Reason and improvement of capacity fading in $LiNi_{0.5}Mn_{1.5}O_4$/graphite batteries

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Spinel $LiNi_{0.5}Mn_{1.5}O_4$ is a promising material for power lithium ion batteries because its high voltage can produce higher energy [1, 2]. The cycle performance of $LiNi_{0.5}Mn_{1.5}O_4$/Li battery is good [3] but that of $LiNi_{0.5}Mn_{1.5}O_4$/graphite battery is poor [4, 5]. J.-H. Kim et al. [5] attribute this phenomenon to active Li^+ loss in the full-cell system through continuous SEI formation. Thus, cathode and anode of cycled full cell with severe capacity fade should remain their structure and still have most capacity. Moreover, adding Li metal should improve cycle performance of $LiNi_{0.5}Mn_{1.5}O_4$/graphite battery.

In this paper, a coin size $LiNi_{0.5}Mn_{1.5}O_4$/graphite full cell is made and cycled. Then it is disassembled and the cathode and anode are re-assembled with Li foil. It can be seen the electrodes still remain over 90% capacity though the capacity of the full cell only remains 10% capacity. This can prove that it is active Li^+ loss but not material itself causes capacity fading. A Li foil is added on the back of anode then the cycle performance of $LiNi_{0.5}Mn_{1.5}O_4$/graphite full cell is highly improved.

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