A New Anode Material for Lithium-Ion Batteries: Sb-AlxCy-C Nanocomposite by One Step Synthesis Using High Energy Mechanical Milling

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A new nanocomposite based on Al, Sb, and C is achieved by one step synthesis using high energy mechanical milling (HEMM), producing nanometer-sized alloy particles of Sb-AlxCy-C. In this work, we determined that a hybrid matrix is formed from Al and carbon that mitigates the volume expansion of the active material during lithiation/delithiation while Sb acts as an active material. We also compared with the pure metallic matrix (AlSb). In addition, we optimized the stoichiometric ratio of Al and Sb in the composite based on electrochemical analyses. The results showed that AlSb-C anode exhibited good rate capability performance and specific capacity and 1:1 molar ratio of Al and Sb showed the best cycling performance after 200 charge/discharge cycles. Overall, the simple method and the new AlSb-C composite are the facile approach to making new materials for use as negative electrodes in lithium-ion batteries, providing an alternative to commercial available graphite electrodes.
Keywords: Antimony, Aluminum carbide, Nanocomposite, Anode, Batteries