Journal of Alloys and Compounds

Underpotential deposition of SnBi thin films for sodium ion batteries: The effect of deposition potential and Sn concentration

Xaba, Nqobile & Modibedi, Remegia M
Council for Scientific and Industrial Research
Pretoria, 0001, South Africa
Email: MModibedi@csir.co.za

Abstract

Bimetallic SnBi film was deposited on a Cu foil substrate via the electrochemical atomic layer deposition (E-ALD) technique. The deposition attainment of Sn and Bi were investigated using cyclic voltammetry (CV) and linear sweep voltammetry (LSV). The deposition potential of Bi was varied in the underpotential deposition (UPD) region and the concentration of Sn was varied in the SnBi bimetallic material. The materials were characterised using field emission scanning electron microscopy coupled with energy dispersive spectroscopy (FE-SEM/EDS) for morphology and elemental distribution, focused ion beam scanning electron microscopy (FIBSEM) for thickness, X-ray diffraction (XRD) for crystallinity and inductively coupled plasma mass spectroscopy (ICP-MS) for composition measurements. Bi deposited at different UPD regions was structurally different. The deposits were crystalline SnBi materials containing Sn, Bi and other phases of Cu and Sn. Bi was concentrated on the surface, while Sn was distributed evenly across the film. The SnBi electrodes were tested as anode materials in Na-ion batteries using galvanostatic cycling (GC), CV and electrochemical impedance spectroscopy (EIS). Initial discharge capacities of 1900 mAh g-1 for SnBi (1:1) and 341 mAh g-1 for SnBi (3:1) electrodes at 38.5 mA g-1 were obtained, while the electrodes suffered capacity loss after 10 cycles.