摘要

在以往銲錫的電遷移研究中，探討對象都是固態銲錫，而液態銲錫是未被探討的。本實驗利用了微量毛細管設計了一個Cu/Sn/Cu結構，同時探討電遷移對液態、固態無鉛銲錫Sn-3.5Ag中Cu溶解現象的影響。我們利用維氏硬度計在Cu導線上打入marker以計算Cu導線溶解量，此marker與Cu導線頂端距離300 μm。在實驗中發現，試片於240 ℃下，施予電流密度$6.3x10^3$ A/cm^2，會造成陰極端Cu導線相當嚴重的Cu溶解現象，通電時間達3 hr約有125 μm Cu導線溶解，並於陽極端生成大量IMC；相同的時間與電流密度，於185 ℃通電，陰極端Cu導線卻僅溶解1 μm；而在未通電的情況下，試片於255 ℃反應3 hr，Cu導線溶解約8.5 μm；相同的時間，試片於200 ℃，Cu導線溶解約1 μm；這表示電子流、熱效應對於Cu溶解現象有著交互的影響，本實驗對此現象作深入的探討，此現象有助於 flip-chip 銲點分析，進而對其毀壞機制的探討。這告訴我們，flip-chip銲點的毀壞，很有可能因電遷移造成銲點局部溶解，進而導致嚴重的Cu溶解現象，最後整個銲點失效。

Abstract

The electromigration of solder at solid state was studied in the past, but it was not discussed at liquid state. In this study, we take the micro capillary to design a Cu/solder/Cu structure. We make the marker on the copper wire with the distance of 300 μm from the head. At 240 °C with current stressing of 6.3×10^3 amp/cm^2, the copper wire at cathode dissolve rapidly. For up to 3 hr with current stressing, the consumption of copper at cathode was 125 μm and there was a lot of IMCs formed at anode. At 185 °C with the same current density and stressing time, the consumption of copper at cathode was only 1 μm. For up to 3 hr at 255 °C without current stressing, the consumption of copper was 8.5 μm. And it was about 1 μm at 200 °C. The result of this study indicate that temperature is important as much as the current density in the consumption of copper. We will disscuss the phenomenon in detail, and it was useful to analyze the failure mechanism in flip-chip solder joints. Electromigration will induce local melting in flip-chip solder joints, then lead to the serious dissolution of copper and fail finally.