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ELECTROCHEMICAL PERFORMANCE OF ANODE MATERIALS, DEVELOPED FROM SRI LANKAN NATURAL VEIN GRAPHITE, IN RECHARGEABLE LITHIUM-ION BATTERIES

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ABSTRACT

Graphite is presently the most common anode material used for rechargeable Lithium Ion Batteries (LIB). However, further development of graphite as a more stable and high-capacity anode material is crucial to face the growing high demand exists for LIB in the battery market. In this study, Sri Lankan vein graphite was developed for LIB anode by introducing acid-leaching purification followed by surface modification. Then, coin cells were assembled in an argon-filled glove box with anode electrode fabricated from the developed graphite, lithium foils as reference and counter electrodes with non-aqueous electrolyte of 1M LiPF6 in ethylene carbonate and dimethyl carbonate (1:1 wt %). Galvanostatic charge-discharge testings performed on the cells showed a significant high initial specific discharge capacity of 399.6 mAhg-1 while maintaining high Coulombic efficiency of around 99 % over 50 cycles. More importantly, the resultant smooth cyclic voltammograms having a sharp anodic peak (delithiation) at 0.452 V and a cathodic peak (lithiation) at 0.459 V endorse for a greater intercalation and de-intercalation of lithium ions with the developed graphite anode material. Furthermore, the resultant electrochemical impedance spectroscopy shows an interestingly low charge transfer resistance at the electrolyte/electrode interface. It implies that our introduced purification and modification to graphite in this study have greatly supported to enhance the charge transfer together with improved reversible capacity and cycling stability. Consequently, it reveals the capability of our introduced purification and modification processes to develop Sri Lankan vein graphite as a more stable and high-capacity anode material for rechargeable lithium-ion batteries.

Keywords: Sri Lankan vein graphite, electrochemical performance, purification, modification