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Date of Facsimile

Paul E. Rauch, Ph.D. – Reg. No. 38,591
Name of applicant, assignee or Registered Representative

Signature

4/29/02
Date of Signature

Our Case No. 10200/12
Cypress Ref. No. PM95012D

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
James E. Nulty et al.	)	
Serial No. 09/540,610	)	Examiner Chu, Chris C.
Filing Date: March 31, 2000	)	Group Art Unit No.2815
For Structure Having Reduced Lateral Spacer Erosion	)	

AMENDMENT AND RESPONSE AFTER FINAL

Commissioner for Patents
Washington, D.C. 20231

Dear Madam:

Responsive to the Final Office Action mailed January 9, 2002, Applicants respectfully request reconsideration in light of the following amendments and remarks.

IN THE CLAIMS

Please amend claims 25-27 and 34 as follows.

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25. (Twice Amended) The semiconductor apparatus of claim 27 wherein said etch stop material comprises silicon nitride.

26. (Twice Amended) The semiconductor apparatus of claim 27 wherein said etch stop material comprises silicon dioxide.

27. (Amended) A structure, comprising:

(a) a conductive layer disposed over a substrate;

(b) a first insulating layer on the conductive layer;

(c) a contact region in said first insulating layer;

(d) at least one insulating spacer in the contact region adjacent to the first insulating layer; and

(e) an etch stop material over said first insulating layer and adjacent to the insulating spacer, the etch stop material being a different material from the insulating spacer.

34. (Twice amended) A structure, comprising:

(a) a first electrically conductive material formed in and/or on a surface of a substrate;

(b) a contact opening in a region adjacent to a second electrically conductive material formed on the substrate;

(c) an electrically insulative spacer in the contact opening adjacent to the second electrically conductive material;

(d) an etch stop material over the electrically insulative spacer and the first and second electrically conductive materials, the etch stop material being a different material from the insulative spacer;

(e) a blanket layer over the etch stop material; and

(f) an opening through a first part of the etch stop material to the first electrically conductive material.

SUPPORT FOR AMENDMENT

The amendments of claims 27 and 34 are supported on page 23, ln. 11-12. Claims 25-26 have been amended for clarity. Appendix A, attached herewith, is a marked-up version of the changes made to the claims. No new matter has been added. Claims 25-39 are pending.

REMARKS

Applicants thank the Examiner for the helpful telephone discussion on March 14, 2002. During this discussion, Applicants noted that the claimed invention specifies that the etch stop material is a different material than the insulating spacer.

The present invention relates to a semiconductor device with well defined contact openings. The current practice with respect to forming contact openings during the fabrication of semiconductor devices, particularly self aligned contact openings, is to use etchants with high selectivity to protect underlying regions. However, the properties of a highly selective etch of the overlying etch stop layer can transform a substantially rectangular spacer adjacent to the contact region into a sloped spacer. Before the conductive material is added to the contact opening, the opening is cleaned with a sputter etch whichcan erode a portion of the sloped insulating spacer. Thus, in conventional self-aligned contact structures, the diagonal thickness of the spacer, rather than the vertical thickness of the insulating layer, determines the minimum insulating layer thickness for the gate. Sloping spacers limit the number of structures that can be included on a device.

The present invention avoids this problem by retaining the substantially rectangular profile of the insulating spacers. The present invention includes at least one insulating spacer in the contact region and an etch stop material over the first insulating layer and adjacent to the insulating spacer, the etch stop material being different from the insulating spacer.

Rejections under 35 U.S.C. § 102 and 103

The rejection of the claims under 35 U.S.C. § 102 and 103 over Dennison et al. (U.S. Pat. No. 5,338,700), either alone or in combination with Gonzalez (U.S. Pat. No. 5,234,856), is respectfully traversed. Dennison et al. describes a barrier layer rather

than an etch stop material, and does not suggest that it is a different material from the insulating spacer.

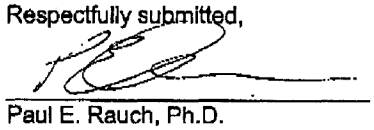
Dennison et al. describes a method of forming a bit line over a capacitor array of memory cells. The semiconductor wafer of Dennison et al. has an array of electrically isolated word lines **12**, **14** and **16** having insulating spacers and caps **18** (Figure 1). The spacers and caps **18** preferably comprise an insulative nitride, such as Si_3N_4 (col. 3, ln. 33-34). The reference further states "a thin layer **20** of Si_3N_4 is provided atop the wafer to function as a diffusion barrier" (col. 3, ln. 34-36). Dennison et al. does not teach or suggest that the spacers and caps **18** and diffusion barrier **20** are different materials. On the contrary, the reference specifically teaches that **18** and **20** are the same material. Furthermore, since **20** is a diffusion barrier, not an etch stop, there would be no reason to use a material distinct from the spacer **18**.

Gonzalez describes a dynamic random access memory cell having a stacked-trench capacitor that is resistant to alpha particle generated soft errors. Gonzalez only describes silicon dioxide in spacers **31** (col. 5, ln. 10-12).

The claimed invention includes an etch stop material that is different from the insulating spacer. The barrier layer of Dennison et al. is described as Si_3N_4, the same material as the spacers. Furthermore, there is no suggestion that they be formed from different materials since the barrier layer is not intended to function as an etch stop layer. The combination with Gonzalez does not correct this deficiency.

Therefore, Applicants submit that Dennison et al., either alone or in combination with Gonzalez, does not anticipate nor make obvious the claimed invention. Withdrawal of the rejection of the claims on these grounds is respectfully requested.

Respectfully submitted,



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APPENDIX A

25. (Twice Amended) The semiconductor apparatus of claim 27 wherein said etch stop [layer] material comprises silicon nitride.

26. (Twice Amended) The semiconductor apparatus of claim 27 wherein said etch stop [layer] material comprises silicon dioxide.

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(d) at least one insulating spacer in the contact region adjacent to the first insulating layer; and

(e) an etch stop material over said first insulating layer and adjacent to the insulating spacer, the etch stop material being a [distinct] different material from the insulating spacer.

34. (Twice amended) A structure, comprising:

(a) a first electrically conductive material formed in and/or on a surface of a substrate;

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(c) an electrically insulative spacer in the contact opening adjacent to the second electrically conductive material;

(d) an etch stop material over the electrically insulative spacer and the first and second electrically conductive materials, the etch stop material being a [distinct] different material from the insulative spacer;

(e) a blanket layer over the etch stop material; and

(f) an opening through a first part of the etch stop material to the first electrically conductive material.