# Reduction of Irreversible Capacity Loss via V2O5 Surface Coating Lithium Rich Cathode Materials

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Compared to conventional cathode materials (e.g., $LiCoO_2$, $LiMn_2O_4$, $Li[Mn_{1/3}Ni_{1/3}Co_{1/3}]O_2$, the lithium rich layered $(Li_2MnO_3)_x(LiMO_2)_y$ (M=Mn, Ni, Co) materials have attracted great interest due to its higher discharge capacity over 250 mAh/g. Nevertheless, these materials demonstrate huge irreversible capacity loss of 60–120 mAh/g in the first cycle because the extraction of $Li_2O$ in the first cycle results in a lower number of Li ion sites in the subsequent cycles. This work has investigated the effect of vanadium oxide ($V_2O_5$) sol–gel coatings on the cycleability of lithium rich cathode materials for lithium ion battery at a high-charge cut-off voltage. The process starts from the impregnation of envia cathode powder in vanadium tri-Isopropoxide oxide THF solution, followed by evaporation, hydrolyzation in vapour and annealing. The crystal structure and morphology of the samples are examined by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM). The results indicated $V_2O_5$ take an amorphous form with the annealing temperature below 300 $^oC$. When the annealing temperature increases to 500 $^oC$, $Li_3VO_4$ phase has been formed. The electrochemical performance, including coulombic efficiency and cycleability, of $V_2O_5$ coated cathode materials was improved as compared to pristine materials.

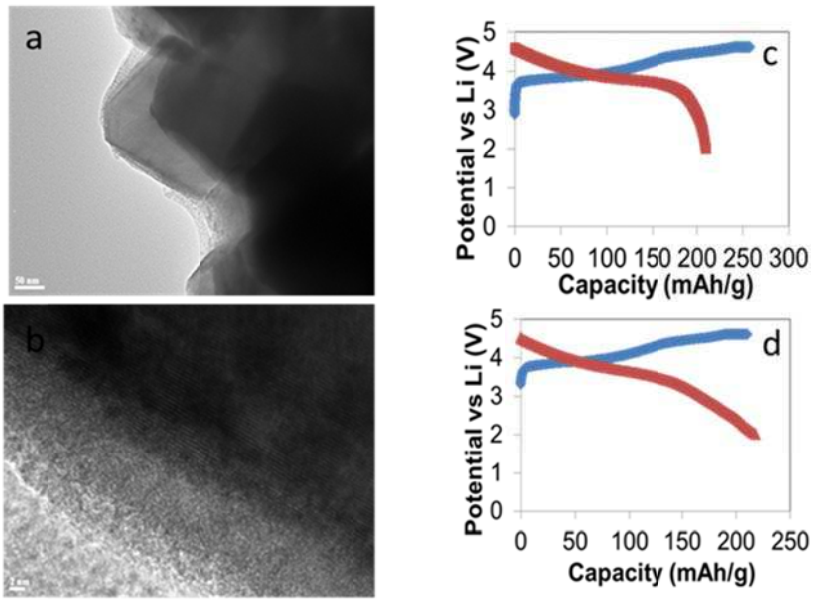


*Figure 1 (a) TEM image and (b) high resolution TEM image showing amorphous $V_2O_5$ on the crystalline lithium rich cathode. (c)The first charge/discharge curve of pristine materials and (d) that of $V_2O_5$ coated ones showing $V_2O_5$ coating effectively reduces the irreversible capacity loss.*