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Electrode Materials for Sodium Ion Batteries; Degradation Mechanism of NaFeO_2 and activation of NaCl

As the application of the secondary batteries expands from portable IT application to the large scale application, the cost of the battery system became more important. Lithium ion batteries are the state of the art battery system and widely used in various application. But, it seems that it will not meet the economical requirement, since the lithium and cobalt is not sufficient enough in the earth crust to be used in the large scale application such as energy storage systems (ESS). Sodium ion batteries can be a strong candidate to replace the lithium ion batteries in ESS application. Sodium is the seventh most abundant element on Earth and the fifth most abundant metal, behind aluminum, iron, calcium, and magnesium and ahead of potassium, thus making the sodium ion batteries very attractive in the economical point of view.

Sodium ion batteries have very similar structure with the lithium ion batteries. The major components in the cell are also similar each other. The strong candidate for the cathode material for the sodium ion batteries are also layered structured materials similar to lithium ion batteries. Among them, O3 type NaFeO_2 is very important material to be studied since it is relatively basic structure and it can give very important information on the reaction & degradation mechanism of the layered structured cathode materials. Its performance degradation mechanism will be presented using the analysis of the phase transition of layered NaFeO_2 and oxidation state of Fe during Na extraction/insertion. In addition to the layered structured materials, a possibility of using the novel material, NaCl , as an electrode material will be presented.