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Paul E. Rauch, Ph.D.
Name of Applicant, assignee or Registered Representative

Signature

Our File No. 09799940-0011

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	
James E. Nulty, et al.	
Serial No. 09/540,610	Examiner Chris C. Chu
Filing Date: March 31, 2000	Group Art Unit No. 2815
For Method for Eliminating Lateral Spacer Erosion on Enclosed Contact Topographies During RF Sputter Cleaning	

AMENDMENT AND REQUEST FOR RECONSIDERATION

Mail Stop - AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Responsive to the Official Action of May 5, 2003 Applicants respectfully request reconsideration in light of the following amendments and remarks.

IN THE CLAIMS

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

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

27. (Currently 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,

wherein the insulating spacer has a substantially rectangular profile in the contact region. wherein the insulating spacer has bears an angle relative to the substrate surface of more than 85°

28. (Cancelled)

29. (Previously presented) The structure of Claim 27, wherein the insulating spacer has a surface portion in the contact region without overlying etch stop material.

30. (Previously presented) The structure of Claim 29, wherein the insulating spacer surface portion without overlying etch stop material comprises an insulating spacer surface portion most distant from said substrate.

31. (Cancelled) .

32. (Previously presented) The structure of Claim 27, further comprising a second insulating layer on the etch stop layer and over the conductive layer.

33. (Previously presented) The structure of Claim 32, further comprising a second conductive material in the contact region.

34. (Currently 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,

wherein the electrically insulative spacer has a substantially rectangular cross-sectional shape in a plane that is substantially perpendicular to the substrate surface.

35. (Cancelled).

36. (Currently amended) The structure of Claim 34, wherein the electrically insulatingve spacer has a surface portion without overlying etch stop material.

37. (Currently amended) The structure of Claim 36, wherein the electrically insulatingve spacer surface portion without overlying etch stop material comprises a surface portion most distant from the substrate.

38. (Previously presented) The structure of Claim 34, further comprising a second insulating layer on the etch stop layer and over the conductive layer.

39. (Previously presented) The structure of Claim 38, further comprising a second conductive material in the contact region.

REMARKS

Claims 27 and 34 have been amended by incorporating the claims 28 and 35, respectively. Claims 36 and 37 have been amended to correct a typographical error. No new matter has been added.

Applicants respectfully requests entry of this amendment, since no new limitations have been presented.

The present invention relates to a semiconductor device with well defined contact openings. In the past, the practice with respect to forming contact openings during the fabrication of semiconductor devices, particularly self-aligned contact openings, was to use etchants with high selectivity to protect underlying regions. However, the properties of a highly selective etch of the overlying etch layer can transform a substantially rectangular spacer adjacent to the contact region into a sloped spacer. Before the conductor materials are added to the contact opening, the opening was cleaned with a sputter etchant which can 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, determined 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. As illustrated in Figure 4K of the present specification, the spacer retains a substantially rectangular or "boxy" profile, i.e. the sides of the spacer are not sloping.

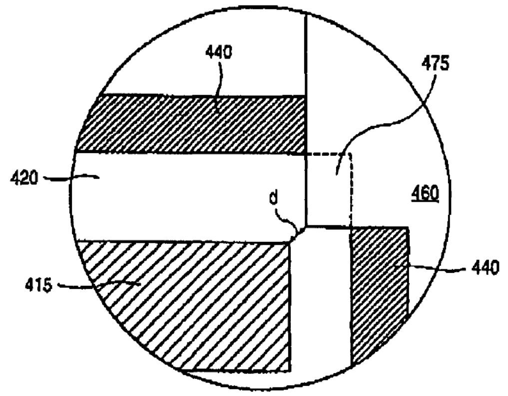
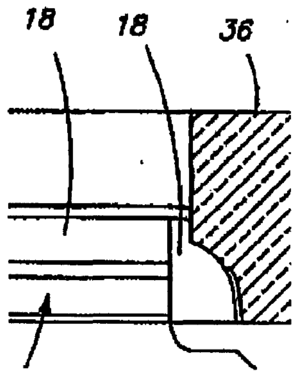


Figure 4K

The rejection of the claims under 35 U.S.C. § 103 over Dennison, et al., in view of Figura, et al., and optionally further in view of Gonzalez, is respectfully traversed. Dennison, et al. does not show a substantially rectangular insulating spacer.

Dennison, et al. describes a method of forming a bit line over a capacitor array of memory cells. Element **18** in Figure 2 shows a spacer. This portion of the figure is reproduced below. As illustrated, the spacer has a sloping portion, and is not substantially rectangular.



A portion of Figure 2 from Dennison, et al.

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