Electrochemical Process Engineering

Bachelor/Master thesis

Electrochemical testing and mechanism analysis of layered transition metal oxide cathode for sodium-ion batteries (SIBs)

As one of the most promising alternatives for lithium-ion batteries (LIBs), SIBs have drawn increasing attention from researchers and industry. The performance of SIBs strongly depends on the electrochemical properties of the cathode materials, which has a great influence on the overall capacity, energy density and cycling stability of the battery. Among various kinds of cathode materials for SIBs, layered oxides ($Na_xTM_yO_2$, TM=transition metals) stand out owing to their high theoretical capacity and facile synthesis.

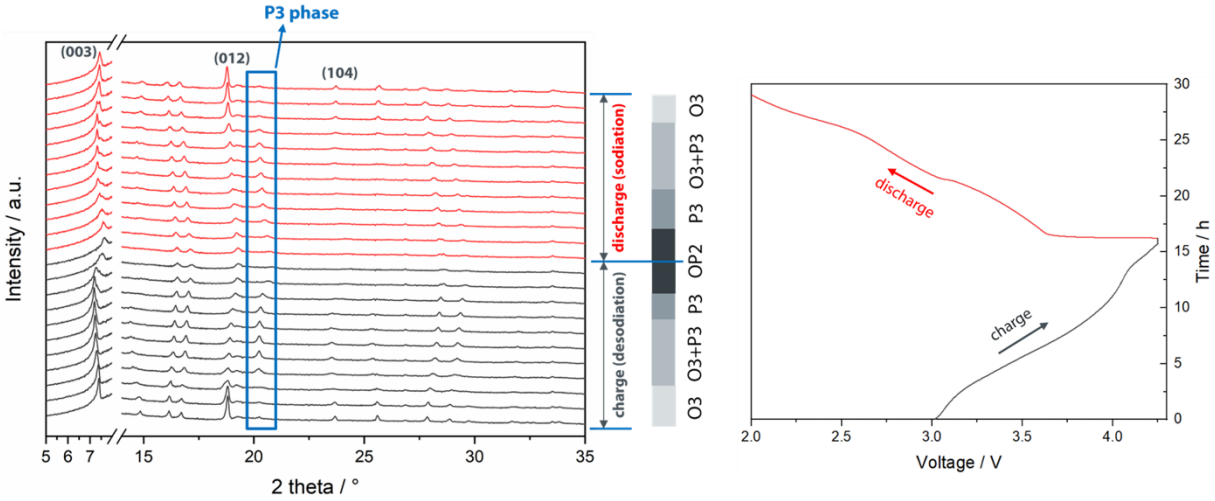

Figure 1. *Operando* XRD patterns of $Na_{0.9}Fe_{0.3}Cu_{0.22}Mn_{0.48}O_2$ cathode in sodium ion battery for the initial cycle and the corresponding charge and discharge curves.

In this project, the electrochemical performances of the Fe/Mn-based oxide cathode materials for SIBs will be tested and evaluated by galvanostatic cycling, electrochemical impedance spectroscopy, galvanostatic intermittent titration technique etc. As shown in Figure 1, the evolution of the crystalline structure (i.e. phase transition) of the oxide materials during charge(sodiation)/discharge(desodiation) can be measured and analyzed by *operando* X-ray diffraction (XRD) at our chair, which provides powerful information for fading mechanism investigation.

This topic is aimed at chemistry, chemical engineering or material science students who have interest in electrochemistry and battery research. Please contact me to discuss more details of the projects if you are interested.

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