CHEMICAL AND PHASE TRANSFORMATION FROM VANADIUM SULFIDE TO OXIDE VIA A NEW CHEMICAL ROUTE FOR THE SYNTHESIS OF Β'-LIXV2O5 AS A HIGH PERFORMANCE CATHODE

Wen Chao Lee[1] , Nina Mahootcheian Asl[1] , (Youngsik Kim[1, 2], Likun Zhu[1, 2])
Purdue School of Engineering and Technology, Indiana University Purdue University Indianapolis, Indianapolis, IN 46202

The used of rechargeable lithium ion batteries are so widely nowadays on consumer electronics especially portable devices such as cellphones, laptops and etc. The advancement of technology has created batteries with providing high energy density without memory effect and minimum the self-discharge on standby mode. Even with these features, researchers are still trying to improve the batteries with more energy density, low cost, better safety and high durability. The energy density improves with high operation voltage and high capacity. All these features came from one source, material. The resources for current commercial cathode material are decreasing and so new alternative cathode with high performance is needed to replace the commercial cathode in the future.

The high temperature vanadium pentoxide phase, β′-LixV2O5, was synthesized via a new chemical synthesis involving the evolution of vanadium oxides from the 600°C heat treatment of the pure LiVS2 in air. By employing this method of synthesis, well-crystalized, rod-shaped β′-LixV2O5 particles 20 – 30 µm in length and 3 – 6 µm in width were obtained. Moreover, the surface of β′-LixV2O5 particles was found to be coated by an amorphous vanadium oxysulfide film (~20 nm in thickness). In contrast to a low temperature vanadium pentoxide phase (LixV2O5), the electrochemical intercalation of lithium into the β′-LixV2O5 was fully reversible where $0.0 < x < 2.0$, and it delivered a capacity of 310 mAh/g at a current rate of 0.07 C between 1.5 V and 4 V. Good capacity retention of more than 88% was also observed after 50 cycles even at a higher current rate of 2 C.

[1]Department of Mechanical Engineering, Indiana University - Purdue University Indianapolis, Indianapolis, IN 46202

[2]Richard G. Lugar Center of Renewable Energy, Indiana University - Purdue University Indianapolis, Indianapolis, IN 46202