An Efficient Carbon Coating Process Applied in Different Synthetic Routes of LiFePO_4 Cathode Materials

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Four LiFePO_4/C composites have been successfully synthesized via Fe_2O_3 route, FeC_2O_4 route, FePO_4 route in solid-state method and FeSO_4 route in hydrothermal method with an efficient carbon coating process which innovatively employed compound carbon sources that consisted of fructose and calcium lignosulfonate. Kilogram grade pilot samples have been prepared and 2000 mAh pouch cells have been assembled and investigated. Due to the introduction of fructose and calcium lignosulfonate, the as-prepared LiFePO_4/C composites possess a layer of conductive carbon that contains calcium compound on the surface of LiFePO_4 particles, which are supposed to improve the electronic conductivity and reduce the side reaction between LiFePO_4 and electrolytes. All of the as-prepared LiFePO_4/C composites show different characteristics in full cells, the capacity retention of Fe_2O_3 derived LFP-S1 was as high as 92.2% after 400 days storage, the capacity retention of FeC_2O_4 derived LFP-S2 at 5C rate was 93.0%, the capacity retention of FePO_4 derived LFP-S3 at $-20\text{ }^\circ\text{C}$ was 66.7%, the capacity retention of FeSO_4 derived LFP-S4 was as high as 90.2% after 3000 cycles at $25\text{ }^\circ\text{C}$.

Keywords: LiFePO_4 ; carbon coating; solid-state; Hydrothermal; Lithium-ion batteries

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