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D E C I S I O N
of 12 July 2004

Case Number: T 0927/02 - 3.4.3

Application Number: 97300463.3

Publication Number: 0786803

IPC: H01L 21/304

Language of the proceedings: EN

Title of invention:

Backing pad and method for polishing semiconductor wafer
therewith

Applicant:

SHIN-ETSU HANDOTAI COMPANY LIMITED

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 123(2)

Keyword:

"Inventive step (yes)"

"Amended subject-matter basis in the application as filed -
(yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0927/02 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 12 July 2004

Appellant:

SHIN-ETSU HANDOTAI COMPANY LIMITED
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Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 16 April 2002
refusing European application No. 97300463.3
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. K. Shukla
Members: G. L. Eliasson
J. P. B. Seitz

Summary of Facts and Submissions

I. In its communication dated 12 November 2001 and annexed to summons to oral proceedings pursuant to Rule 71(1) EPC, the examining division had informed the applicant that the claims 1 to 8 filed with the letter dated 15 August 2000 of European patent application No. 97 300 463.3 did not comply with the requirements of the European Patent Convention. In particular, the application was considered as not complying with the requirements of Article 123(2) EPC and Article 52(1) EPC in combination with Articles 54 and 56 EPC. In its response, the applicant withdrew his request for oral proceedings and requested that a decision be issued according to the state of the file. The examining division refused the European patent application in a decision dispatched on 16 April 2002 for the reason that the objections raised in the above-mentioned official communication were not met.

The following prior art documents were cited by the examining division in its communication dated 12 November 2001:

D1: EP-A-0 578 351;

D2: JP-A-60 099 561 with corresponding Patent Abstracts of Japan; and

D3: WO-A-94 04 599.

II. The appellant (applicant) lodged an appeal on 29 May 2002, paying the appeal fee the same day. A statement of the grounds of appeal was filed on 8 August 2002

together with new claims. With the letter dated 10 October 2002, the appellant requested oral proceedings in advance of any decision to refuse the appeal.

III. In a communication, the Board introduced a complete translation in English of document D2. In response to objections of lack of clarity under Article 84 against claims 1 and 8 in the above communication, the appellant filed amended application documents with the letter dated 3 June 2004.

IV. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of one of the following requests:

Main Request:

Claims 1 to 8 filed on 9 June 2004 with the letter dated 3 June 2004

Description

pages 1 to 3 and 6 to 12 as originally filed
pages 4, 4A and 5 filed on 9 June 2004 with the letter dated 3 June 2004

Drawings Sheets 1/2 to 2/2 as originally filed

First Auxiliary Request:

Claim 1 according to the first auxiliary request as recited in the statement of the grounds of appeal

Second Auxiliary Request:

Claim 1 according to the second auxiliary request as recited in the statement of the grounds of appeal

Oral proceedings were requested in the event that the Board intended to dismiss the appeal.

V. Independent claims 1 and 8 according to the main request read as follows:

"1. A backing pad (1) for use in fixing a wafer (W) on said backing pad (1) by a waxless method when polishing semiconductor wafers, said backing pad (1) comprising a sheeted elastic member having a wafer holding surface (1a); characterised in that: said wafer holding surface (1a) of said sheeted elastic member has a plurality of elongate grooves (2) carved therein and extending to the periphery of the sheeted elastic member."

"8. A method for polishing a semiconductor wafer (W) in which the wafer (W) is fixed on a backing pad by a waxless method, wherein said wafer (W) is supported on a backing pad (1) as set forth in any one of claims 1 to 7."

VI. The objections raised by the examining division can be summarized as follows:

(a) Claim 1 does not meet the requirements of Article 123(2) EPC, since it specifies that the grooves extend to the periphery of the sheeted

elastic member, whereas the application as filed only discloses that the grooves are *formed straight* towards the outer periphery (cf. Figure 1; page 6, lines 21 to 25).

- (b) The subject matter of claims 1 to 4 and 8 is not new having regard to either document D2 (cf. Figures 4 to 11) or document D3 (cf. Figures 7 and 8 with accompanying text) (Article 54 EPC).
- (c) The subject matter of claims 1 to 4 does not involve an inventive step having regard to documents D1 and D2 (Article 56 EPC): The subject matter of claim 1 differs from that of document D1 in that the grooves are elongate and extend to the periphery of the elastic sheet member, whereas in document D1 the grooves are discrete.

The objective problem addressed relates to removing air and water trapped between the wafer and the backing pad. Document D1, however, already addresses the problem of excess water and air (page 5, lines 11 to 15). Furthermore, the surface void ratio at the wafer holding surface is 90 to 98% (page 3, lines 47 to page 4, line 1), which means that a large number of voids will have to overlap which then provide paths for the water and air to escape. Therefore, the need to expel the water is not only immediately evident, but also at least implicitly dealt with and solved in document D1, since this was the reason for having such high surface-void ratio. The skilled person would find the alternative means of using grooves known from document D2.

In document D2, "a water film is formed ... by a surface tension", which implies that wafer is stuck to the back pad with surface tension before it is frozen, i.e. basically the same mechanism as in document D1.

VII. In support of his requests, the appellant provided essentially the following arguments:

- (a) Contrary to the examining division's opinion, claim 1 according to the main request meets the requirements of Article 123(2) EPC objection, since the application as filed explicitly discloses the alternative of having grooves in a curved form (cf. application as filed page 7, lines 3 to 5 or page 3, lines 51 to 52 of the application as published).

- (b) In the device of document D2, the grooves 8 formed in the wafer holding surface 2 are filled with water so that the water slightly protrudes from the grooves due to surface tension. The water protruding from the grooves forms a uniform water film when a wafer 4 is pressed onto the wafer holding surface and the wafer. The wafer is fixed to the backing pad by freezing the water film (cf. abstract). It follows from the above that the grooves do not extend to the periphery of the wafer, since in that case the device of document D2 would not function.

In the claimed device, on the other hand, the grooves extending to the periphery of the elastic

sheeted member permit the expulsion of excess water and air which may be trapped in pockets between the wafer and the wafer holding surface when the wafer is pressed to the wafer holding surface.

(c) Document D3 relates to a polishing pad and not to a backing pad and a polishing pad is not suitable as a backing pad. Therefore, the subject matter of claim 1 according to the main request is new with respect to document D3.

(d) Document D1 discloses an elastic sheeted member having *discrete* bubbles (cf. abstract, page 3, line 41, page 4, lines 37 and 40, page 6, line 58, claim 1, Figures 1 to 4). As to the void ratio 90-98% referred to by the examining division, this is disclosed in claim 3 which depends on claim 1, which specifies that the bubbles are discrete. Furthermore, it is disclosed on page 5, lines 30 to 32 that "the lateral walls of the bubbles on the surface side [being] sufficiently thin owing to the large void ratio of the surface of the foamed layer". It is thus clear from document D1 that the bubbles are intended to be discrete, and are not intended to overlap in the manner suggested by the examining division.

The argument of the examining division is founded on the premise that the maximum void surface ratio of closely packed, rigid circles is 90.69%, so that a ratio range of 90 to 98% implies that the voids must overlap. This argument overlooks the

fact that the cells/bubbles are of a foam material and are neither perfectly circular nor rigid.

- (e) As to inventive step, document D1 is concerned with improving flatness and solves this problem by using a foamed layer in which the discrete bubbles are uniform in size, shape, orientation, and distribution (cf. page 5, lines 30 to 35).

Since document D1 does not disclose voids which are overlapping and document D2 relates to a different fixing mechanism (frozen water) from that of document D1, it would be illogical to combine the teachings of documents D1 and D2.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. *Amendments - Main request*

With respect to claim 1 as filed, claim 1 according to the main request further specifies that the plurality of elongate grooves extend to the periphery of the elastic sheeted member. This is disclosed in Figure 1 of the application as filed showing straight grooves 2 extending to the periphery of the elastic sheeted member (cf. application as published, page 3, lines 39 to 42), together with the statement that the grooves do not necessarily have to be formed straight (cf. page 3, lines 50 to 52 of the application as published).

Thus, contrary to the finding in the communication of the examining division, claim 1 as amended according to the main request is based on the application as filed (cf. item VI(a) above) and its subject matter does not extend beyond the content of the application as filed. Therefore, the application meets the requirements of Article 123(2) EPC.

3. *Novelty - Main request*

3.1 Document D1 discloses a backing pad for use in fixing a wafer by a waxless method when polishing semiconductor wafers. The backing pad comprises a sheeted elastic member having a plurality of slender discrete bubbles (cf. abstract). According to document D1, in order to improve the flatness of the wafer to be polished, the slender discrete bubbles should have substantially equal size and shape and should be erected parallel to one another and dispersed at substantially equal pitch in the width direction (cf. page 3, lines 1 to 15 and 39 to 49). Preferably, the surface void ratio should be 90 to 98% (cf. claim 3).

3.1.1 In its communication, the examining division held that close-packed, rigid circles can only attain a surface void ratio of 90.69% without overlap, and therefore, the high surface void ratio disclosed in document D1 (90 to 98%) implies that at least some the bubbles in the device of document D1 are not "discrete" but overlapping (cf. item VI(c) above).

3.1.2 The appellant argued, on the other hand, that the examining division based their finding on the assumption that the bubbles in the sheeted elastic

member could be considered as rigid circles, an assumption which is not supported by the disclosure of document D1 (cf. item VII(d) above).

- 3.1.3 The Board agrees with the appellant that document D1 consistently discloses that the bubbles are discrete (cf. e.g. abstract; page 4, lines 37 to 41). Figure 2 furthermore shows a plan view of the sheeted elastic member where the bubbles 6 have shapes which deviate significantly from circular shape. As convincingly argued by the appellant, it is possible to obtain surface void ratios substantially higher than 90.69% when the bubbles are not required to have circular shape.

Furthermore, according to document D1, the wafer is held to the wafer holding surface by a vacuum produced by expulsion of water through the voids (bubbles) of the sheeted elastic member (cf. page 7, lines 30 to 35; as well as page 5, lines 11 to 15). If a vacuum or suction were to be produced, then the bubbles at the wafer holding surface must be discrete.

- 3.1.4 Thus, the subject matter of claim 1 according to the main request differs from the device of document D1 in that the wafer holding surface of the sheeted elastic member has a plurality of elongate grooves carved therein which extend to the periphery of the sheeted elastic member, whereas in document D1, the wafer holding surface has a plurality of *discrete* bubble formed therein.

- 3.2 Document D2 discloses a backing pad 1 for fixing a wafer for polishing, where a plurality of grooves or

holes 8 are formed in the wafer holding surface 2 of the backing pad (cf. abstract; Figures 1 to 13). Before the wafer is mounted, the grooves 8 are filled with water so that the water slightly protrudes from the grooves 8 due to surface tension. When a wafer 7 is pressed down onto the wafer holding surface 2, the protruding water forms a uniform water film. The water film is subsequently frozen to fix the wafer to the backing pad (cf. translation, page 2, last paragraph to page 3).

3.2.1 As the appellant convincingly pointed out, it follows from the above that the grooves 8 in the device cannot extend to the periphery of the wafer holding surface 2, since otherwise, water would not be contained in the grooves (cf. item VII(b) above). The Board furthermore notes that document D2 does not disclose that the wafer holding surface 2, in which the grooves 8 are carved, is made of a sheeted elastic member.

3.2.2 Thus, the subject matter of claim 1 according to the main request is new with respect to document D2, since it differs from the device of document D2 in that (i) the grooves in the wafer holding surface extend to the periphery of the elastic sheeted member, whereas in the device of document D2, the grooves do not extend to the periphery; and (ii) the wafer holding surface is formed in a sheeted elastic member, whereas document D2 does not disclose any particular properties of the material in which the grooves are carved.

3.3 Document D3 discloses a *polishing pad* for polishing semiconductor wafers, which is made of a polymeric matrix impregnated with polymeric microelements which

each have a void space therein (cf. abstract). Thus, the Board agrees with the appellant that document D3 does not disclose a backing pad for use in fixing a wafer when polishing semiconductor wafers, and therefore, does not disclose the device of claim 1.

3.4 The subject matter of claim 1 according to the main request is thus new.

4. *Inventive step - Main request*

4.1 Document D1 is considered the closest prior art, since as in the claimed device, it discloses a backing pad comprising a sheeted elastic member having a wafer holding surface.

4.2 As stated under item 3.1.4 above, the subject matter of claim 1 according to the main request differs from the device of document D1 in that the wafer holding surface of the sheeted elastic member has a plurality of elongate grooves carved therein which extend to the periphery of the sheeted elastic member, whereas in document D1, the wafer holding surface has a plurality of *discrete* bubble formed therein.

4.3 As mentioned in the application in suit, the device of document D1 has the disadvantage that pockets of excess air or water trapped between the wafer and the wafer holding surface may not be removed completely, since the bubbles are discrete. This can result in a wafer which after polishing does not have uniform thickness (cf. application as published, page 2, 53 to page 3, line 3).

- 4.4 The examining division referred to page 5, lines 11 to 15 of document D1 to argue that document D1 also discusses the problem of removing excess air and water trapped between the wafer and the wafer holding surface (cf. item VI(c) above). The Board finds however that the cited passage refers to removing excess water before the wafer is fixed to the backing pad, so that a suction effect is produced in the sheeted elastic member for fixing the wafer by squeezing the sheeted elastic member like a sponge (cf. page 7, lines 30 to 35; the term "aspiration" is used on page 5, line 14, whereas "vacuum" is used on page 7, line 35). The problem addressed by the application in suit, however, relates to removing pockets of excess air or water which may be trapped between the wafer and the wafer holding surface after that the wafer has been fixed.
- 4.5 Although the problem of improving the flatness of the polished wafers is addressed in document D1, the solution offered therein is to produce *discrete* bubbles in the wafer holding surface which have uniform size and shape and are uniformly distributed over the wafer holding surface (cf. D1, page 3, lines 11 to 15 and 39 to 49).
- 4.6 Since document D2 relates to a completely different technique of attaching the wafers to the backing pad than that employed in document D1, the Board follows the appellant's argument that the skilled person seeking to improve the flatness of wafers which are polished using the device of document D1 would have no reason to consider the teaching of document D2.

4.7 For the above reasons, in the Board's judgement, the subject matter of claim 1 according to the main request involves an inventive step within the meaning of Article 56 EPC.

4.8 Since the method according to independent claim 8 uses the backing pad as defined in claim 1, the subject matter of claim 8 is also novel and involves an inventive step for the same reasons as for claim 1.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of the first instance with the order to grant a patent with the following documents:

Claims 1 to 8 filed on 9 June 2004 with the letter dated 3 June 2004

Description

pages 1 to 3 and 6 to 12 as originally filed
pages 4, 4A and 5 filed on 9 June 2004 with the letter dated 3 June 2004

Drawings Sheets 1/2 to 2/2 as originally filed

The Registrar:

The Chairman:

C. Eickhoff

R. K. Shukla