Enhancement of $LiFePO_4$ (LFP) Electrochemical Performance Through The Insertion of Coconut Shell Derived rGO – Like Carbon as Cathode of Li-Ion Battery

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ABSTRACT

An old coconut shell as a green biomass was known as a potential carbon materials for rGO and cost effectiveness. The objective of this study is synthesizing an rGO – like carbon (C) compound from coconut shells and inserting into $LiFePO_4$ (LFP), as Li-ion battery cathode. Thus, an LFP/rGO nanocomposite was successfully fabricated using an unconventional approach which is the combination of the sol-gel technique and mechanical ultracentrifugation. $LiFePO_4$ precursors were prepared from commercial starting materials, using the sol-gel technique, and the composites' carbon weight content was varied between 15% and 30%. This process was subsequently followed by evaluating the microstructural characteristics and electrochemical properties as cathode for the Li-ion batteries. The results showed a high tendency of achieving maximum efficiency with merged LFP and rGO, although LFP molecules appear scattered but are firmly attached to each rGO structure, acting as a "bridge" between the surrounding particles. This reduced graphene oxide (rGO) link is relatively effective in limiting LFP grain growth as well as expanding the surface area, leading to a declined Li-ion diffusion rate. Consequently, the bridge presence also demonstrated a significant effect by enhancing the conductivity, electrical capacity and performance of the LFP/rGO cycle than pure LFP. Furthermore, the percentage ratio of the synthesized LFP/rGO cathode (85:15), attained higher cycle capacity, compared to 70:30 on the level of 0.1 C, with specific discharging average of 128.03 $mAhg^{-1}$ and retention capacity of 97.75% after 50 cycles, at room temperature and a rate of 0.1 C.

Keywords: reduced graphene oxide (rGO), LFP ($LiFePO_4$), LFP/rGO, nanocomposites, and mechanical ultracentrifugation method.