

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KEVIN L. BEAMAN, JOHN T. MOORE,
and RONALD A. WEIMER

Appeal No. 2006-1181
Application No. 10/393,718

ON BRIEF¹

Before HAIRSTON, BLANKENSHIP and SAADAT, Administrative Patent Judges.

SAADAT, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 19-25. Claims 1-18 have been cancelled.

We affirm.

BACKGROUND

Appellants' invention is directed generally to a method for adjusting the threshold voltage of transistors using a nitridization process and more specifically, to a semiconductor device utilizing such process. According to Appellants, an isolation layer

¹ An oral hearing scheduled for May 24, 2006 has been waived via a facsimile transmission received April 6, 2006.

is formed over a semiconductor substrate as the gate dielectric layer wherein nitrogen is incorporated into the isolation layer to inhibit mobility of charge carriers in the isolation layer (specification, page 5). An understanding of the invention can be derived from a reading of exemplary independent claim 19, which is reproduced as follows:

19. A semiconductor device, comprising:

a semiconductor substrate;

an isolation layer formed on a first surface of the semiconductor substrate;

a gate structure formed on a first surface of the isolation layer, wherein application of a first voltage to the gate structure results in the creation of a depletion region in the region of the semiconductor substrate located adjacent the isolation layer, said first voltage being substantially equal to a threshold voltage of said device; and

wherein a pre-determined amount of nitrogen is incorporated into said isolation layer, said predetermined amount of nitrogen selected to shift the threshold voltage of said device by a pre-selected amount such that the threshold voltage of the device is greater in magnitude than a threshold voltage of an equivalent device without nitrogen incorporation.

The Examiner relies on the following references:

Wristers et al. (Wristers) 5,674,788 Oct. 7, 1997

Stanley Wolf (Wolf), "Silicon Processing for the VLSI Era, Volume 2: Process Integration," Lattice Press, 1990, pp. 298-311.

Claims 19-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Wristers and Wolf.

Rather than reiterate the opposing arguments, reference is made to the briefs (filed December 27, 2004 and March 17, 2005)

and the answer (mailed January 13, 2005) for the respective positions of Appellants and the Examiner. Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but chose not to make in the brief have not been considered (37 CFR § 41.37(c)(1)(vii)).

OPINION

In rejecting the claims under 35 U.S.C. § 103², the Examiner relies on Wristers for showing all the claimed features except for a description of the characteristics of the semiconductor device and creation of a depletion region when the first voltage is applied (answer, page 4). The examiner further relies on Wolf for describing the formation of a depletion region in the substrate in an area adjacent the isolation layer upon application of a voltage that exceeds a threshold voltage (id.).

² The rejection of claim 19 under the first paragraph of 35 U.S.C. § 112, for insufficient written description, stated in the final rejection (mailed May 11, 2005), has been withdrawn by the Examiner (answer, page 6).

Appellants argue that Wristers teaches away from the claimed invention by introducing the isolation layer to a high-pressure nitrogen environment which is different from the claimed plasma nitridization (brief, page 5). Appellants further assert that the resulting structures, as manifested by the nitrogen profiles and depicted in Figures 5 and 6 of Wristers, differ from Appellants' Figure 8 in having a sharp peak concentration profile, in their extent in the isolation layer and concentration uniformity (brief, pages 5-8).

In response, the Examiner disagrees with Appellants' arguments (brief, page 5) that Wristers teaches away from the claimed invention and indicates that the argued processing steps and the resulting nitrogen profile are not recited in the claims (answer, page 6). We agree with the Examiner that the claims merely require that nitrogen be introduced into the isolation layer and shift the threshold voltage by a pre-selected amount that corresponds to the concentration of nitrogen. As pointed out by the Examiner, the specific argued features cannot be included in the broad recitation of shifting the threshold voltage as a result of introducing nitrogen.

Therefore, contrary to Appellants' assertion that Wristers does not teach or suggest an isolation layer having a "predetermined amount of nitrogen" (reply brief, page 2), we observe that the Examiner has properly relied on Wristers for incorporating nitrogen in the gate dielectric layer for increasing the threshold voltage level (col. 3, lines 4-7 and 22-39). Wristers further describes that a sufficient concentration of nitrogen in the isolation layer blocks the penetration of boron atoms and prevents hot electrons from becoming trapped in the isolation layer (col. 8, lines 54-65).

We also find that the claimed invention does not require a specific amount of nitrogen or any of the nitrogen concentration profiles depicted in Appellants' figure 8 (brief, page 8). To the extent claimed, Wristers describes how boron atom penetration in the absence of nitrogen lowers the threshold voltage (col. 3, lines 4-7) whereas a sufficient concentration of nitrogen blocks boron atoms in the isolation layer preventing the decrease in the threshold voltage (col. 8, lines 59-65).

Based on the presented arguments, the weight of evidence in support of each side and our findings above, we find the Examiner's case of *prima facie* obviousness to

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be reasonable and sustain the 35 U.S.C. § 103 rejection of claims 19-25 over
Wristers and Wolf.

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CONCLUSION

To summarize, the decision of the Examiner to reject claims 19-25 under 35 U.S.C. § 103 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a)(1)(iv).

AFFIRMED

MDS

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