Effect of heat-treatment on Li_2ZrO_3-coated $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ and its high voltage electrochemical performance

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Abstract Summary: The surface of $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ particles was modified by Li_2ZrO_3. Influences of heat-treatment were studied by X-ray diffraction (XRD), scanning electron microscope (SEM), energy dispersive spectrometer (EDS), transmission electron microscope (TEM) and X-ray photoelectron spectroscopy (XPS). The results show that Li_2ZrO_3 is well-crystallized and successfully coated on the surface of $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ after heated at 700 ^oC. Electrochemical tests demonstrate that the coated sample exhibits excellent cycling performances.

Introduction: Layer-structured $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ is considered as one of the most promising substitutes for $LiCoO_2$ because of its low cost, higher reversible capacity, and milder thermal stability [1]. Nevertheless, its low rate capability, poor cyclic performance and thermal stability at high cut-off voltage still need to be improved to meet the requirement of high-power and high capacity for hybrid electric vehicles. Li_2ZrO_3, as an Li-ion conductor, it can not only protect cathode material from electrolyte but also provide the tunnel for Li-ion transportation [2, 3]. Electrochemical tests demonstrate that the coated sample heated at 700 ^oC exhibits excellent cycling performances with 89.0 % (25 ^oC) and 84.9 % (55 ^oC) capacity retention at 1 C after 100 cycles under the high cut-off voltage of 4.6 V.

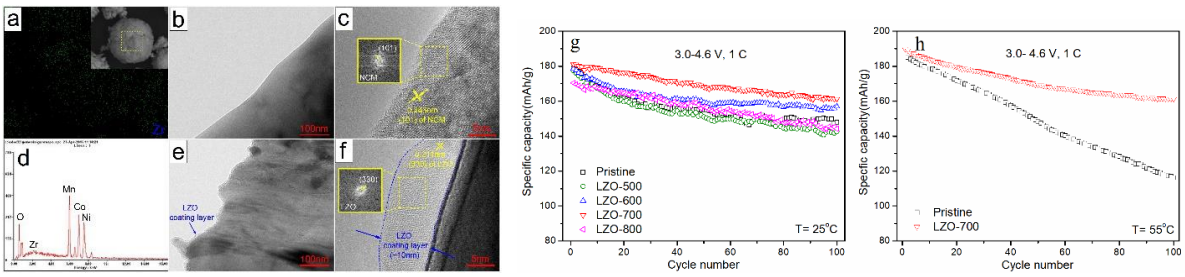

Fig. 1. EDS mapping of (a) Zr and (d) EDS spectrum of the selected area in (a), TEM images of (b) the pristine and (e) LZO-700 sample, HRTEM and corresponding FFT (fast Fourier transform) images of (c) the pristine and (d) LZO-700 sample. (g) cycling performances of the pristine and Li_2ZrO_3-coated samples at 25 ^oC and (h) 55 ^oC.

References

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