



United States Patent [19]
Matsubara et al.

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[45] **Date of Patent:** **Jul. 18, 2000**

[54] **INSULATING FILM COMPRISING AMORPHOUS CARBON FLUORIDE, A SEMICONDUCTOR DEVICE COMPRISING SUCH AN INSULATING FILM**

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[30] **Foreign Application Priority Data**

Dec. 2, 1996 [JP] Japan 8-321694
Jun. 5, 1997 [JP] Japan 9-148017

[51] **Int. Cl.⁷** **H01L 31/0312**

[52] **U.S. Cl.** **257/52; 257/55; 257/76; 257/77; 438/482; 438/483**

[58] **Field of Search** **257/77, 76, 55, 257/52; 438/482, 483**

[56] **References Cited**

FOREIGN PATENT DOCUMENTS

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[57] **ABSTRACT**

A structure and manufacturing process of a low dielectric constant interlayer insulating film used between wiring layers and semiconductor devices using such film are disclosed. The insulating film which can withstand in an actual process comprises an amorphous carbon fluoride film. A diamond like carbon film and a silicon excess layer are disposed on both sides of the amorphous carbon fluoride film to be inserted between the wiring layers, whereby adhesion to wiring and another insulating film contacting it is significantly enhanced. In addition, a silicon based insulating film is disposed and flattened on a multilayer film containing an amorphous carbon fluoride film buried with a wiring layer, and is used as a hard mask for anisotropically etching the diamond like carbon film and the amorphous carbon fluoride film with oxygen plasma to form a via hole.

13 Claims, 23 Drawing Sheets

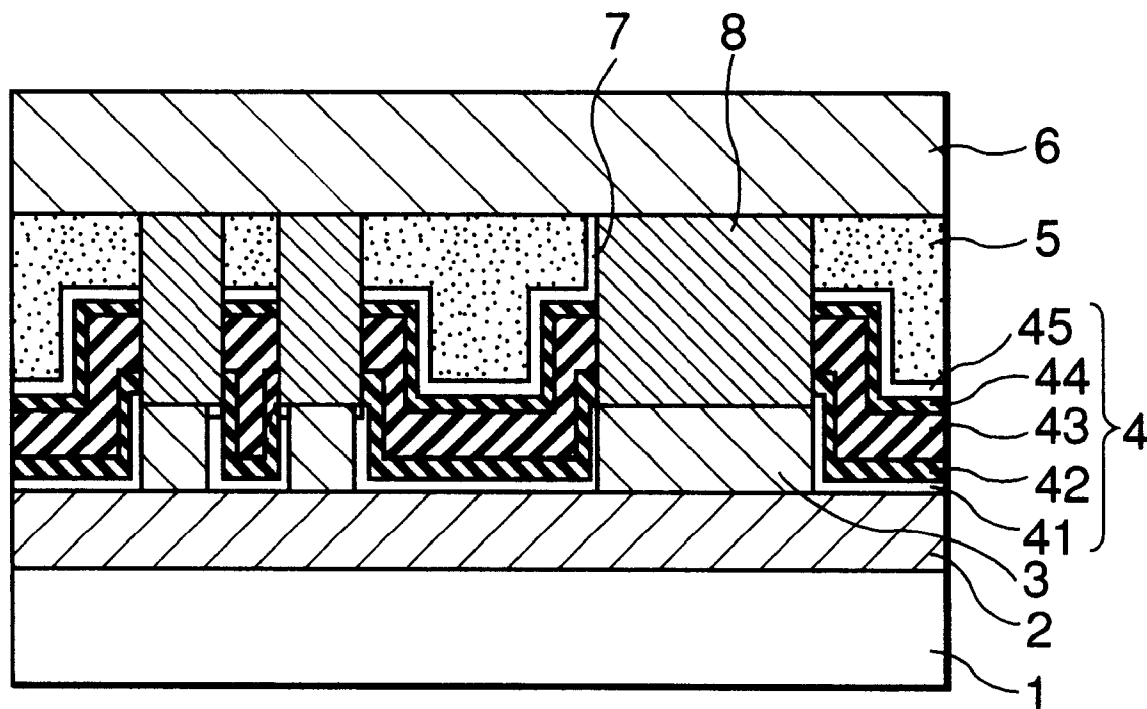


FIG. 1

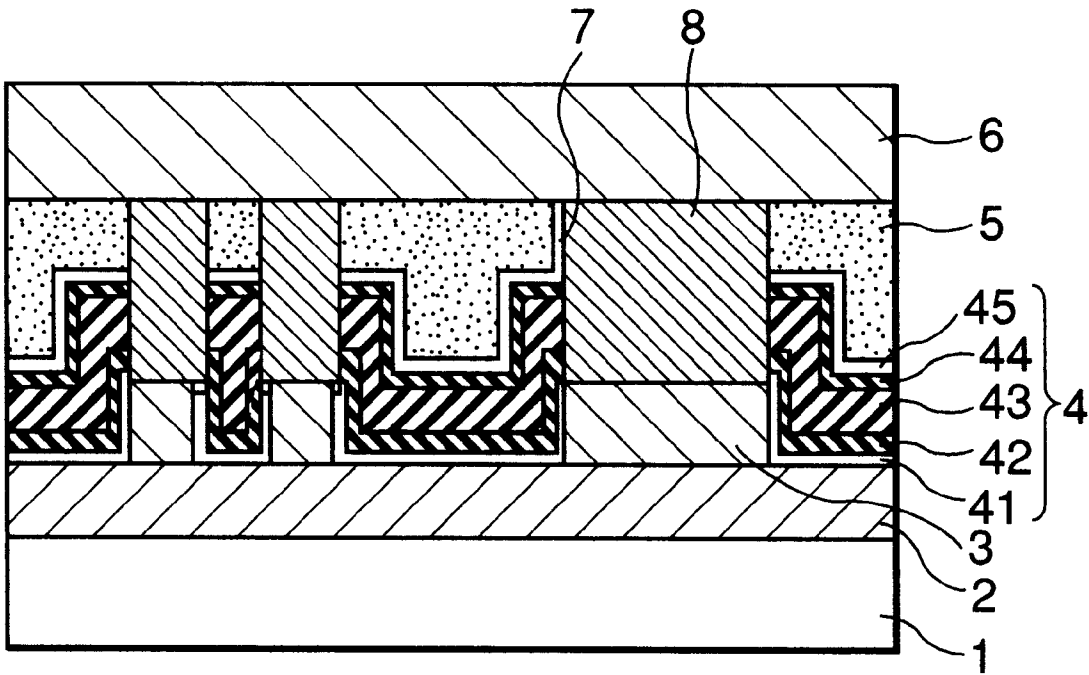


FIG.2(a)

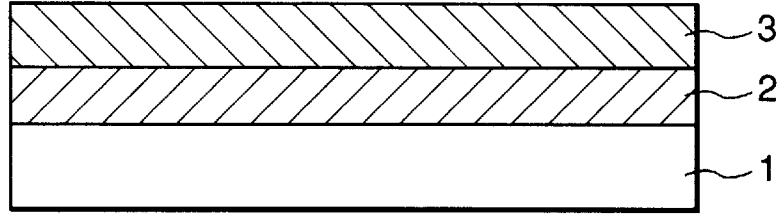


FIG.2(b)

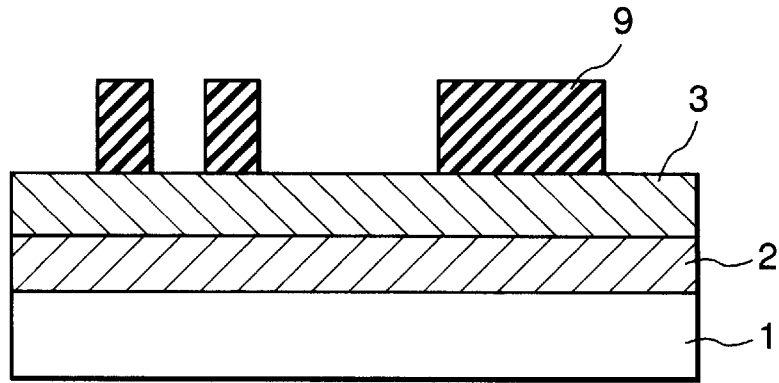


FIG.2(c)

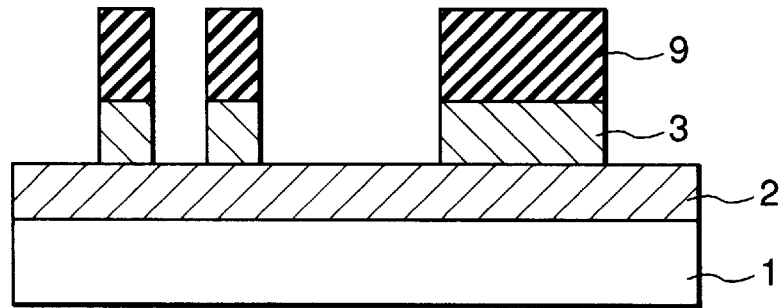


FIG.3(d)

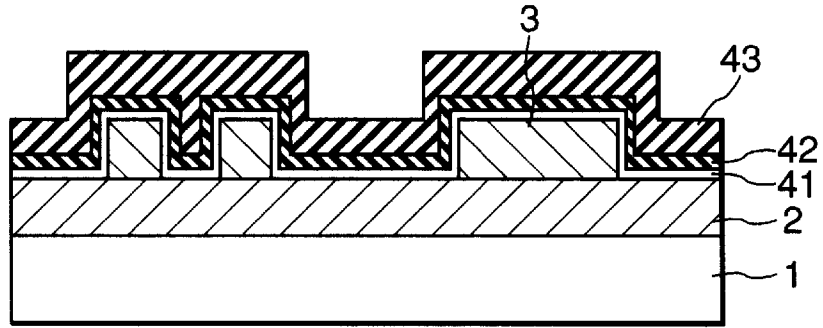


FIG.3(e)

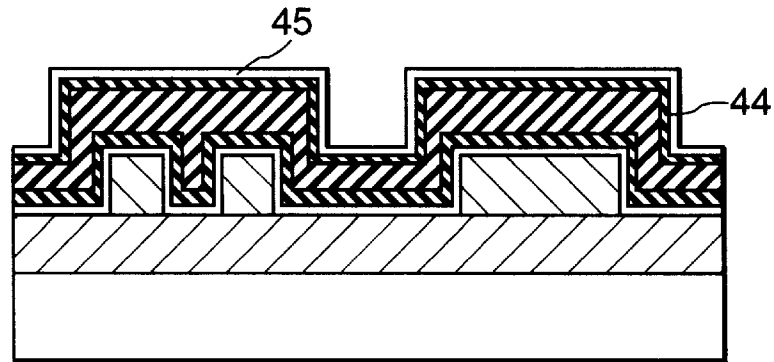


FIG.3(f)

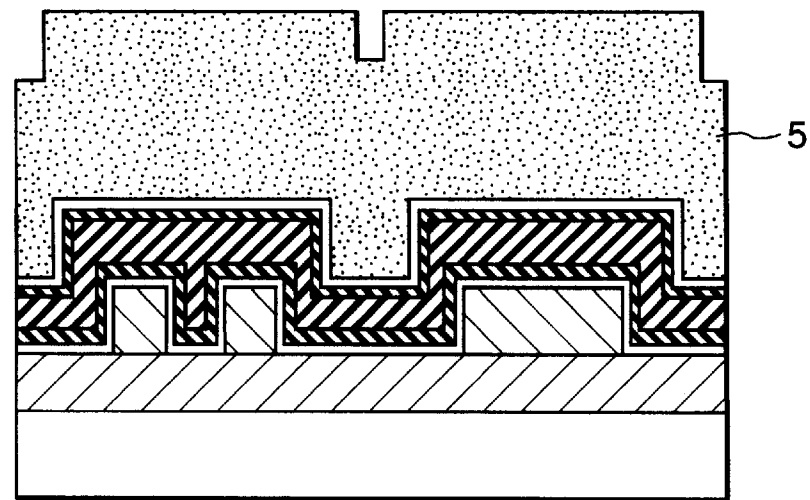


FIG.4(g)

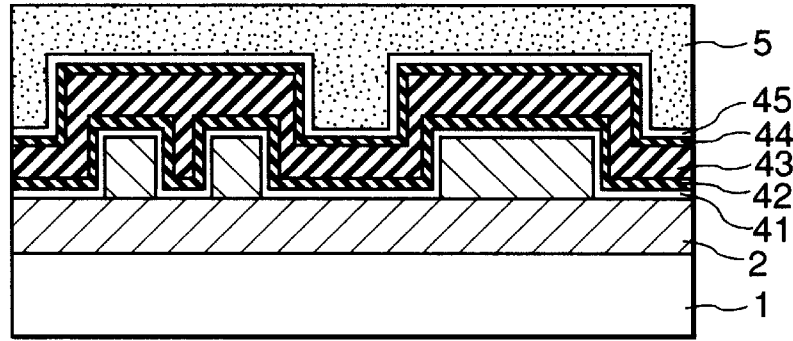


FIG.4(h)

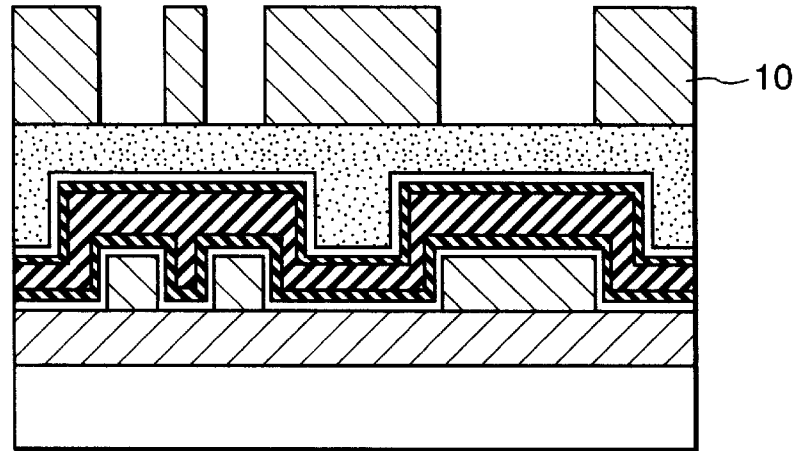
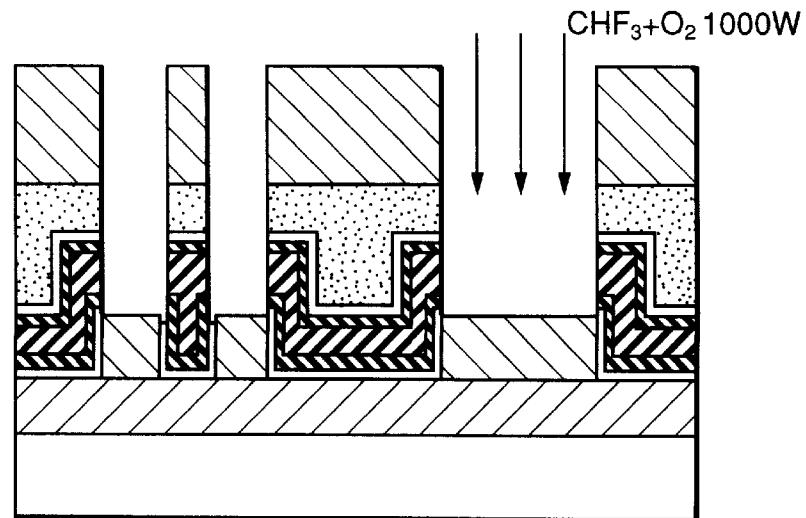


FIG.4(i)



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