Copper Core Bump Attached with Lead Free Solder for High Density Interconnection

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With the packaging miniaturization in electronic industry, the interconnect density has been increased remarkably. As a critical step for high density interconnection, the preparation of solder bump is extensively studied. In particular, the electrodeposition receives much interest in the formation of solder bump with small size and fine pitch recently, in consideration of the resolution limitation in screen printing technology.

In this presentation, copper core bump attached with lead free solder was aimed to develop for the application in high density bonding by electrodeposition. The adoption of Cu core was to prevent the deformation of solder during reflow process. Solder layer was intended to directly attach on the surface of Cu core bump to make it a copper core-solder bump. For the demands of lead free products in electronic industry, lead free solder was attached on Cu core bump.

By the methods of electrodeposition and photolithography, a process was successfully developed for the preparation of bump. Cu bumps were achieved in size of 50μm diameter and 100μm pitch by using 80μm thickness dry film resist (MP100, TOK Co. Ltd.), and the height of bump reached 50±5μm.

Bump height uniformity was investigated by laser detection method. It indicated that over 93% bumps were in the height range of 45~55μm. The values around the pattern circumference were relatively large in whole distribution map of height. Dummy pattern was simulated to improve the height uniformity of bump. It was shown that all bumps located in the height of 50±5μm. The height uniformity of bump was effectively optimized by dummy pattern.

The bump with a diameter of 35μm and a pitch of 75μm was also developed through 40μm thickness dry film resist. And uniform bumps were obtained in height

Sn-10%wtZn plating was electrodeposited on Cu core bump as lead free solder layer. The Cu/Sn-Zn bumps were observed after reflowing. It was seen that a half-spherical shape solder of Sn-Zn attached on Cu core bump.

Ni plating as under ball metallurgy (UBM) layer inhibited the formation of intermetallic compound (ϒ-Cu_5Zn_8) at the interface of reflowed Sn-10%wtZn plating/Cu.

References

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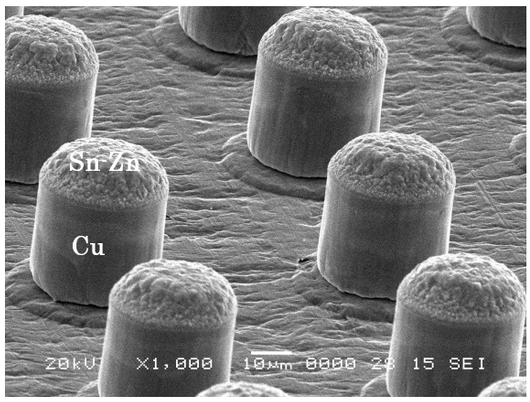

Fig.1 The morphology of Cu core bump and Sn-10wt%Zn plating layer on it (SEM)

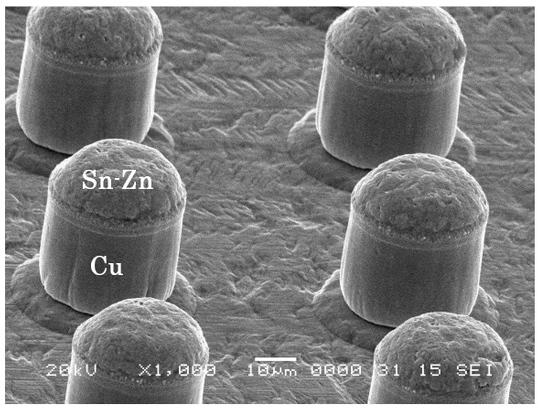

Fig.2 The morphology of reflowed Cu core—Sn-10wt%Zn solder bump (reflowed at 229°C, SEM)

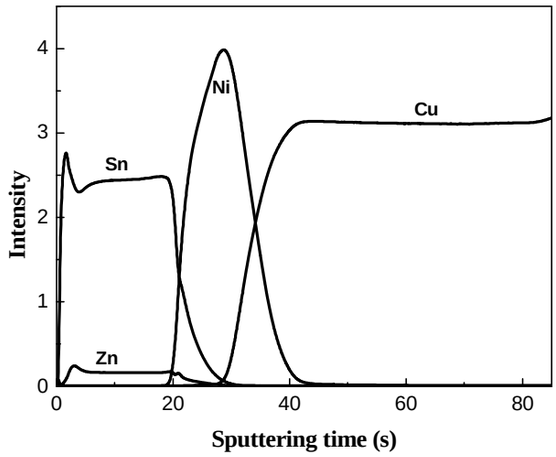

Fig.3 The element distribution in reflowed Sn-10wt%Zn plating/Cu with Ni plating at its interface (GDS).