December 2004.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Amendments*

2.1 Compared to Claim 1 as filed, Claim 1 according to the main request contains the following amendments:

(a) "having a weight-average molecular weight of 5 000 to 100 000";

(b) "and an acid value in the range of 25 to 150"; and,

(c) "the following".

2.2 The amendments have a basis in the description as filed: Amendment (a), paragraph bridging pages 9 and 10; amendment (b), page 12, last paragraph, second sentence; amendment (c), page 14, first paragraph, first sentence.

2.3 Hence, 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 (Article 123(2) EPC).

2.4 Therefore, the main request is admissible.

3. *Novelty*

3.1 According to Claim 1 under examination, a photosensitive solder resist ink should be capable of

development with a dilute alkaline solution and comprise components (A) to (d) as specified. The term "comprises" in Claim 1 is not restricting, it does not exclude the possible presence of further components in the claimed resist. In fact, according to the description of the application in suit, the resist ink can include further components such as:

- (a) An epoxy compound which is slightly soluble in the diluent in an amount not harmful to electrocorrosion and heat resistances; and,
- (b) An ultraviolet-curable epoxy acrylate (page 19, first full paragraph and last paragraph, of the application as filed).

Therefore, the argument of the appellants that the resist of Claim 1 uses the soluble epoxy compound "alone" is not convincing.

3.2 D1 discloses a resist ink for producing printed circuit boards, comprising a photosensitive resin composition which is developable with a dilute, alkaline aqueous solution and which comprises;

A. an ultraviolet-curable resin having a weight-average molecular weight of from 6,000 to 30,000, which is obtained by reacting a polymer comprising (a) from 60 to 100 mol% of glycidyl (meth)acrylate and (b) from 0 to 40 mol% of other ethylenically unsaturated monomer(s) copolymerizable with (a), with from 0.7 to 1.2 chemical equivalents, relative to one epoxy equivalent of the polymer, of (meth)acrylic acid and with a saturated or unsaturated, polybasic acid anhydride,

B. a photo-polymerization initiator,

C. a diluent, and

D. a thermo-setting component comprising a thermo-setting epoxy compound (Claim 4 in connection with Claims 1 and 2).

Also, D1 concerns a solder resist formed from the resist ink of claim 4, on a substrate (Claim 6), as well as a printed circuit board produced by using the resist ink of Claim 4 (Claim 7).

3.2.1 The definition of ultraviolet-curable resin (A) in Claim 1 of D1 is narrower than, but encompassed by, the definition of ultraviolet-curable resin (A) in Claim 1 under examination. According to D1, ultraviolet-curable resin (A) has an acid value of preferably from 25 to 150, more preferably of from 40 to 100 (paragraph bridging pages 16 and 17, in particular first sentence on page 17) and can include an aromatic ring moiety. In fact, resin (A) used in Example A-3 of D1, which is identical to Synthesis Example 2 of the application under examination, has a content of aromatic ring moiety of 4 wt% (Table 1).

Finally, Production Examples A-2, A-3, A-4 and A-5 of D1 are identical to Synthesis Examples 1, 2, 3 and 4 of the application in suit (compare Table 1 in D1 with Table 1 in the present application as filed).

Therefore, ultraviolet-curable resin (A) of the photosensitive solder resist ink of D1 includes all of

the features pertaining to the ultraviolet-curable resin (A) defined in Claim 1 in suit.

3.2.2 The definition of photo-polymerization initiator (B) in Claim 4 of D1 is identical to the definition of photo-polymerization initiator (C) in Claim 1 of the application under examination. Furthermore, D1 mentions that the initiator may be selected among a number of suitable compounds (paragraph bridging pages 17 and 18), which are also mentioned in the application under examination as filed (paragraph bridging pages 15 and 16). Therefore, D1 discloses that a photo-polymerization initiator as defined in Claim 1 in suit is present in the solder resist ink composition.

3.2.3 Also, D1 mentions suitable diluents (C), in particular organic solvents, more particularly carbitols. The same compounds are mentioned in the application under examination as suitable diluent (D) (compare page 19, in particular the last paragraph on page 19 of D1 with the first full paragraph on page 18 of the application in suit). Although the application in suit also mentions petroleum-based aromatic mixed solvents such as Swasol and Solvesso, which are not part of the compounds listed in D1, Swasol is nevertheless exemplified in D1 (Table 2 and note 6). Also carbitol acetate (Table 1) and dipentaerythritol hexaacrylate (Table 2) are exemplified in D1, as well as in the examples of the present application. Therefore, the diluents mentioned or exemplified in D1 are identical to those mentioned and exemplified as suitable component (D) in the application in suit, so that they fall under the definition of Claim 1 in suit.

3.2.4 D1 does not expressly indicate that thermosetting epoxy component (D) should be soluble in diluent (C). However, D1 mentions preferred epoxy resins suitable as component (D) (paragraph bridging pages 20 and 21 of D1). Suitable epoxy resins are bisphenol A-type epoxy resins, bisphenol F-type epoxy resins, phenol-novolak epoxy resins, cresol novolak type epoxy resins, N-glycidyl epoxy resins, alicyclic epoxy resins such as "EHPE-3150" and hydrogenated bisphenol A-type epoxy resins as well as epoxy resins such as triglycidyl isocyanurate and "YX-4000". In particular, according to D1, the "especially favorable resins are triglycidyl isocyanurate, "YX-4000" and cresol novolak-type epoxy resin (page 21, last sentence of the first, incomplete paragraph). In the examples of D1 (Table 2), the epoxy resin used is TEPIC-S (Note 2 of Table 2), which is a triglycidyl isocyanurate resin.

3.2.5 According to the definition of Component (B) in Claim 1 of the application under examination, epoxy compound (B) should be soluble in diluent (D). In particular, that epoxy compound can be an aromatic epoxy resin (Claim 3 of the application in suit), more particularly it can be selected from the group consisting of bisphenol-A type epoxy resin and novolak type epoxy resin (Claim 4). According to the description of the application in suit (first paragraph on page 15), the novolak type resins can be the phenol novolak epoxy resin, the cresol novolak epoxy resin and the bis-phenol-A type novolak epoxy resin. Further, resins such as bisphenol A-type epoxy resins, bisphenol F-type epoxy resins, phenol-novolak epoxy resins, cresol novolak type epoxy resins, N-glycidyl epoxy resins, alicyclic epoxy resins such as "EHPE-3150" and hydrogenated bisphenol A-type epoxy

resins are soluble in the defined diluents, whereas resins such as triglycidyl isocyanurate and "YX-4000" are only slightly soluble in the defined diluents (application under examination: page 4, lines 2-4; page 6, lines 12-14; Comparative Example 4 and Note 7 in Table 3).

3.2.6 Although D1 exemplifies the use of a slightly soluble resin such as TEPIC, i.e. a triglycidyl isocyanurate, it nevertheless explicitly mentions that cresol novolak-type epoxy resins, which are soluble in the diluents, are also especially favorable.

3.2.7 According to the established case law of the Boards of Appeal of the EPO (4th edition, 2001, I.C.2.7, in particular in connection with T 666/89, OJ EPO 1993, 495, Reasons, point 5), not only the examples of a document should be regarded as state of the art but also the whole content of a citation should be considered when deciding on the question of novelty. In applying this principle, the evaluation has therefore not to be confined merely to a comparison of the claimed subject-matter with the examples of D1, but has to extend to all the information contained in the earlier document. Hence, it has to be established what has been made available to the skilled person reading the specification of D1.

3.2.8 In the present case, diluent-soluble, cresol novolak-type epoxy resins are also especially favourable, i.e. they are mentioned by D1 on the same level of choice than a triglycidyl isocyanurate which is slightly soluble in a diluent. Further preferred resins mentioned in D1, such as bisphenol-A resins, are also soluble in the diluent in the sense of the application in suit. Thus, although D1 exemplifies embodiments wherein the first most favourable resin mentioned is used, that disclosure of D1 represents a situation where a single list of specifically mentioned, equally favourable alternatives to TEPIC is given, from which any suitable alternative to TEPIC can be taken. Consequently, the skilled person would seriously contemplate using a cresol novolak-type epoxy resin, or even a bisphenol-A epoxy resin, in the resist composition, instead of TEPIC.

3.2.9 It follows from the above analysis, that the disclosure of D1 cannot be restricted to the exemplified compositions and that it makes available further embodiments which, instead of TEPIC, can use cresol novolak-type epoxy resin or bisphenol-A type epoxy resin with a diluent in which they are soluble.

3.2.10 Thus, D1 makes available a photosensitive sensitive solder resist ink having the features as defined in Claim 1 according to the main request.

3.3 It follows from the above, that D1 is the first application disclosing the claimed subject-matter (Article 87(1) EPC). Thus, the application in suit cannot enjoy the priority right of JP 268310/94, with the consequence that Article 89 EPC is not applicable

and its effective date is its filing date of 2 October 1995, i.e. after the publication date of D1 (17 March 1995).

- 3.4 Since D1 is state of the art pursuant to Article 54(2) EPC, and since it discloses all of the features in combination as claimed, as set out above, the subject-matter of Claim 1 according to the main request is not novel.

Auxiliary request

4. *Amendments*

Compared to Claim 1 according to the main request, Claim 1 of the auxiliary request contains the following amendment: "as measured by GPC". The amendment has a basis in the description as filed, page 21, [Measurement of weight-average molecular weight]. Hence, 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 (Article 123(2) EPC). Therefore, the auxiliary request is admissible.

5. *Novelty*

- 5.1 D1 discloses that the weight-average molecular weight of the ultraviolet-curable resin is measured by GPC, i.e. under conditions corresponding to those disclosed in the application in suit (paragraph bridging pages 23 and 24 of D1).

5.2 Consequently, for the reasons given above (points 3.2-3.4), also the subject-matter of Claim 1 according to the auxiliary request lacks novelty over the resist disclosed in D1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

C. Eickhoff

R. Teschemacher