Chunman Zheng et al., J Fundam Renewable Energy Appl 2017, 7:6(Suppl)
DOI: 10.4172/2090-4541-C1-035

2nd International Conference on

Battery and Fuel Cell Technology

July 27-28, 2017 | Rome, Italy

Structural change and thermal properties of NCA/$LiMn_2O_4$ blend materials during the charging process

Chunman Zheng, Wenzhu Yang, Hui Wang and **Kai Xie**
National University of Defense Technology, China

Layered oxides $LiNi_{0.8}Co_{0.15}Al_{0.05}O_2$ (NCA) is one of the most attractive cathode material for high power applications such as hybrid/plug-in hybrid electrical vehicles. It shows great benefits in high volumetric energy density and high rate performance. However, there are still some technical hurdles to be solved, such as high temperature stability. The poor high temperature stability is attributed to the chemical reaction of NCA cathode material with the electrolyte in the process of charging and discharging. Blending with other stable cathode materials is one effective way to improve the properties of materials. For example, Tran et al. reported the blend material of $LiMn_2O_4$ and NCA, demonstrating very stable cycle performance and high temperature stability. In the present work, NCA/$LiMn_2O_4$ blend materials with different ratio were prepared in order to improve the properties of materials. Structural change and thermal properties of NCA/$LiMn_2O_4$ blend materials during the charging process were systematically studied. Figure 1 shows the XRD patterns of NCA/$LiMn_2O_4$ blend materials which were charged to 4.2 V and 5.0 V, respectively. It shows that the layered cathode materials undergo a reversible phase transition, namely a phase transition from H1 phase to M phase (3.748 V), M phase to H_2 phase (4.017 V), and H_2 phase to H_3 phase (4.227 V). During the phase transition, the cell parameters of blended materials a and b decreases whereas c increases. Figure 2 shows the temperature change of NCA/$LiMn_2O_4$ blend materials during the charging process and the high temperature stability of blend materials which were charged to 4.2 V. When the mass ratio of $LiMn_2O_4$ is 20%, the blend cathode materials exhibit better anti-overcharge behavior with less heat generated. The decomposition temperature of the blend materials which were charged to 4.2 V is higher than the pure NCA. The blend materials with 20% $LiMn_2O_4$ have the best temperature stability.

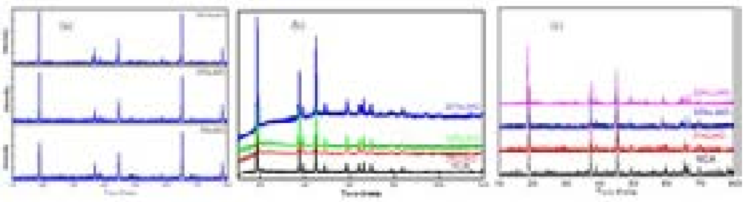

Figure 1: XRD patterns of (a) NCA/$LiMn_2O_4$ blend materials, (b) blend materials charged to 4.2V, (c) blend materials charged to 5.0V.

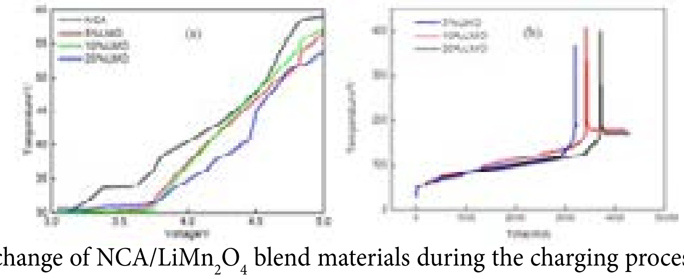

Figure 2: (a) The temperature change of NCA/$LiMn_2O_4$ blend materials during the charging process, (b) high temperature stability of blend materials charged to 4.2V.

Biography

Chunman Zheng studies energy materials and their electrochemistry, including synthesis of cathode material, anode material, nano-carbons as well as their applications in lithium storage and conversion. He received his Bachelor's degree in Applied Chemistry and Doctorate degree in Materials Science and Engineering in 2006 at National University of Defense Technology, China. He is now an Associate Professor in Department of Materials Science & Engineering at National University of Defense Technology, China.

zhengchunman@hotmail.com