**Design and Development of Sodium-ion Batteries Based on Layered Transitional Metal Oxide Cathode Material**

Zi-Feng Ma, Haiying Che, Yingying Xie, Hong Wang, Xiaozhen Liao

Shanghai Electrochemical Energy Devices Research Center, Department of Chemical Engineering, Shanghai Jiao Tong University, Shanghai, 200240, China

E-mail: zfma@sjtu.edu.cn

The Rechargeable lithium-ion batteries have been considered as a promising power source for the electric vehicles and the grid energy storage systems. However, lithium resources are limited and will restrict the huge applications of lithium-ion batteries. It is of great significance to develop eco-friendly sodium ion batteries which employ abundant sodium resources. Recently, we developed the large-scale synthesis route of NaNi1/3Fe1/3Mn1/3O2 (NFM) by using hydroxide co-precipitation combined with solid-state reaction, and the optimization reaction condition was studied by using in situ XRD. The metastable structure change of NaNi1/3Fe1/3Mn1/3O2 during electrochemical sodium ion intercalation which cycled at 0.1C rate between 2.0 to 4.0V, and 2.0 to 4.3V, were studied by using in operando TXM-XANES and XRD, and the thermal decomposition behavior and structure evolution of charged NaNi1/3Fe1/3Mn1/3O2 cathode material during heating process was measured by using in situ high-energy X-ray diffraction (HEXRD) technique.



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