Thermally Treated Sri Lankan Graphite as an Anode Material for Rechargeable Lithium-Ion Battery

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ABSTRACT

Graphite is a typical layered compound that consists of hexagonal sheets of sp^2-carbon atoms weakly bonded together by Vander Waals force. Therefore, it is an excellent lithium intercalation compound as anode materials in Lithium ion rechargeable batteries (LIB). Reversible intercalation and deintercalation are key process operating in lithium ion cells by high capacity (337 mAh/g) and low potential (0.1 – 0.3 V vs. Li^+/LI). Natural graphite would be a strong candidate since it is cheap. The surface chemistry of the graphite can be effectively modified by mild oxidation in air by forming dense oxide layer which is important for formation of a stable and protecting solid electrolyte interface (SEI) during initial few cycles non-toxic and widely available. Sri Lankan natural graphite is a potential candidate for anode material due to high purity, low cost and wide availability

Therefore, with in this study aims to develop performance enhanced low-cost anode material based on thermal oxidation of different structural types of vein graphite from Bogala and Kahatagaha-Kolongaha mines.

Then, four structural types, namely coarse flakes of radial (CFR) graphite, coarse striated-flaky (CSF) graphite, needle-platy (NPG) graphite and shiny-slippery-fibrous (SSF) were categorized in both mines. After preparing powdered samples (<53 μm) were used for thermal oxidation at 550^0C in a Muffle Furnace (OT-HTMF 05) under air for 6hours. What more both treated and untreated samples were used to characterize electrically by using four-probe d.c. conductivity method at room temperature & used to define graphine surface is modified by carbonyl, carboxyl and hydroxyl functional groups.

As a result of this study, the absence of such absorption peaks in untreated graphite reveals the formation of carbonyl group on periphery of hexagonal carbon basal plane. And also the d.c electrical conductivity of both types of graphite has increased slightly after oxidation.

Therefore, this study reveals that the vein graphite form Bogala and Kahatagaha-Kolongala are promising materials to produce anode materials for LIB with possible high reversible capacity.