Structural Characterization and Phase Behavior of Sn/In Nanosolders at Elevated Temperatures

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Abstract

Low temperature soldering is required in many electronics manufacturing processes, such as flexible electronics, assembly and packaging of thermal sensitive components (e.g., LEDs). Because of the potentially low melting temperatures caused by melting temperature depression phenomenon of the nanomaterials, nanosolders have been proposed for enabling new soldering applications. Studying the phase diagrams of nanoparticles composed of solder materials is important in understanding the relationship of their melting temperatures and compositions. Coupled with structural characterization, complete structure-property relationship may be obtained, which can provide useful information on the phase evolution in the nanoscale and soldering processing conditions. Herein, we report the phase evolution of Tin/Indium (Sn/In) nanosolder particles at different elemental compositions and various temperatures. The Sn/In nanosolder particles were synthesized by a surfactant-assisted chemical reduction method in ambient conditions. They were heated up to different temperatures (still below their melting temperatures). XRD was used to determine the structures of the phases present at different compositions and temperatures, and DSC was used to measure the phase transition temperatures. The phase evolution of the Sn/In nanosolders leads to new understanding of the phase transition phenomena in a nanosystem, which provides important information for their low temperature soldering applications.