APPROCH TO 3D-IC THRU VIA CU FORMATION IN SUPERCRITICAL CARBON DIOXIDE FLUIDS USING A FLOW TYPE REACTION SYSTEM

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New metal-wiring (interconnect) technologies are required to fabricate high performance LSIs. One of the crucial technological targets is the formation of MEMS-based thru vias of 3D IC. Cu electroplating is the most popular deposition technology being currently investigated; however, the deposition technology in supercritical fluids is becoming of crucial interest as a replacement of electroplating because of its excellent penetration capability of
supercritical fluids. In this study, Cu deposition in thru via was carried out using a flow-type deposition processor that was designed to enable long time deposition [1,2]. A precursor, Cu(dibm)2, was dissolved in acetone and was supplied to a reaction chamber continuously. Deposition temperature was varied from 180 °C to 280 °C, and the precursor and H2 concentrations were fixid at 0.0292 mol%, 1.53 mol% respectively. Deposition time was 60 min. Figure 1 shows
cross-sectional view of Cu deposited in thru via at 220 °C. Cu film reached 129 μm in a hole of 10 μm in dia. Figure 2 shows the temperature dependence of the Cu-coating depth. At 180 °C, Cu film reached full-depth (350 μm) but its thickness was very small. As the temperature increased, the maximum depth was decreased, whereas the film thickness increased. The film thickness profiles in via holes are shown in Figure 3. At 280 °C, a large film thickness at the via opening decreased rapidly with depth. At lower temperatures, the film thickness profiles became less depth-dependent. These experimental results were compared with numerically simulated results.

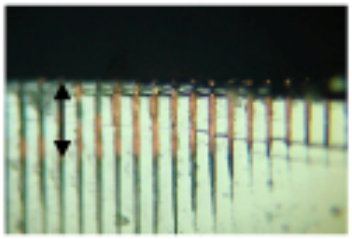

Fig.1 Cu films deposited reached to 129μm at 220C, 1h

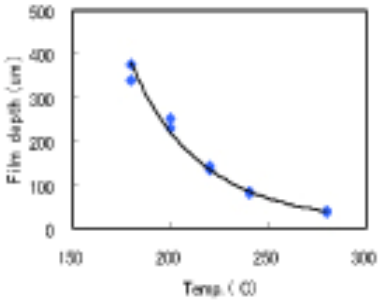

Fig.2 Cu film depth in Thru-Via at 180C-280C

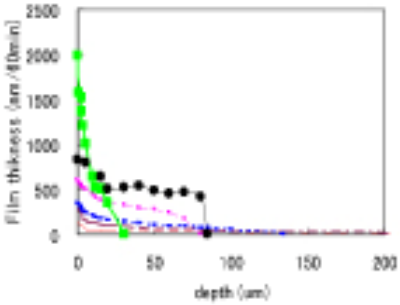

Fig.3 Film thickness profiles in Thru-Via at 180C-280C

[1] M. Matsubara and E. Kondoh, 40th Autumn Meeting of Society of Chemical Engineering Japan, (Sep. 2008)
[2] M. Matsubara, M. Hirose, K. Tamai, and E. Kondoh, submitted to J. 1234500000000000 Eelctrochem. Soc.