Improvement of electrochemical properties of Sri Lanka natural vein graphite by physical and chemical treatments

N W B Balasooriya[1*], Philippe Touzain[2] and P W S K Bandaranayake[3]

[1,3]*Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka*

[2]*Laboratoire d'Electrochimie et de Physico-chimie des Matériaux et Interfaces (LEPMI), ENSEEG, INPG, B.P.75, 38402 St.Martin d'Hères, France*

Sri Lanka natural vein graphite is found in various morphologies with different structural and physical characteristics. The most abundant morphology, the Shiny- Slippery- Fibrous graphite (SSI) found from Bogala and Kahatagaha-Kolongaha mines, shows a very high purity of over 98% and high crystallinity. The present studies has been focused to modify the structure and electrochemical properties of natural vein graphite by physical and chemical treatments. Out of various treatment methods tested, the mechanical ball-milling and the chemical oxidation in air or $(NH_4)_2S_2O_8$ have shown a considerable improvement to the structure of natural vein graphite. The treated graphite was investigated by X-ray diffraction and electrochemical measurements. The ball-milled natural graphite shows an increase in the rhombohedral content with a higher $(101)_R/(101)_H$ intensity ratio. A high irreversible capacity is achieved due to increase in defect concentration with a lower tendency to solvent co-intercalation. The chemical treated graphite shows an improvement of reversible capacity and coulombic efficiency in the first cycle. In chemical oxidation the reaction occurs at the liquid-solid interface which produces a modified surface-film through oxidation process stabilizing the graphite structure as well as increasing the reversible capacity. Therefore, the physical ball-milling and the chemical oxidative treatment in air and $(NH_4)_2S_2O_8$ are simple and effective methods of increasing the electrochemical intercalation of lithium ions into natural vein graphite.

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*bkalues@yahoo.com Tel: 081 2380104 Ext.4240