Improvement of Electrochemical Performance of Lithium Iron Phosphate by Controlled Sol-Gel Synthesis

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The porous phase-pure lithium iron phosphate ($LiFePO_4$/C) composite particles with a few nanometers thick layer of carbon were synthesized by sol-gel method. The in situ coating of carbon on the $LiFePO_4$ particles was achieved by the pyrolysis of carbon source during the thermal treatment. The synthetic conditions were observed to affect physical, morphological and electrochemical properties of the composites. The composite synthesized via a single-step thermal treatment at 700 ℃ in the presence of a mixture of citric acid and sucrose possesses a large surface area and porous structure. The structure of the residual carbon coated in this sample is observed to be graphene-rich with the lowest D/G (disordered/graphene) ratio in the Raman spectra. When the three $LiFePO_4$/C composites were evaluated as cathode materials in lithium cells at room temperature, the composite prepared in the presence of sucrose as an additional carbon source showed the highest electrochemical performance exhibiting high discharge capacities of 153 (corresponding to 90% of the theoretical capacity), 120 mAh/g at 0.1, 1C-rates.