

### High rate electrochemical performance by using catalyst in lithium ion rechargeable batteries

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Lithium ion rechargeable batteries (LIB)s of LiCoO<sub>2</sub>/C system was designed in 1991 by Sony company [1]. Since then, LIBs have been significantly attracted for the various applications as a power sources in portable electronic devices such as smart phones, laptop computers, cameras. Due to its high energy density, excellent safety and long cycle life, its application as power source has been extended to industry such as electrical vehicles (EV)s, and hybrid electrical vehicles (HEV)s.

LiCoO<sub>2</sub> is the principal cathodic material for commercial LIB; however it suffers from many disadvantages of such as toxicity, high cost of the rare mineral resources, and unreliability at high temperature. In an effort to replace LiCoO<sub>2</sub>, lithium iron phosphate (LFP) has been attracted as a promising cathode material due to an eco-friendliness, inexpensiveness, and structural stability [2]. Even though LFP has many advantages, it has a major disadvantage of poor electrochemical rate performance resulted from an intrinsically low electrical conductivity ( $10^{-9}$  to  $10^{-10}$  Scm<sup>-1</sup>) at room temperature [3].

In this work, LFP/C composites with a catalyst for improving electrical conductivity were prepared by vibratory wet ball milling and subsequent heat treatment. LFP electrodes obtained from solid state synthesis method showed high capacity, excellent rate and cyclic performance

In order to systematically study the high electrochemical rate performance of LFP obtained by using catalyst, powder XRD (X-ray diffractometer) will be used to measure the crystallite size and Impedance spectroscopy will be used to check the conductivity. Raman spectroscopy will be used to analyze the D/G ratio of residual carbon. FE-SEM (Field Emission Scanning Electron Microscopy) and TEM (Transmission Electron Microscopy) will characterize the surface and structure respectively.

Coin-type cells for the electrochemical test will be assembled in an argon-filled glove-box with Celgard 400 as a separator, 1M LiPF<sub>6</sub> in ethylene carbonate (EC)/dimethyl carbonate (DMC) (1:1 v/v) will be used as an electrolyte, and Li foil as a counter electrode. Discharge (Li insertion)/ charge (Li extraction) experiments will be carried out galvanostatically within a voltage window of 2.5-4.0V (vs. Li/Li<sup>+</sup>) and at various C-rates.

### References:

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