BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 5 August 1999

Case Number: T 0599/95 - 3.4.3

Application Number: 85301674.9

Publication Number: 0157508

IPC: H01L 21/302

Language of the proceedings: EN

Title of invention:
Thin adhesive sheet for use in working semiconductor wafers

Patentee:
Nitto Denko Corporation

Opponent:
Suzuki, Tohru

Headword:
-

Relevant legal provisions:
EPC Art. 123(2), 54, 56

Keyword:
"Main request and auxiliary request:
Amendments (generalisation by way of a functional feature) - not allowable under Article 123(2) EPC"
"Auxiliary request A:
Novelty (yes - no unambiguous disclosure of a feature in the prior art)"
"Inventive step (no)"

Decisions cited:
T 0176/89, T 0284/94

Catchword:

-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0599/95 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 5 August 1999

Appellant: (Proprietor of the patent)
Nitto Denko Corporation
1-2, Shimohozumi 1-chome
Ibaraki-shi
Osaka (JP)

Representative:
Bubb, Antony John Allen
Chancery House
Chancery Lane
London WC2A 1QU (GB)

Respondent: (Opponent)
Suzuki, Tohru
Berudomiru Saginuma 102
18-13 Saginuma 1-chome Miyamae-ku
Kawasaki-shi
Kanagawa (JP)

Representative:
Kador, Ulrich, Dr.
Corneliusstrasse 15
80469 München (DE)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 17 May 1995 revoking European patent No. 0 157 508 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: R. K. Shukla

Members: M. Chomentowski
A. C. G. Lindqvist

Summary of Facts and Submissions

I. European patent No. 0 157 508 was revoked by the decision of the opposition division, dated 17 March 1995, on the grounds that the patent, in the amended form according to a main request and an auxiliary request, lacked novelty and an inventive step, respectively, having regard to prior art documents D1 = JP-A-50164/83 and D3 = WO 81/00309.

Claim 1 of the main request was for **a thin adhesive sheet** for use in working semiconductor wafers, said sheet comprising a light permeable support and a pressure-sensitive adhesive layer provided thereon. The composition of the adhesive layer was specified to be 100 parts by weight of a rubber or acrylic polymer, 1 to 100 parts of a photopolymerizable compound having a number average molecular weight of 10,000 or less and containing at least two photopolymerizable carbon-carbon double bonds, and 0.1 to 5 parts of a photopolymerization initiator. Mechanical properties, in particular the peeling adhesive force of this layer when attached to a semiconductor wafer, before and after curing the adhesive layer with light, respectively, were specified in the claim, the irradiation with light forming a three-dimensional network structure and lessening the adhesive force of the layer.

The auxiliary request differed from the main request in that it was directed to the "Use of a thin adhesive sheet ... in the working of semiconductor wafers", all

the features of the adhesive sheet itself being the same.

The Opposition Division took the view that the claimed adhesive sheet of the main request was not distinguished from that disclosed in document D1 since the adhesive sheet of document D1 contained the same components in the same amount and was prepared in an identical way as that of the main request, so that it had all the properties of the claimed adhesive sheet even though these properties were not explicitly stated in document D1.

The Opposition Division took the following view in respect of the auxiliary request:

Since document D1 did not mention the use of the known adhesive sheet with a semiconductor wafer, and since document D3 concerned the use of adhesive sheets with semiconductor wafers, the adhesive sheet having however another composition, the subject-matter of the claim was new.

Starting from document D3, dealing with the same problem as the patent in suit, i.e. providing a temporary support for, inter alia, semiconductor wafers, it would be obvious for the skilled person who learns from document D3 that the adhesive layer was suitable for glass and aluminium plates, to look for another adhesive sheet which could be used with glass and aluminium plates and which showed the same useful properties, and he would thus be incited to at least try, with a reasonable expectation of success, the adhesive sheet of document D1 and thus arrive in an

obvious way at the use of the adhesive sheet as set out in claim 1 of the auxiliary request.

II. The patent proprietor lodged an appeal against this decision on 14 July 1995 paying the appeal fee on 17 July 1995 and filed the statement of the grounds of appeal on 17 September 1995.

III. In response to observations by the respondent (opponent), the appellant (patent proprietor) filed with the letter dated 14 August 1997 amended claims 1 forming, respectively, the basis of a main request and an auxiliary request (hereinafter "Auxiliary request").

Claim 1 of the auxiliary request has the following wording, wherein the amendments in relation to claim 1 of the auxiliary request forming the basis of the contested decision have been emphasized by the Board.

"1. Use of a thin adhesive sheet comprising a light-permeable support and provided thereon a pressure-sensitive adhesive layer which is **radically polymerized and** cured by irradiation with light to form a three-dimensional network structure,

wherein the pressure-sensitive adhesive layer is a composition comprising by weight 100 parts of a rubber or acrylic polymer, from 10 to 100 parts of a photopolymerizable compound having a number average molecular weight of 10,000 or less and containing at least two photopolymerizable carbon-carbon double bonds in the molecule, and from 0.1 to 5 parts of a photopolymerization initiator, and the 180° peeling

adhesive force of said adhesive layer to a semiconductor wafer (as determined at a peeling speed of 300 mm/min) on a unit width of 20 mm is 2 N (200 g/20 mm) or more, and after irradiation with light decreases to 1.5 N (150 g/20 mm) or less, in the working of semiconductor wafers."

IV. The respondent filed new arguments and two Declarations by Mr Kazuyoshi EBE on 5 July 1999 and 9 July 1999, respectively. The Declarations comprised the results of measurements of various properties of the adhesive film of Example 1 of document D1 carried out under the supervision of Mr EBE.

V. During the oral proceedings of 5 August 1999, the appellant filed a new main request and an auxiliary request A, and requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the text of claim 1 of the main request, or of claim 1 of the auxiliary request filed on 14 August 1997 (see item III above) or claim 1 of the auxiliary request A.

Claims 1 of the main request and the auxiliary request A read as follows:

"1. A method of working semiconductor wafers by bonding a thin adhesive sheet for use in working of semiconductor wafers to a surface of the semiconductor wafer, the thin adhesive sheet comprising a light-permeable support and provided thereon a pressure-sensitive adhesive layer which is **radically polymerized and** cured by irradiation with light to form a three-dimensional network structure,

characterized in that the pressure-sensitive adhesive layer is a composition comprising by weight 100 parts of a rubber or acrylic polymer, from 10 to 100 parts of a low molecular weight compound having a number average molecular weight of 10,000 or less and containing at least two photopolymerizable carbon-carbon double bonds in the molecule, and from 0.1 to 5 parts of a photopolymerization initiator, the 180° peeling adhesive force of the adhesive layer to a semiconductor wafer (as determined at a peeling speed of 300 mm/min) on a unit width of 20 mm is 2N (200 g/20 mm) or more, and after irradiation with light, decreases to 1.5 N (150 g/20 mm) or less."

Auxiliary request A is in substance identical with the main request but does not comprise the feature "radically polymerized and", and it reads as follows:

"1. A method of working semiconductor wafers by bonding a thin adhesive sheet for use in the working of semiconductor wafers to a surface of the semiconductor wafer, the thin adhesive sheet comprising a light-permeable support and provided thereon a pressure-sensitive adhesive layer which is cured by irradiation with light to form a three-dimensional network structure, characterized in that the pressure-sensitive adhesive layer is a composition comprising by weight 100 parts of a rubber or acrylic polymer, from 10 to 100 parts of a low molecular weight compound having a number average molecular weight of 10,000 or less and containing at least two photopolymerizable carbon-carbon double bonds in the molecule, and from 0.1 to 5 parts of a photopolymerization initiator, the 180° peeling

adhesive force of the adhesive layer to a semiconductor wafer (as determined at a peeling speed of 300 mm/min) on a unit width of 20 mm is 2 N (200 g/20 mm) or more, and after irradiation with light, decreases to 1.5 N (150 g/20 mm) or less."

VI. The appellant submitted the following arguments in support of his requests:

The main and the auxiliary request:

The terms "radically polymerized" are admissible because the skilled person reading the original disclosure, in particular the list of the cited photoinitiators, would understand from his general knowledge, based for instance on the document "Photoinitiator Effectiveness in Curing Trifunctional Acrylate Monomers", by B.L.Brann et al., in "AFP SME Technical Papers, 1986, Society of Manufacturing Engineers, Dearborn, Michigan, USA, pages 4.57 to 4.68, that the patent in suit only concerns the type of adhesives which are radically polymerized.

The auxiliary request A:

Since the term "metallic" in document D1 is vague and since the skilled person would understand that silicon is generally not considered as a metallic product, he would not find therein any indication of silicon or a semiconductor whatsoever. Since moreover the material of the adhesive layer of document D3 is different, the subject-matter of the claim is new.

Document D3 concerns an adhesive sheet for processing

silicon, and is thus the appropriate starting point for the claimed method. It is submitted that it is not permissible, when considering inventive step, to combine the teaching of the closest prior art document with the teaching of another separate document if such combination would involve the loss of the essential feature of the closest prior art itself, i.e., the loss of the technical contribution made by this closest prior art document itself. This is already derivable from the decision T 176/89 of 27 June 1990. Therefore, the subject-matter of the auxiliary request A involves an inventive step because a combination of documents D3 and D1 should not be permitted.

VII. The respondent (opponent) argued in substance as follows in support of his request that the appeal be dismissed and that the European patent remain revoked:

The auxiliary request:

The terms "radically polymerized" are not to be found in the original disclosure. This amendment provides in place of the list of particular products cited in the original description, a "functional feature" which generalizes the subject-matter of the application, and this is not admissible because it covers possible equivalents which could result in new particular embodiments (cf. the decision T 284/94, OJ EPO 1999, 464).

The auxiliary request A:

On the basis of the dictionaries cited in the appeal

proceedings, it can be considered that silicon is a metallic product, or at least has properties such that it can be considered as being metallic. Therefore, since the adhesive sheet of document D1 is the same as that of the patent in suit, the method of the auxiliary request A is not new.

Starting for instance from document D3, which concerns an adhesive sheet for processing not only silicon, but also glass plates and aluminium plates, and which comprises the same three components as the adhesive sheet of the method in dispute, there is an incentive to look for better products for the adhesive sheet because some of the results shown in this document need improvement. Therefore, since in particular document D1 is for a method using an adhesive layer of the same type whereby also glass plates and aluminium plates are processed, the skilled person would not be restricted to the particular products of document D3 but would in an obvious way take into account the teaching of document D1, i.e. the adhesive sheet composition of the present claim.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 Admissibility of the amendments (Article 123 EPC)

2.1.1 Claim 1 of the main request has been amended in

relation to claim 1 as granted, *inter alia*, in that the pressure-sensitive adhesive sheet is **radically polymerized** by irradiation with light.

2.1.2 In connection with the allowability of the above amendment pursuant to Article 123(2) EPC the appellant has submitted the following arguments:

The description of the application as filed (see page 7, line 21 to page 8, line 4) contains examples of photopolymerization initiators which can be used with the photopolymerizable compounds listed directly above in the description; all the examples of photoinitiators cited in said text location are generally known to the person skilled in the art of polymerization chemistry as being of the type wherein the polymerization of the photopolymerizable compound takes place by free radicals.

It is further mentioned in the original description (see page 12, lines 1 to 7) that, when the pressure-sensitive adhesive layer is irradiated with light, the photopolymerizable compound is polymerized and, at the same time, free radicals are generated in the base polymer, and the thus excited base polymer reacts with the photopolymerizable compound; as a result, the pressure-sensitive adhesive layer is cured, thereby forming the three-dimensional network structure.

Moreover, the above-mentioned document "Photoinitiator Effectiveness in Curing Trifunctional Acrylate Monomers" contains information about the function of the photoinitiator in photopolymerization and the way it works, in particular by generating radicals which

will initiate a reaction in an uncured coating resulting in a cured polymer.

It has not been disputed that, in the method known from document D3, the photoinitiators and photopolymerizable compounds are specific ionic photoinitiators capable of promoting the polymerization of oxirane rings, i.e. both products are distinguished from the photoinitiator and the photopolymerizable compound of the invention in suit, which concerns compounds containing at least two photopolymerizable carbon-carbon double bonds in the molecule, and the corresponding photopolymerization initiator.

Therefore, the skilled person would directly and unambiguously understand that, on the basis of the information in the application as originally filed and of his general knowledge, only pressure-sensitive adhesive layers which are **radically polymerized and** cured by irradiation with light to form a three-dimensional network structure, and not other types of photoinitiators, such as the ionic ones of document D3, are to be taken into consideration.

2.1.3 The Board is however of the view that the amendment "radically polymerized" contravenes Article 123(2) EPC for the following reasons:

There is no specific disclosure of the expression "radically polymerized" in the application as filed. Moreover, as submitted by the respondent, this expression is a functional generalization of the list of photopolymerization initiators disclosed on page 7,

line 21 to page 8, line 4 of the European patent application as filed. Such a generalization covers functional equivalents of the photoinitiators, for which there is no basis in the original European patent application. From the passage on page 12 of the original description cited by the appellant (see item 2.1.2 above), it is not unambiguously derivable that only the free radicals generated in the base layer are responsible for the polymerization of the pressure sensitive adhesive layer.

2.1.4 For the foregoing reasons, in the Board's judgment, claim 1 of the main request does not satisfy the requirement of Article 123(2) EPC that a European patent may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed.

2.2 Consequently, the appellant's main request is not allowable.

3. *Auxiliary request*

3.1 Admissibility of the amendments

Claim 1 of the auxiliary request concerns the use of a thin adhesive sheet and specifies that the pressure-sensitive adhesive layer is **radically polymerized** by irradiation with light to form a three-dimensional network structure. Claim 1 of the auxiliary request thus contains the same disputed expression and therefore contravenes Article 123(2) EPC for the reasons mentioned in respect of claim 1 of the main request.

4. *Auxiliary request A*

4.1 Admissibility of the amendments (Article 123(2) EPC)

Claim 1 has been amended in relation to claim 1 as filed, *inter alia*, in that

(i) it relates to a **method** of working semiconductor wafers by bonding a thin adhesive sheet to it, and not to a thin adhesive sheet, and

(ii) the amount of low molecular weight compound in the pressure-sensitive adhesive layer is changed from 1 to 100 parts by weight to 10 to 100 parts by weight.

Contrary to claims 1 of the main and the auxiliary request, claim 1 of the auxiliary request A does not specify that the pressure-sensitive layer is radically polymerized.

The objections against the amendments (i) and (ii) above pursuant to Article 123(2) EPC were not longer maintained by the respondent during the appeal proceedings, and the Board is also satisfied that there are no objections under Article 123(2) EPC in respect of claim 1 as amended.

4.2 Novelty

4.2.1 A method of processing **articles** by bonding a thin adhesive sheet to a surface of the article is known from document D1, the thin adhesive sheet comprising a light-permeable support and provided thereon a

pressure-sensitive adhesive layer which is cured by irradiation with light to form a three-dimensional network structure (see in particular the introduction and Example 1). In document D1 the articles to which the adhesive film can be applied are disclosed to be metallic plates (e.g. stainless steel plates, aluminium plates), painted metallic plates, decorative laminates and glass plates (see page 1, last paragraph).

4.2.1.1 Concerning the thin adhesive sheet:

The adhesive layer according to Example 1 of document D1 comprises 100 parts by weight of an acrylic pressure sensitive adhesive (trade name "Aron 5-1511x, available from Toa Gosei Kagaku), 5 parts of trimethyolpropane triacrylate (a photopolymerizable compound), 0.1 part of benzophenone (a photoinitiator) and 1 part of polyfunctional polyisocyanate.

In connection with the pressure-sensitive adhesive Aron 5-1511x, the respondent submitted in his response to the grounds of appeal a certificate (and its translation in English) issued by the company Toa Gosei Kagaku Kogyo, to demonstrate that the solid content of the pressure sensitive adhesive in Aron 5-1511x is 40.2 % by weight. Based on this amount, it was submitted by the respondent that the amount of the photopolymerizable compound trimethyolpropane triacrylate was 12.4 parts by weight, and thus within the claimed range of 10 to 100 parts by weight. The above evidence and the submission were not disputed by the appellant, and the Board has no reason to dispute the same.

In the Board's view therefore the composition of the adhesive film of Example 1 of document D1 falls within the composition range of the adhesive sheet as claimed in claim 1.

4.2.1.2 Concerning the articles to be processed:

The respondent has argued that it is directly and unambiguously derivable from document D1, which states that the articles to be processed can be metallic plates (e.g., stainless steel plates and aluminium plates), painted metallic plates and glass plates, that the expression "metallic plates" implies silicon plates, i.e. semiconductor plates; indeed, the reference "Kirk-Othmer, Encyclopedia of Chemical Technology, Third Edition, Vol. 20, New-York, 1982, page 846, mentions silicon as a metal, and it is also derivable from the Webster dictionary that silicon has a plurality of properties which are mentioned as being "metallic". Therefore, the skilled person would understand that, in the context of the disclosure in document D1, articles such as metallic plates can be silicon wafers.

The Board however does not agree with the above contention for the following reasons:

As was convincingly argued by the appellant, there are several references in the literature, for instance "Hackh's Chemical Dictionary, Third Edition, The Blakiston Cy, Philadelphia, page 771," which state that silicon is a non-metal, so that it cannot be concluded that, in document D1, "metal" is to be understood directly and unambiguously as meaning also

"semiconductor". Moreover, even by taking the same Webster dictionary cited by the respondent, it can be derived that "metallic" applies to many other meanings such as "metallic voice", "metallic smile", and this shows that the word "metallic" is much too vague to specifically indicate, in an expression such as "metallic plate (e.g. stainless steel plate or aluminium plate)", semiconductors such as silicon.

Therefore, the method of claim 1 of the auxiliary request A is distinguished from the method of document D1 at least in that the adhesive sheet is bonded to a semiconductor wafer.

4.2.2 A method of working semiconductor wafers by bonding a thin adhesive sheet to a surface of the semiconductor wafer, the thin adhesive film comprising a light-permeable support and a pressure-sensitive adhesive layer provided thereon wherein the adhesive layer is cured by irradiation with light to form a three-dimensional network structure, is known from document D3 (see in particular page 1, line 4 to page 2, line 4). However, contrary to claim 1 of auxiliary request A, this known method uses a different thin adhesive sheet.

4.2.3 The further prior art documents are less relevant.

Therefore, in the Board's judgement, the subject-matter of claim 1 of auxiliary request A is new in the sense of Article 54 EPC.

4.3 Inventive step

4.3.1 Document D3 (see page 1, lines 8 to 25) can be regarded as the relevant starting point for the invention according to auxiliary request A

- because it also concerns a method of working semiconductor wafers by bonding a thin adhesive sheet to a surface of the semiconductor wafer wherein the thin adhesive film comprises a light-permeable support and provided thereon a pressure-sensitive adhesive layer which is cured by irradiation with light to form a three-dimensional network structure, and, moreover,

- because this document has the same object as that mentioned in the patent in suit (see page 2, lines 40 to 43; see also lines 3 to 39), which is to provide a thin adhesive sheet having the above-mentioned properties for working semiconductor wafers.

4.3.2 Thus, starting from document D3, an object of the present invention can be seen in providing an alternative thin adhesive sheets for working semiconductor wafers.

It has not been disputed that D3 (see page 9, line 1 to page 11, line 4, in particular Tables IIA and IIB) teaches the skilled person that the thin adhesive sheets for working semiconductor wafers such as silicon wafers also provide adequate temporary protection in methods for working articles such as **metallic plates, e.g. aluminium plates**, and **glass plates**.

Indeed, document D1 also concerns a method for working (e.g. processing) articles such as **glass plates** or **metallic plates (e.g. aluminium plates)** by using thin adhesive sheets as document D3. Moreover, as can be seen from Table 1 of document D1, the adhesive layer when bonded to a **stainless steel plate** has the adhesive force values, before and after irradiation, falling within the respective ranges according to claim 1.

It was pointed out by the appellant that document D3 discloses an ion-polymerizable composition containing an oxirane ring and an ionic photoinitiator, whereas the present invention and document D1 employ a composition which is radically polymerizable. The skilled person, who, in the present case, is a chemical engineer wishing to improve upon the composition of document D3, it was submitted by the appellant, would in the first place explore other compositions involving ionic polymerization, and would not abandon the novel technical contribution over the state of the art made by document D3 in favour of an adhesive of quite different chemical nature. Decision T 176/89, paragraph 10.2 of the "Reasons for the decision", was cited in support of the above submission.

The Board however cannot follow the above submission, since, as was pointed out by the respondent, the adhesive sheet of document D3 has three components as that of document D1, that is, an acrylic or rubber as a base polymer, a photopolymerizable compound and a photoinitiator, and the only feature distinguishing the composition of the adhesive sheet of document D3

from that of document D1 is that the former does not comprise a double bond in the molecule of the photopolymerizable compound and the corresponding photoinitiator.

Document D3 (see page 2, lines 4 to 26; see also page 11, line 35 to page 12, line 18) teaches two ways of practising the method, one of the ways comprising a step of blending an epoxy resin into an otherwise conventional pressure-sensitive adhesive, drawbacks of such adhesive products being however also mentioned. Thus, there was an incentive for looking for other compounds than those of document D3 and, since such different adhesive compositions were known from document D1 for use with some of the same articles (e.g. glass and aluminium plates), a combination with document D1, resulting in the method of claim 1 of the auxiliary request A, was obvious. Moreover, when the skilled person is looking for an alternative adhesive sheet to that employed in document D3, having similar adhesive properties in respect of silicon wafers, the use of a polymerizable compound having a carbon-carbon double bond known from document D1 in the document D3 does not amount to a combination of conflicting teachings as was the case in decision T 176/89 cited by the appellant.

The new evidence (Declaration by Mr EBE, see item IV above), in the Board's view, was in response to the amendments to claim 1 filed with the grounds of appeal, and cannot therefore be regarded as late filed evidence within the meaning of Article 114(2) EPC.

This evidence, however, is no more relevant than the

disclosure in the cited prior art document D1, according to which the pressure sensitive adhesive sheet has the peeling adhesive force in respect of stainless steel falling within the claimed range of the present invention. Since the compositions of the prior art adhesive sheet and the adhesive sheet of the invention are identical, and since the peeling adhesive force depends upon the physical condition of the surface of the article, and not on its electrical properties, i.e. whether or not it is a semiconductor, the Board sees no reasons why the prior art adhesive sheet of Example 1 of document D1 would not have the peeling adhesive force in respect of a silicon wafer as in claim 1 of the invention. The new evidence therefore does not need to be taken into consideration, and is accordingly disregarded.

For the foregoing reasons, in the Board's judgement, having regard to the documents D3 and D1, the subject-matter of claim 1 of the auxiliary request A is obvious to a skilled person and thus does not involve an inventive step in the sense of Article 56 EPC.

5. Consequently, the European patent cannot be maintained in any of the forms requested by the appellant (Article 102(3) EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Spigarelli R. Shukla