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Influence of Cu micro/nano-particles mixture and surface roughness on the shear strength of Cu-Cu joints

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Abstract:

With the optimal mass ratio (9/1) of 100 nm to 1 μ m particles, the bonding layer showed a highly dense sintering structure and was thinner than that of only 100 nm particles, the shear strength of the Cu-Cu joint was over 20 MPa even at relatively low temperature 250 °C and pressure of 4 MPa. The sawtooth structure formed between the bonding layer and the copper substrates can increase the bonding area and further promote the shear strength of joint, the optimal surface roughness of copper substrate for maximum enhanced effect was $R_a = 189.9 \pm 5.4$ nm.

Key words: *Nanoparticles; Cu-Cu joints; Sintering; Bonding material; Low temperature soldering*

1. Introduction

Three-dimensional integrated circuits (3D-IC) had risen in popularity as they provide high packaging density and enhanced performance due to vertical stacking, as shown by Huang et al. (2015). Low temperature bonding is critical in 3D-IC industry for meeting the requirements of low cost and thermal budget. Cu-Cu bonding has attracted much attention due to its high electrical conductivity and strong bonding strength. In order to achieve considerable bonding strength of

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