Flux crystal growth concept as new approaches to material synthesis and design: A challenge for super-ion conduction path in all-solid-state LIBs

Katsuya Teshima[1], Nobuyuki Zettsu[2]

[1] Center for Energy and Environmental Science, Shinshu University, Nagano, Japan
[2] Department of Materials Chemistry, Shinshu University, Nagano, Japan

Email:teshima@shinshu-u.ac.jp

Lithium ion secondary batteries (LIBs) have been extensively studied because of their potential use as power sources in mobile electronics, hybrid-electric vehicles and next-generation electric mobilities. Recently, we are especially focusing on all-crystal (solid)-state LIBs. They have attracted significant attention due to their high energy densities, that is, originating from the device miniaturization, and high safety caused by their non-flammability. However, there is extremely large innovation gap between general LIBs and all-solid-state LIBs because of difficulties in smooth lithium ion transfer, i.e., diffusion of lithium ions and electrons are interfered at interfaces of different solid materials. Therefore, we have tried to control and design their interfaces between active materials and solid electrolytes and fabricate materials for all-solid-state LIBs on the basis of crystal science and engineering. Our group has researched a classic flux method for preparing active materials and solid electrolytes, and developed flux coating method for fabricating active crystal layers on metal collectors and solid electrolyte layers. The flux method is a nature-mimetic liquid phase crystal growth technique, and has several advantages over other methods like solid state reaction. It is a relatively low-temperature process that requires very simple equipment, and high-quality crystals with well-developed facets can be grown. The details of materials preparation and interfaces design by use of our flux crystal growth concepts will be presented in the NN17 conference. In addition, we will propose a new concept "roll-to-roll flux coating method" for preparing all-solid-state LIBs.

Reference(s)

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