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**Quevedo-Lopez et al.**

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(54) **METHODS AND SYSTEMS TO MITIGATE ETCH STOP CLIPPING FOR SHALLOW TRENCH ISOLATION FABRICATION**

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See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

5,989,978 A \* 11/1999 Peidous ..... 438/436  
6,180,492 B1 \* 1/2001 Shih et al. .... 438/435  
6,191,004 B1 \* 2/2001 Hsiao ..... 438/435

6,323,106 B1 \* 11/2001 Huang et al. .... 438/433  
6,326,282 B1 \* 12/2001 Park et al. .... 438/424  
6,468,853 B1 \* 10/2002 Balasubramanian et al. .... 438/221  
6,656,852 B2 12/2003 Rotondaro et al.  
6,660,613 B2 \* 12/2003 Kim et al. .... 438/424  
6,664,195 B2 12/2003 Jang et al.  
6,667,246 B2 12/2003 Mitsuhashi et al.  
6,734,082 B2 \* 5/2004 Zheng et al. .... 438/435  
6,881,645 B2 \* 4/2005 Ahn et al. .... 438/424  
6,958,513 B2 \* 10/2005 Wang ..... 257/330  
7,012,027 B2 \* 3/2006 Perng et al. .... 438/710  
7,022,583 B1 \* 4/2006 Leng et al. .... 438/424  
7,029,987 B2 \* 4/2006 Kim ..... 438/424

\* cited by examiner

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(57) **ABSTRACT**

The present invention facilitates semiconductor fabrication by maintaining shape and density of an etch stop layer (206) during trench fill operations. The shape and density of the etch stop layer (206) is maintained by forming a protective alloy liner layer (310) on the etch stop layer (206) prior to trench fill operations. The protective alloy liner (310) is comprised of an alloy that is resistant to materials employed in the trench fill operations. As a result, clipping and/or damage to the etch stop layer (206) is mitigated thereby facilitating a subsequent planarization process that employs the etch stop layer (206). Additionally, selection of thickness and composition (1706) of the formed protective alloy (310) yields a stress amount and type (1704) that is applied to channel regions of unformed transistor devices, ultimately providing for an improvement in channel mobility.

**14 Claims, 15 Drawing Sheets**

