東京大学
微細構造解析
プラットフォーム
The University of Tokyo

東京大学微細構造解析プラットフォーム
公開講演会

“From solid state chemistry to Battery materials Electrochemistry: a tool for Solid State Chemistry”

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Researches on battery materials has considerably increased during the last 30 years due to the huge development of lithium-ion batteries for portable devices (laptops, cellular phones, ...) and more recently with the need to store energy in order to optimize its consumption. In order to found new materials and to understand the intercalation-deintercalation mechanisms new chemistry approaches are developed at the border between solid state chemistry and electrochemistry. The cell voltage is equal to the difference in Fermi level between the two electrodes. If one electrode exhibits a constant voltage, it can act as reference and therefore, the cell voltage reflects all structure modifications that occurs on the material upon intercalation. The change is cell voltage depends on: (i) the electronic band filling, (ii) the change in the band structure due to change in composition, (iii) the modification of the Magdelung energy. In some cases the monotonous decreases of the voltage during the intercalation reaction indicates that the reaction occurs through a monophasic domain. In numerous cases, the reaction mechanism is more complicated and involves biphasic domains and/or formation of materials with a specific composition. The voltage vs composition curve is much more complicated and gives directly the phase diagram of the studied system. For the solid state chemist, the studies of the electrochemical reaction using a battery opens new possibilities to determine phase diagram at RT, but also to synthesize new metastable phases from a precursor made by classical solid state chemistry. Moreover, exchange reactions open new fields to synthesize new metastable materials. The in situ or in operando experiments allow to follow directly the structural modifications occurring during the electrochemical reaction. In this presentation, some typical results obtained in our lab concerning lithium and sodium layered oxides will be presented to emphasize the dual approach: batteries to solid state chemistry and solid state chemistry to batteries.

March 3 (Fri), 2017 15:00～16:30
Main meeting room at Institute of Engineering Innovation, UT
(工学部総合研究機構　9 号館 1 階　大会議室)
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