Electrochemical Preparation of Sub-micrometer Sn-Sb Alloy powder in ChCl-EG deep eutectic solvent

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The sub-micrometer Sn-Sb alloy powders were electrochemically prepared on a titanium substrate in choline chloride-ethylene glycol (ChCl-EG, 1:2 molar ratio) deep eutectic solvent containing 0.2 M SbCl₃ and 0.2 M SnCl₂. The electrochemical behaviors of Sb(III) and Sn(II) were investigated using cyclic voltammetry techniques. It revealed that the reduction of Sb(III) and Sn(II), as well as co-reduction of them in ChCl-EG involved the irreversible process controlled by diffusion. The diffusion coefficients of Sb(III) and Sn(II) species were in the range of 10⁻⁷ and 10⁻⁶ cm² s⁻¹, respectively. Potentiostatically deposited Sn-Sb alloys were characterized by inductively coupled plasma atomic emission spectrometry (ICP-AES), scanning electron microscopic (SEM) and X-ray diffraction (XRD). The deposition potential played an important role in controlling the composition, but had little effect on surface morphology. Depending on the deposition potential, sub-micrometer Sn-Sn alloy powders containing about 2.7–67.4 at.% Sn were obtained.

Keywords: Deep eutectic solvent; Sn-Sb alloy; Electrodeposition; Sub-micrometer.

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