

Development of Low-force Copper Contact Processes

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Abstract-A contact process between IC pads and test probes at low contact force is a key to develop a probe card with smaller pitch and high pin count. In this paper, we have report on the characteristics of low-force contact methods on Cu electrodes. One is the fritting process, in which an electric breakdown is utilized to break the surface oxide, and another is the heating treatment in hydrogen gas aimed at deoxidizing the surface Cu oxide. A conventional tungsten needle probes and Ni/Fe alloy microcantilever were used as testing probes, and contact resistance at low contact force of 1 mN~5 mN were measured. Contact resistances smaller than 1 Ω for W needle probes and Ni/Fe micromachined probes were obtained by the fritting processes in which voltages of up to 10 V is applied and flowing current of 100-300 mA. A deoxidization process at over 530 K was found to be effective for decreasing the contact resistance especially for contact with low voltage. An X-ray photoelectron spectroscopy was utilized to investigate the surface state of hydrogen treated Cu, and the deoxidization of Cu₂O to Cu was observed in samples treated at 530 K, while no change was found in that at 420 K.

Keywords; fritting contact, deoxidization of Cu, IC probing