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Enhancement on the bonding strength of instantly-bonded Cu-Cu joints by post annealing

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Abstract

This study investigates the bonding time and temperature on shear strength in copper-to-copper direct bonding with highly $\langle 111 \rangle$ oriented nanotwinned copper. Instant bonding process was performed under 10 and 30 seconds and post-bonding annealing was executed at 300 °C. Before bonding process, we use CMP to polish the surface of microbumps to reduce surface roughness.

The advantage of the two steps bonding is that we can obtain enough bonding strength in extremely short time due to very large diffusivity of our highly $\langle 111 \rangle$ oriented nanotwinned copper in the first step bonding process. We further more increase the bonding strength of the samples by the second-step annealing process by grain growth. By now, we successfully to fabricate the sample with only first bonding step process in 10 seconds and the shear strength can reach to 55MPa and the bonding strength can increase to above 110MPa after 300 °C/150 N post bonding annealing in one hour.