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**Datasheet for the decision  
of 10 October 2013**

**Case Number:** T 0873/09 - 3.4.03

**Application Number:** 98310071.0

**Publication Number:** 928017

**IPC:** H01L 21/302

**Language of the proceedings:** EN

**Title of invention:**  
Semiconductor wafer processing method

**Applicant:**  
Shin-Etsu Handotai Co., Ltd.

**Headword:**  
-

**Relevant legal provisions (EPC 1973):**  
EPC Art. 56

**Keyword:**  
"Inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0873/09 - 3.4.03

**DECISION**  
of the Technical Board of Appeal 3.4.03  
of 10 October 2013

**Appellant:** Shin-Etsu Handotai Co., Ltd.  
(Applicant) 6-2, Ohtemachi 2-chome  
Chiyoda-ku  
Tokyo (JP)

**Representative:** Wibbelmann, Jobst  
Wuesthoff & Wuesthoff  
Patent- und Rechtsanwälte  
Schweigerstrasse 2  
D-81541 München (DE)

**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 12 January 2009  
refusing European patent application  
No. 98310071.0 pursuant to Article 97(2) EPC.

**Composition of the Board:**

**Chairman:** G. Eliasson  
**Members:** V. L. P. Frank  
P. Mühlens

## Summary of Facts and Submissions

- I. This is an appeal against the refusal of European patent application No. 98 310 071 for the reason that the method of claim 1 of the main request was not new.
- II. The appellant requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

Description:

pages 1, 2, 5, 13-16, 18, 26-29 as originally filed,  
page 3, 3A filed at the oral proceedings of 2 October 2007,  
page 3B, 4, 17, 33 filed with letter dated 1 October 2013,  
pages 6, 11-12, 19, 30, 34 filed with letter dated 23 August 2007,  
pages 7-10, 20-25, 31-32 deleted

Claims:

1-6 filed with letter dated 11 September 2013,

Drawings:

figures 1-6 as originally filed,  
figures 7-10 deleted.

- III. The independent claim of the main request reads as follows:

"1. A method of processing a semiconductor wafer sliced from a monocrystalline ingot, said method comprising at least the steps of chamfering,

lapping, etching, mirror-polishing, and cleaning and wherein, in said etching step, alkali etching is first performed and then acid etching is performed, and an etching amount of the alkali etching is greater than an etching amount of the acid etching, characterized in that a wafer that has undergone the alkali etching is immersed into aqueous solution of hydrogen peroxide before being subjected to the acid etching."

IV. The following document is mentioned in this decision:

D3 = EP 0 754 785 A

V. The examining division pointed out in their communication of 11 January 2005 that a method comprising the features of claims 2 and 3 as filed appeared to be patentable (point 6). The same observation was repeated in the communication of 29 Mai 2007, annexed to the summons to oral proceedings (point 3).

With letter of 23 August 2007 the applicant filed amended main and auxiliary claim requests and description pages corresponding to these requests. Independent claim 1 of the auxiliary request corresponded to the examining division's suggestion.

Oral proceedings before the examining division took place on 2 October 2007. At the oral proceedings the examining division decided to refuse the main request and announced its intention to grant a patent on the basis of the auxiliary request (see the minutes of the oral proceedings). On 14 November 2007 a corresponding

communication under Rule 51(4) EPC mentioning the intention to grant a patent was sent to the applicant. The applicant did not approve the text proposed for grant, maintaining the claims of the main request. The application was consequently refused.

The appellant filed with the statement of grounds of appeal a main request and auxiliary requests A - D, the claims of auxiliary request D corresponding essentially to that of the auxiliary request in examination, and argued why the objections raised by the examining division were not correct.

In a communication annexed to the summons to oral proceedings the board expressed its preliminary view that neither the claims of the main request nor that of auxiliary requests A - C appeared to be allowable. It also objected that the wafer of claims 7 and 8 of auxiliary request D, directed to a chemically etched semiconductor wafer, appeared to lack novelty over the disclosure of document D3.

With letter of 11 September 2013 the appellant withdrew the main request and auxiliary requests A-D and submitted a new main request corresponding to claims 1 to 6 of previous auxiliary request D.

The oral proceedings were thus cancelled.

## Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

Claim 1 is a direct combination of claims 2 and 3 as filed. The requirements of Article 123(2) EPC are thus fulfilled.

3. Novelty and inventive step

3.1 The present application relates to a method for removing, through chemical etching, a damaged layer on the surface of a monocrystalline semiconductor wafer. The conventional process for obtaining a monocrystalline semiconductor wafer typically comprises steps such as slicing a monocrystalline ingot and chamfering and lapping the wafer. These steps damage the wafer's surface layer. Chemical etching removes the damaged layer while maintaining the surface flatness.

3.2 The board considers that document D3 represents the closest state of the art. It discloses in the words of claim 1:

A method of processing a semiconductor wafer sliced from a monocrystalline ingot, said method comprising at least the steps of chamfering, lapping, etching, mirror-polishing, and cleaning and wherein, in said etching step, alkali etching and acid etching are performed (column 1, lines 15-49).

- 3.3 The method of claim 1 differs thus from the conventional method disclosed in document D3 in that
- (a) alkali etching is performed before acid etching,
  - (b) the etching amount of the alkali etching is greater than that of the acid etching, and in that
  - (c) a wafer that has undergone the alkali etching is immersed into an aqueous solution of hydrogen peroxide before being subjected to the acid etching.

3.4 According to the description, alkali etching is performed first and immediately after the step of lapping in order to remove the mechanically damaged layer, while maintaining the flatness of the wafer attained through lapping. Subsequently, acid etching is performed in order to decrease the depth of locally formed deep pits remaining after the alkali etching and to reduce the wafer's surface roughness. The etching amount of the alkali etching is greater than the etching amount of the acid etching in order to decrease the depth of locally formed deep pits remaining after the alkali etching. However, the surface of a wafer that has undergone alkali etching is active and hydrophobic, so that foreign matter easily adheres to the wafer. If the surface of the wafer is oxidized through immersion into an aqueous solution of hydrogen peroxide and thus made hydrophilic, particles hardly adhere to the wafer's surface, improving the result of the process (page 4, line 8 - page 5, line 7).

- 3.5 Hence the problem addressed by the application can be considered as how to improve the conventional method of producing a monocrystalline semiconductor wafer.
- 3.6 None of the available prior art documents discloses in particular the step of immersing the semiconductor wafer in an aqueous solution of hydroxide peroxide between the alkaline and acid etching steps which, according to the application, oxidises the wafer's surface and reduces the adhesion of foreign matter. This allows in turn to improve the results of the subsequent acid etch.
- 3.7 The board shares for these reasons the view of the examining division that the method of processing a semiconductor wafer of claim 1 involves an inventive step within the meaning of Article 56 EPC 1973. As the board is furthermore persuaded that the other requirements of the EPC are met, the appellant's request is allowable.



## 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 first instance with the order to grant a patent in the following version:

#### Description:

pages 1, 2, 5, 13-16, 18, 26-29 as originally filed,  
page 3, 3A filed at the oral proceedings of  
2 October 2007,  
page 3B, 4, 17, 33 filed with letter dated  
1 October 2013,  
pages 6, 11-12, 19, 30, 34 filed with letter dated  
23 August 2007,  
pages 7-10, 20-25, 31-32 deleted

#### Claims:

1-6 filed with letter dated 11 September 2013,

#### Drawings:

figures 1-6 as originally filed,  
figures 7-10 deleted.

Registrar:

Chair:

S. Sánchez Chiquero

G. Eliasson