

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 9 November 2000

Case Number: T 0914/96 - 3.4.3

Application Number: 92 301 710.7

Publication Number: 0 502 663

IPC: H01L 21/76

Language of the proceedings: EN

Title of invention:

Semiconductor device processing method providing isolation regions in a semi-conductor substrate

Applicant:

NCR International, Inc., et al

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes, after amendment)"

Decisions cited:

-

Catchword:

-



Case Number: T 0914/96 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 9 November 2000

Appellant: NCR International, Inc.
1700 South Patterson Boulevard
Dayton
Ohio 45479 (US)

Representative: Gill, David Alan
W.P. Thompson & Co.
Celcon House
289-293 High Holborn
London WC1V 7HU (GB)

Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 20. Mai 1996
refusing European patent application
No. 92 301 710.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: R. K. Shukla
Members: M. Chomentowski
M. B. Günzel

Summary of Facts and Submissions

I. European patent application No. 92 301 710.7 (publication No. 0 502 663), relating to a method providing isolation regions in a semiconductor substrate, was refused by the decision of the Examining Division dated 20 May 1996 on the grounds that the subject-matter of claim 1 lacked an inventive step having regard to prior art documents

D1 = US-A-4 580 330, and

D2 = J.Electrochemical Society, vol. 134, no. 6, pages 1503 to 1507.

II. The applicant lodged an appeal against this decision on 22 July 1996 paying the appeal fee the same day. The statement of the grounds of appeal was filed on 26 September 1996. The appellant requested:

- as a main request that the decision under appeal be set aside, and
- as an auxiliary request that a patent be granted on the basis of a sole claim based on original claim 8 and directed to features indicated by the Examining Division in the communications of 8 March 1995 and 9 February 1996 as being acceptable for the grant of a patent on the application, and a new amended description page 5 disclaiming the embodiment illustrated by Figures 11 to 14.

Moreover, the appellant requested oral proceedings in the event that the above requests were not to be

allowed.

III. In the annex to the summons to oral proceedings, the Board of appeal informed the appellant of its preliminary view that

- the subject-matter of the appellant's main request appeared to lack an inventive step and that
- the claim of the appellant's auxiliary request did not appear to meet the requirement of Article 84 EPC. A modified text of the claim which could meet these objections was indicated by the Board.

IV. In its response dated 17 April 2000 the appellant filed a new text of the only claim corresponding to the text suggested by the Board, together with a modified page 2a of the description. He requested that a patent be granted on this basis, i.e. with the following patent application documents:

Description:

Pages 1, 3, 4 and 6 to 12 of the application as filed;
Page 2 filed by the applicant with the letter dated 24 May 1995;
Page 2a filed with appellant's fax of 17 April 2000;
Page 5 filed with the appellant's letter dated 26 September 1996 (statement of the grounds of appeal);

Claim:

the sole claim filed with appellant's telefax of 17 April 2000;

Drawings:

Sheets 1/12 to 12/12 of the application as filed.

The sole claim reads as follows:

"1. A method of processing a semiconductor device having a silicon substrate (30), comprising the steps of forming a pad oxide layer (33) on said substrate (30), forming a trench (39) through said pad oxide layer (33) and into said silicon substrate (30), blunting the corner (53) of the silicon substrate (30) found at the sidewall of the trench (39) at the point of interface between the silicon substrate (30) and said pad oxide layer (33) by the formation of rounding oxide (40) at said region, forming a silicon nitride protection layer (70) to extend over said rounding oxide at said region, exposing the base of said trench (39) and thermally growing field oxide (43) in said trench (39), exposing said blunted corner (53) and forming an oxide layer (52) to extend over said blunted corner (53), the method comprising the step of, prior to said step of forming said silicon nitride protection layer (70), partially removing said layer of rounding oxide (40) from the side walls of said trench (39) to form substantially planar and parallel surfaces of the rounding oxide on the side walls of the trench."

V. In view of the amendments, the oral proceedings were not considered necessary and were cancelled accordingly.

Reasons for the Decision

1. The appeal is admissible.
2. *Admissibility of the amendments*

The sole claim of appellant's request corresponds to the combination of claim 1 and the dependent claims 2 to 6 and 8 of the application as filed. The Board is satisfied that, because of the successive dependency of these original claims on which the amendments are based, the claim 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).

It is to be noted that Page 5 of the description contains an amendment according to which the first of the two alternate procedures which can be effected after the field implantation shown in Figure 10, i.e. the procedure of Figures 11 to 14, relates to the subject-matter of the invention but does not illustrate an embodiment thereof.

Moreover, since the present sole claim is in the one-part form, the relevant prior art is indicated in the description and the drawings (Rule 29(1) EPC).

Therefore, the Board is satisfied that the description has been amended for consistency with the claimed subject-matter and does not go beyond the content of the application as filed (Article 123(2) EPC).

3. *Novelty and inventive step*

3.1 The Board is satisfied that the subject-matter of the present sole claim does not form part of the state of the art and is new in the sense of Article 54 EPC.

3.2 According to the application in suit (see Figures 1A to 1C, 6, 7 and 7A and the corresponding text), it is an

object of the present invention to provide a process for integrated circuit manufacture in which bird's beaks, i.e. an undesirable profile of the oxide structure near the isolation parts of the devices, may be reduced without causing a structural configuration such as a sharp corner (53) (see Figures 6, 7 and 7A) which induces thinning of a subsequently formed layer at the location prone to bird's beak formation.

In simplified terms, a process according to the invention enables a sharp corner (53) shown in Figures 6 and 7A to be rounded off to create the rounded corner (64) of Figure 7B. The rounding reduces the thinning of the oxide layer formed on the corner (Figure 7A) and promotes the formation of a thicker oxide layer shown in Figure 7B.

The Board agrees with the finding of the Examining Division in particular in its communication of 8 March 1995 (cf. paragraphs 4 to 8) that the step of removing the layer of rounding oxide from the sidewalls of the trench (39) to form substantially planar sidewall surfaces, prior to the step of forming said layer of silicon nitride (70), is not suggested in the prior art. With this step, the sacrificial additional oxide layer (28) of document **D1**, is no more necessary, and this simplifies the method as claimed.

Document **D2** does not show planar and parallel sidewalls of trenches in a semiconductor body and is thus not relevant.

Therefore, in the Board's judgment, for the skilled person, the subject-matter of the present sole claim was not obvious in view of the state of the art and

thus involves an inventive step in the sense of Article 56 EPC.

Order

For these reasons it is decided that:

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

Description:

Pages 1, 3, 4 and 6 to 12 of the application as filed;
Page 2 filed by the applicant with letter dated 24 May 1995;
Page 2a filed with appellant's telefax of 17 April 2000;
Page 5 filed with appellant's letter dated 26 September 1996;

Claim:

the sole claim filed with appellant's telefax of 17 April 2000;

Drawings:

Sheets 1/12 to 12/12 of the application as filed.

The Registrar

The Chairman

L. Martinuzzi

R. Shukla