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Al/Al Direct-Contact Via Plug Formation Using Selective Al-CVD

Nobuyuki Takeyasu, Hiroshi Yamamoto, Tomohiro Ohta

Synopsis :

Direct-contact via plug of a submicron diameter with a novel via plug structure has been realized by selective aluminum chemical vapor deposition (Al-CVD). Lower and upper Al interconnects are directly connected with the plug of aluminum. Essential point of this technique is to carry out sequentially the following three processes without exposing wafers to the ambient: surface cleaning by reactive ion etching (RIE), plug formation by selective Al-CVD and sputter deposition of upper level Al film. The via structure has no heteromaterial interfaces across the current path. Electrical characteristics of the Al plug were evaluated and compared with those of the conventional W plug. The resistance of a via chain in 0.5- μm diameter was 0.24 Ω /via, which was 1/3 that of the W-filled plug, and interface resistance was estimated to be extremely low. Electromigration (EM) tolerance of the new plug was better than that of the W plug. The direct-contact Al-CVD plug is, thus, very suitable for realizing high-performance LSI with lower process cost.

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The body can be viewed from the next page.

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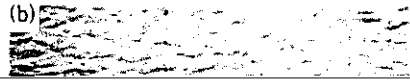
Synopsis:

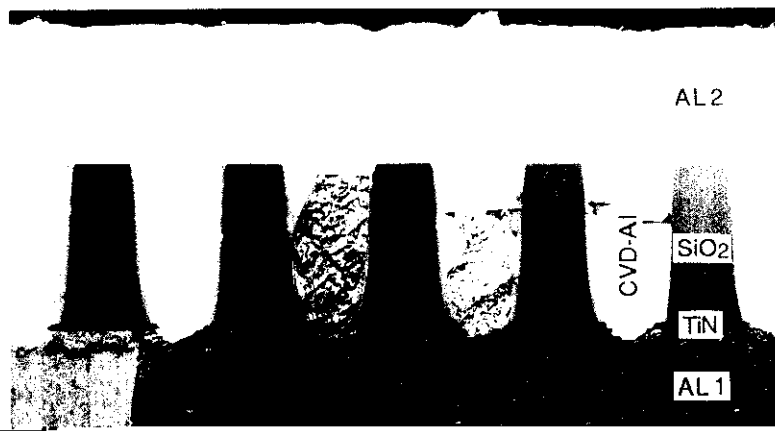
Direct contact via plug formation of Al/Al was achieved by selective Al-CVD.

mands.

The metallization technique using Al-CVD has been investigated, using triisobutylaluminum (TIBA)⁵⁻⁹⁾ or

sputtered on it. These processes were performed continuously in the same vacuum with a base pressure of less than 1×10^{-7} Torr (1.33×10^{-7} hPa). First, RIE was

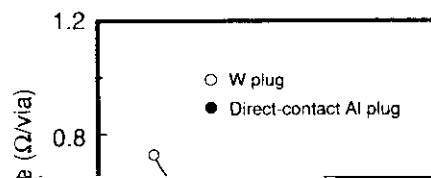




via structure fabricated in this study

Al plugs having no voids and that the plugs contact both the lower and upper interconnects without any intermediate layers.

3.2 Electrical Characterization



Via size (μm)

current density of $7 \times 10^6 \text{ A/cm}^2$. The resistance change of

0.8 0.5 0.3

the direct-contact Al plug was smaller than that of the

9) T. Amazawa and H. Nakamura: "Selective Chemical Vapor Deposition of Aluminum" Ext. Abstr. of the 19th

Aluminum Metallization Technology Using a Combination of CVD and Sputtering" Proc. 1991 IEEE VLSI