

VALUE ADDITION TO SRI LANKAN VEIN GRAPHITE AS AN ANODE MATERIAL IN RECHARGEABLE Li-ION BATTERIES

H.P.T. Sasanka Hewathilake^{1, 2*}, N.W.B. Balasooriya³,
H.W.M.A.C. Wijayasinghe¹ and H.M.T.G.A. Pitawala³

¹National Institute of Fundamental Studies, Hantane Road, Kandy.

²Department of Science and Technology, Uva Wellassa University, Badulla.

³Department of Geology, University of Peradeniya, Peradeniya.

tharindu.tsh@gmail.com

Sri Lanka is endowed with high purity vein graphite deposits with extensive fracture hosted mineralization in the basement high grade rocks. Although, graphite has many profitable industrial applications, still the Sri Lankan vein graphite (SLVG) is exported as a cheap raw material without hardly any value addition. Many investigations have proved natural graphite as an alternative low cost anode material suitable for rechargeable Lithium-Ion Batteries (LIBs).

Presently, LIBs are the energy source for most of the portable electronic devices and electrical vehicles. However, LIBs still suffer with high unit cost of the electrode materials and their performance related issues. If SLVG can be developed as battery grade anode material for the LIB application, it could earn a ten-fold higher foreign exchange income than exporting raw SLVG.

This study therefore, investigates the electrochemical performance of SLVG as an anode material for the LIBs. The purified SLVG powder by acid digestion, that possesses extra high purity with modified surface characteristics, was selected for this study. Electrochemical half-cell studies were carried out using CR 2032 coin cells assembled with purified SLVG as the active electrode material and 1M LiPF₆ (EC:DMC; vol. 1:1) as the electrolyte. Cyclic voltammograms and the charge-discharge studies performed on this half-cell, revealed a high stable reversible capacity of 450 mA h g⁻¹, which is significantly higher than the theoretical capacity (372 mA h g⁻¹, LiC₆). Also, the resulted low irreversible capacity acquiesces to the high Columbic efficiency of over 99.9%. Moreover the formation of Solid Electrolyte Interface without strong passivation reaction, smooth lithiation-delithiation process and solvent co-intercalation were well evidenced for the structural stability and the low internal resistance of the developed SLVG anode. Therefore, highly crystalline Sri Lankan vein graphite can be presented as a value added, low-cost alternative anode material for the Li-ion rechargeable batteries.

Keywords: Vein graphite, Anode electrode, Li-ion battery, Value addition