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Electrical property of Copper Film by PIBD(Partially Ionized Beam Deposition)

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Copper has been investigated as metallization material for ULSI device due to low electronic resistivity and high electromigration resistance. Because of very small metallization line dimension, low resistivity is required to reduce RC time delay in very thin thickness. The resistivity of metal film is depends on impurity, surface scattering and grain boundary scattering. Especially surface scattering and continuity of copper film results in the stiff increase of resistivity as copper film is thin.

In this study, the copper films were prepared by PIBD system. The copper films were deposited on Si(100) substrate with partially ionized beam and neutral one. The copper films were deposited at room temperature and working pressure was $5 \times 10^{-7} \sim 1 \times 10^{-6}$ Torr. Ionization voltage was 450 V and acceleration voltage was ranged from 0 and 3 kV. The film thickness was varied between 300 and 1800 Å. Crystallinity was investigated by peak height ratio (200) to (111) of XRD pattern. Grain size of each copper film was carried out by SEM. The resistivities of copper films deposited under various conditions were measured by 4-point probe method. Especially, electrical property of copper films were investigated with film thickness.