New Li–Mn–O Cathode Materials with High Voltage and Capacity

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We have synthesized $Li_{0.44}MnO_2$ with a tunnel structure by ion exchange reaction in molten salt using $Na_{0.44}MnO_2$ as a precursor. ICP-AES analysis indicated the Na/Li ratio in the present $Li_{0.44}MnO_2$ sample was less than 0.003. The electrochemical tests using lithium metal anode showed the good charge-discharge cycles, and its initial discharge capacity of 166 mAh/g between 2.5 and 4.8 V. A plateau region above 4 V was first revealed in the present study. Partial replacement of manganese with titanium upgrades the performance further to initial discharge capacity of 177 mAh/g.

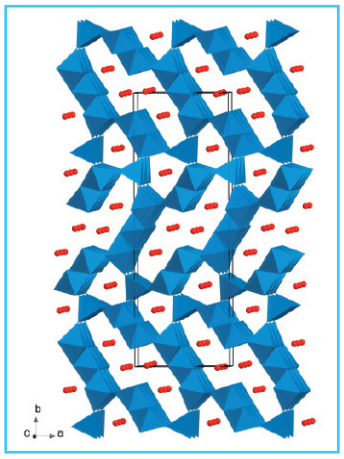

Fig. 1. Crystal structure of $Li_{0.44}MnO_2$.

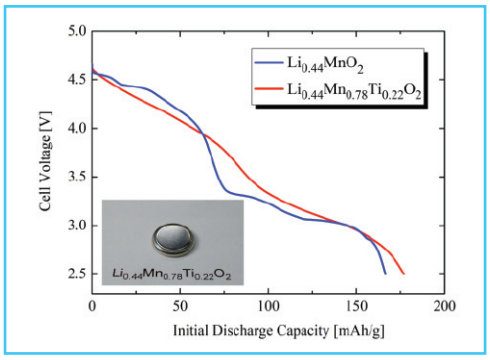

Fig. 2. Initial discharge curves of newly developed lithium manganese oxide cathode materials and its capacity upgraded by substitution with titanium, using lithium metal anode after charging up to 4.8 V. The photograph is prototype coin-type cell.

Novel Ionic Liquids Electrolyte for Li Metal Anode

Ionic Liquids Based on Aliphatic Quaternary Ammonium

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We have synthesized new ionic liquids based on aliphatic quaternary ammonium and fluorine-contained anion. Especially, N-methyl-N-propylpiperidinium (PP13) bis(trifluoro-methylsulfonyl)imide (TFSI) exhibits wide electrochemical windows comparing with conventional RTILs based on 1-ethyl-3-methylimidazolium (EMI) and TFSI. In the RTIL (PP13-TFSI), lithium metal could be electrochemically deposited on a metal electrode. The most striking feature was that the surface of the deposited lithium was very smooth comparing with a dendritic deposition in an conventional organic electrolyte.

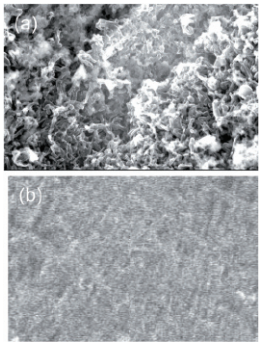

Fig. 1 SEM pictures of electrochemically deposited Li metal.
(a) in an organic solvent (PC), (b) in PP13-TFSI.

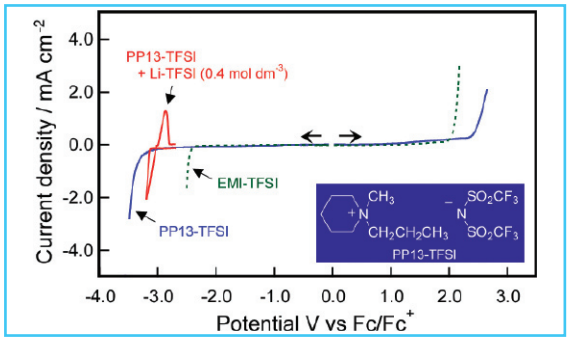

Fig. 2 Various voltammograms taken in RTILs at 298 K. (blue) linear sweep voltammograms (LSV) of PP13-TFSI on glassy carbon electrode (GC); (green) LSV of EMI-TFSI on GC; (red) cyclic voltammogram of PP13-TFSI containing Li-TFSI. Scan rate = 50 mV/s.