Studies of interfacialmicrostructures and series resistance on electroplated and hot-dipped Sn-*x*Cu photovoltaic modules

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Sn-Cu alloys are considered promising candidate solders for replacingSn-Ag solder due to their good weldability with Cu, good thermal fatigue, andlow cost. The present study applied molten Sn-*x*Cu (x = 0.3, 0.7, 2.5,and 5.0 wt.%) alloy solders to a photovoltaic (PV) ribbon. A hot-dippedSn-0.7Cu PV ribbon reflowed on a Si solar cell had the lowest series resistanceof the tested module (Cu/Solder/Ag), due to high solders conductivity, low IMCsthickness, and low Ag consumption. After biasing for 72 h, the rapid growth ofintermetallic compounds (IMCs) (Cu_6Sn_5, Ag_3Sn)caused the series resistance of the module to increase by 52%, due to highsolders conductivity, low IMCs thickness, and low Ag consumption. To improvethe performance of the PV module, an electroplated PV ribbon was used in placeof the hot-dipped one. The required solder thickness for the electroplated ribbonwas one-third that for hot-dipped ribbon. Applying less solder to a PV ribbonavoids the over-growth of IMCs, and thus enhances module conductivity. The electroplatedPV ribbon better suppressed the rise in series resistance of the module(increased by 18 %). Using an electroplated PV ribbon can reduce the requiredamounts of solder and Ag paste, reducing the cost of solar cell fabrication.

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