

Carbon Coated Silicon Nanoparticles Embedded MWCNT/Graphene Matrix Anode Material for Li-Ion Batteries

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Abstract : We present a work which was conducted in order to improve the cycle life of silicon based lithium ion battery anodes by utilizing novel composite structure. In this study, carbon coated nano sized (50-100 nm) silicon particles were embedded into Graphene/MWCNT silicon matrix to produce free standing silicon based electrodes. Also, conventional Si powder anodes were produced from Si powder slurry on copper current collectors in order to make comparison of composite and conventional anode structures. Free -standing composite anodes (binder-free) were produced via vacuum filtration from a well dispersion of Graphene, MWCNT and carbon coated silicon powders. Carbon coating process of silicon powders was carried out via microwave reaction system. The certain amount of silicon powder and glucose was mixed under ultrasonication and then coating was conducted at 200 °C for two hours in Teflon lined autoclave reaction chamber. Graphene which was used in this study was synthesized from well-known Hummers method and hydrazine reduction of graphene oxide. X-Ray diffraction analysis and RAMAN spectroscopy techniques were used for phase characterization of anodes. Scanning electron microscopy analyses were conducted for morphological characterization. The electrochemical performance tests were carried out by means of galvanostatic charge/discharge, cyclic voltammetry and electrochemical impedance spectroscopy.

Keywords : graphene, Li-Ion, MWCNT, silicon

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