〔知能生産システム工学〕

35－5　Sn-Pb系はんだボール接合体の組織と強度に及ぼすAg添加とリフロー冷却速度の影響

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Sn-37 mass%Pb and Sn-36 mass%Pb-2 mass% Ag solder balls have been bonded on Cu pads at the cooling rates of reflow. The microstructure and the mechanical properties of the ball bonding have been investigated. The eutectic lamellar structure (Sn phase/Pb phase) of both ball was finer. The lamellar spacing of Sn-36 mass%Pb-2 mass%Ag solder ball was much smaller than that of Sn-37 mass%Pb one at the faster cooling rates. The lamellar structure became finer since Ag may interrupt the diffusion of Sn and Pb. The ball hardness depended on the cooling rate and increased with the smaller lamellar spacing at the faster cooling rate. Since the eutectic Ag_3Sn intermetallic compound formed in Sn-36 mass%Pb-2 mass%Ag solder ball, the hardness of this al-loy ball was higher than that of Sn-37 mass%Pb one. The shear strength of both ball bonding dropped remarkably at 10K/min since Ni_3Sn_4 reaction layer at the bonding interface was thicker. The shear strength of Sn-36 mass%Pb-2 mass%Ag ball was lower than that of Sn-37 mass Pb one at each cooling rate. The primary needle-shape Ag_3Sn was observed in Sn-36 mass%Pb-2 mass%Ag ball and near the bonding interface. The lower shear strength of Sn-36 mass%Pb-2 mass%Ag ball bonding was due to the primary needle-shape Ag_3Sn near the bonding interface and the brittle Ni_3Sn_4 reaction layer. Since the fracture face of the Sn-36 mass%Pb-2 mass%Ag ball was flatter than that of the Sn-37 mass%Pb ball, the brittle fracture occurred at the Sn-36 mass%Pb-2 mass%Ag ball bonding interface.

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