



[54] METHOD OF REMOVING RESIST MASK AND A METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE

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[30] Foreign Application Priority Data

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[51] Int. Cl.<sup>6</sup> ..... H01L 21/312

[52] U.S. Cl. .... 438/514; 438/704; 438/725; 438/714

[58] Field of Search ..... 156/643, 646, 156/651, 659.1; 437/229, 20, 22, 931; 148/DIG. 83

[56] References Cited

U.S. PATENT DOCUMENTS

- 4,040,083 8/1977 Saiki et al. .... 437/236
- 4,789,427 12/1988 Fujimura et al. .... 156/643
- 4,861,424 8/1989 Fujimura et al. .... 156/643
- 4,861,732 8/1989 Fujimura et al. .... 437/229
- 4,938,839 7/1990 Fujimura et al. .... 156/643
- 4,980,022 12/1990 Fujimura et al. .... 156/643

OTHER PUBLICATIONS

S. Wolf "Silicon Processing for the VLSI Era; Process Technology", vol. 1., 534, 1986.

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[57] ABSTRACT

The present invention relates to a method of manufacturing a semiconductor device including a process of removing a photoresist mask or a photosensitive polyimide mask remaining after implanting impurity ions into a semiconductor layer or the like, and has an object to prevent generation of oxides of impurities and photoresist explosion and arranging it so that no residue remains. The present invention comprises the steps of forming a mask composed of photosensitive organic matter on a layer, implanting impurity ions into the layer through the mask, and removing the mask through processing including three steps of: exposing the mask to a plasma activated gas containing hydrogen, exposing to the mask to a plasma activated gas containing oxygen, and exposing the mask to a solution containing nitric acid under conditions sufficient to dissolve alumina which had formed on the mask during exposure of the mask to oxygen.

18 Claims, 8 Drawing Sheets

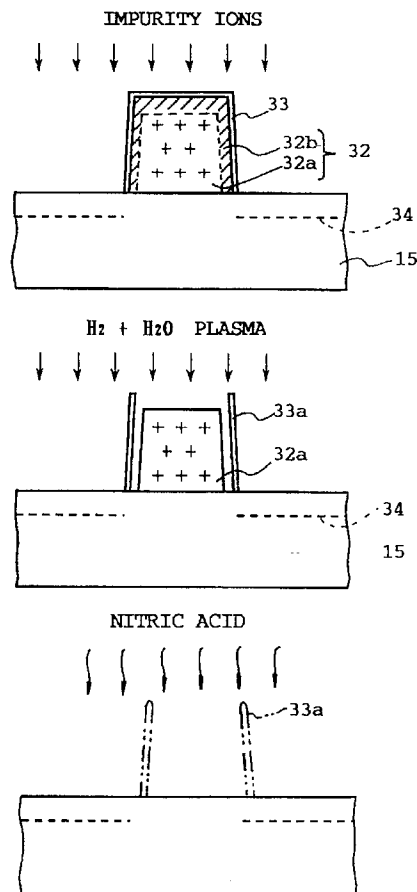


FIG. 1A  
(PRIOR ART)

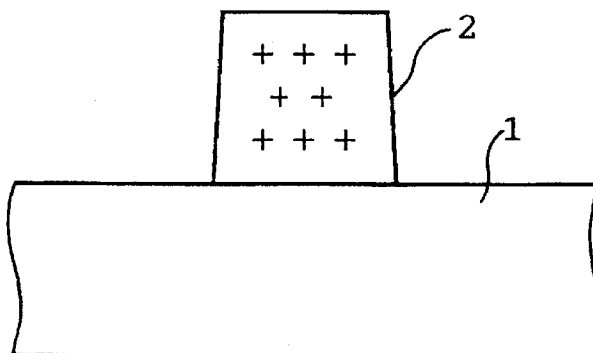


FIG. 1B  
(PRIOR ART)

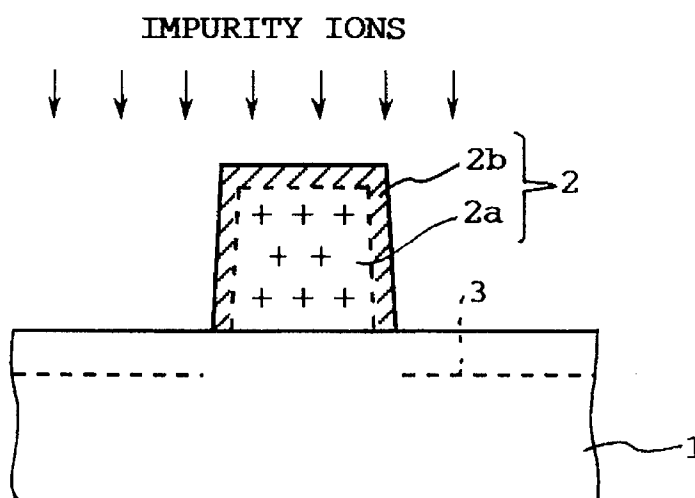


FIG. 1C  
(PRIOR ART)

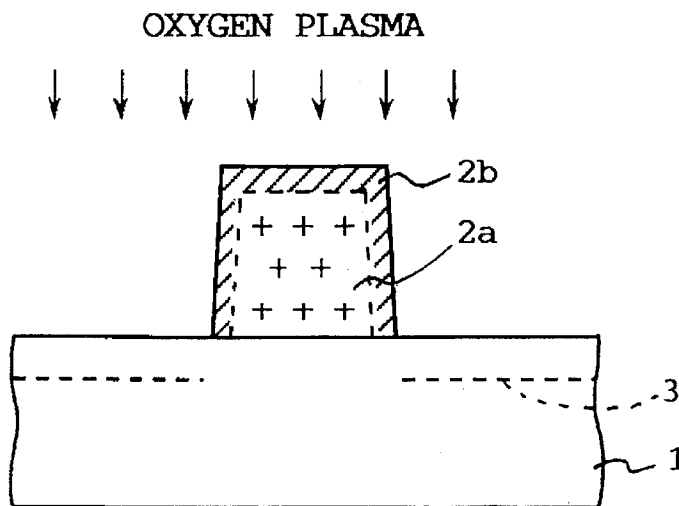


FIG. 1D  
(PRIOR ART)

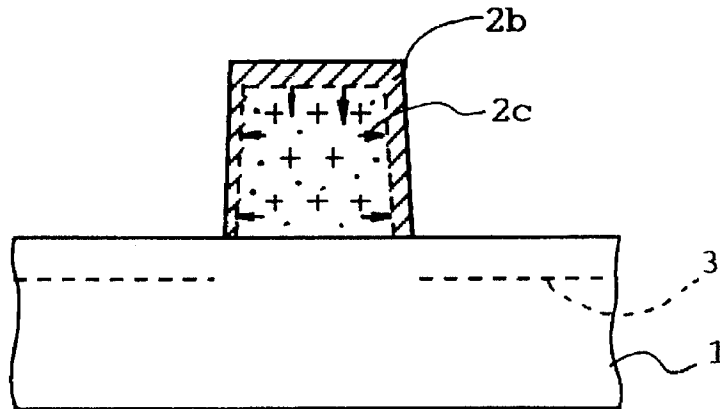


FIG. 1E  
(PRIOR ART)

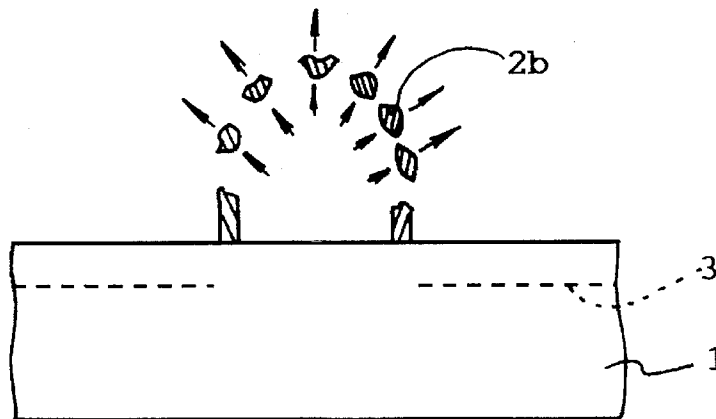


FIG. 2

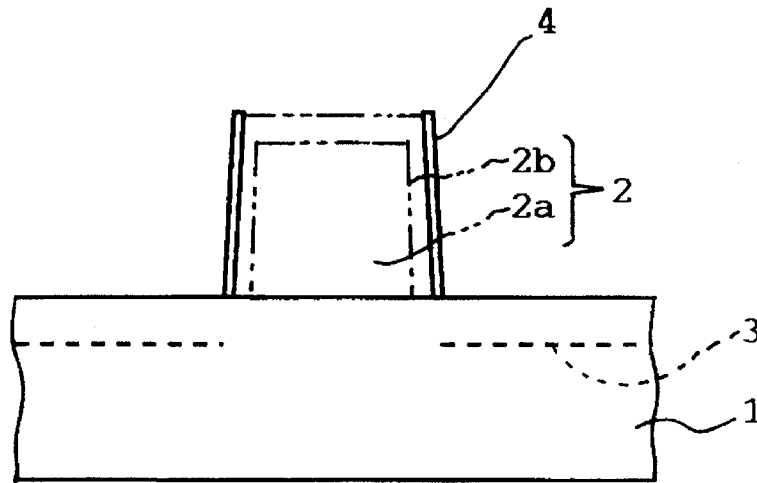


FIG. 3A

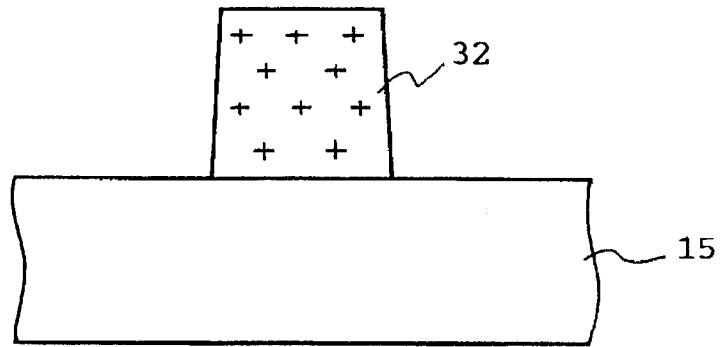


FIG. 3B

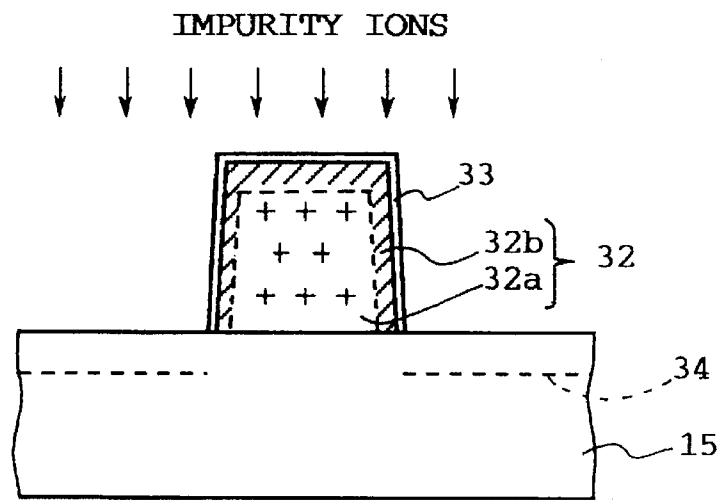
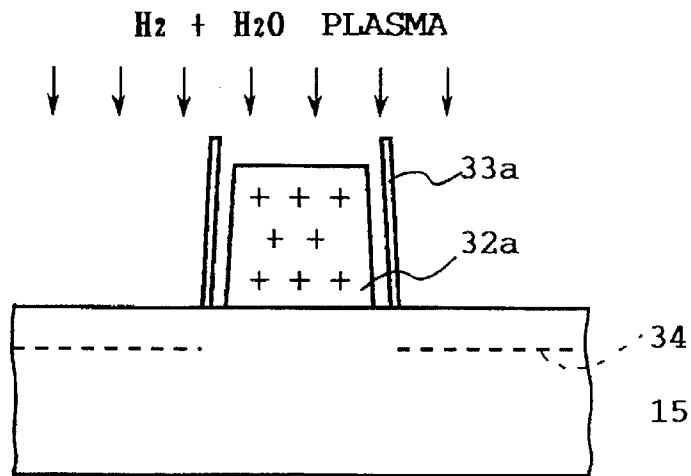


FIG. 3C



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