

Investigation on Structural Modification of Sri Lankan Vein Graphite for Ion Intercalation

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by

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Abstract

Lithium-ion batteries are now widely used in electronic devices. Li-ion batteries have become the main energy source for the portable devices. Synthetic graphite is used as anode material in Li-ion batteries. Since both synthetic graphite and Li are very costly the Li-ion batteries are presently expensive. Cost of the batteries can be reduced by using Sri Lankan vein graphite for anode. On the other hand, natural graphite can be processed into expanded layer form (structural modification) of GO which is expected to facilitate the intercalation of ions. Therefore intercalation of larger ions is better. So further more cost reduction can be done by using more abundant and less expensive, but larger ions like Na^+ , Mg^{2+} , etc. To study the possibility to produce such a battery, ion intercalation behavior of GO was investigated in this study.

Purified samples from all four varieties of Sri Lankan vein graphite (KSSF, KNPG, KCFR and KCSF) were oxidized to GO by using improved hummers method. FTIR spectra confirmed the successful synthesis of GO. DC electrical conductivity was measured using four probe method and KSSF gave the highest DC electrical conductivity value. A half-cell was fabricated using KSSF GO. Tape casting method was used to make the electrode. A gel electrolyte was used in the cell and sodium metal was used as the reference. Assembling and testing of the cell was conducted inside a N_2 filled glove box. Discharging current of the half-cell under $0.5 \text{ k}\Omega$ load over time was measured and it was recorded using a computer interfacing program. Then discharging current was plotted against the time. GO half-cell gave an O.C.V. of 2.9 V, which indicates the successful intercalation of Na^+ ions to GO. Therefore it can be concluded that it is possible to intercalate relatively larger ions like Na^+ to structurally modified Sri Lankan vein graphite (GO).

Key words – Vein graphite, Graphite Oxide, Intercalation