

Fabrication and In situ Measurements of Solid-State Thin-Film Lithium Batteries

Naoaki Kuwata

Institute of Multidisciplinary Research for Advanced Materials, Tohoku University

In this talk, fabrication technique of solid-state thin-film batteries (TFBs) using pulsed laser deposition (PLD) is reported. TFBs are fabricated by depositing layers of cathode, electrolyte and anode. We use several transition metal oxides (LiCoO_2 , LiMn_2O_4 , and LiCoMnO_4) as a cathode layer. As a solid electrolyte, amorphous lithium phosphate is deposited from ceramic Li_3PO_4 target. Although the oxide electrolytes show lower ionic conductivity than sulfides, the resistance of the electrolyte layer is small enough to operate thin-film batteries. The anode layer is selected by the electrochemical stability of electrolyte. Lithium metal can be used for L-P-O electrolyte.

TFBs are also applied to a fundamental study of lithium intercalation in solid-state batteries. We use in situ Raman spectroscopy to measure the structural change of cathode materials (LiCoO_2 and LiMn_2O_4) in TFBs. Detailed information of the phase transition is obtained related to lithium insertion/extraction in TFBs. Very slow movement of phase-boundary is also observed in solid-state batteries.