Energy Density Increment in Li-ion rechargeable battery Using $LiCoO_2$/LiV_3O_8 and graphite/Li-metal composite Electrode cell

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ABSTRACT

Lithium cobalt oxide ($LiCoO_2$; LCO), uses as cathodes in current battery systems, exhibits good capacity retention and high nominal voltage. However, its low theoretical capacity and energy density have limits for further high energy required devices such as electrical vehicles or energy storage system. To solve this disadvantages, lithium trivanadate (LiV_3O_8, LVO) was applied as a co-active material which has a relatively high theoretical capacity (280 mAg h^{-1}) and good cycle stability. By investigating the various ratios of LCO:LVO, the optimal condition is found for yielding the best electrochemical performance. In other words, this optimal ratio features the advantage of LVO's high discharge capacity while maintaining LCO's capacity retention ability. For the full cell test, Li-metal powder (LP) and graphite were applied as anode materials. LP is synthesized by the droplet emulsion technique and this shape is prohibited dendrite growth. The LP layer was formed on the graphite anode surface by the dipping method. The new lithium metal secondary battery system (LCO+LVO composite cathode and graphite+Li-metal composite anode) was tested at various C-rate with cut-off voltage ranging from 1.8 to 4.0 V (versus Li/Li^+). And the structure, morphology, and electrochemical properties of the new type of battery's electrode were investigated by the implementation of X-ray diffraction (XRD), field emission scanning electron microscope (FE-SEM), transmission electron microscope (TEM), and energy dispersive spectroscopy (EDS). The result was analyzed by electrochemical impedance spectroscopy (EIS).

Keywords: Lithium metal batteries; storage; composite; hybrid electrode; non-lithiated cathode