A New Surface Finish for Solder Joints Exhibiting both Low Consumption Rate and Oxidation Resistance

Solder joints are the most friable links in microelectronic devices. In fact, a failure in solder joints is the easiest root which would take the responsibility for malfunction in electronic products. Therefore, to improve the reliability of solder joints is one of the most important tasks for electronic industry.

In microelectronic, optoelectronic, and MEMS packaging, the contact pads for solder usually use the Au/Ni bi-layers, such as UBM（Under Bump Metallurgy）and surface finish. The Ni layer needs to be plated an oxidation protection layer, such as Au. However Au will get into the solder and form many Au-bearing intermetallic particles, e.g.（Au1-xNix）Sn4. In addition, the Ni layer is easily to be consumed that causes the solder reacting with the conducting layer fast and results the failure of the devices as the consequence. This paper emphasized on the improvement of solder joints, whereas we probed the solder reacting with the diffusion barrier layer and measured the consumption degree of the diffusion barrier layer at different temperatures and time.

In this paper, it was mentioned that the Ni, Co and Pt pads reacted with liquid tin. The results could be obtained that the consumption rate of Pt pad was slower at different temperatures and time. The order of the consumption rate was Pt＜Ni＜Co, then the consumption thickness of Pt pad was about 1/3 ～ 1/2 of Ni pad. Moreover, it was discovered that the thickness of PtSn4 is thicker than the thickess of Ni3Sn4, because one mole of Pt required to consume four mole of Sn, and then produced one mole of PtSn4. Nevertheless one mole of Ni only consumed 4/3 mole of Sn, and then produced one mole of Ni3Sn4. As a result, it caused the thickness of PtSn4 is thicker than the thickess of Ni3Sn4.

The diffusion barrier layer was considered that required better wetting. We did a wetting test for the platinum and compared with the nickel. The results showed that the wettability of the platinum was worse than the nickel, however we used RMA or water-soluble flux. But the wetting time of the platinum still is lower 5sec.

Finally, we summarized the results into two parts. Firstly, it was obtained that the thickness of consumption was about 1/3 ～ 1/2 of Ni pad for Pt pad. Secondly, the platinum was a noble metal which could be also considered to serve as the oxidation protection layer. Furthermore, the wettability of the platinum had an acceptable range

and the wetting time was reduced when using water-soluble flux. In other words, a single Pt layer could be utilized to replace both the oxidation protection layer and diffusion barrier layer. Hence these results showed that the Pt pad had a potential to be applied for solder joints.