Materials and interface design for high energy density rechargeable batteries : From Li-ion to Solid-State Batteries

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Abstract

Expansion of the application of the batteries from small electronic devises to energy storage system or electric vehicles moves up the energy ubiquitous era in which the electrical energy can be used anywhere, anytime, without being constrained by time and space. At the same time, one of the recent biggest issues of unusual climate change or global warming accelerates the development of efficient energy storage system for clean energy. Those changes in energy and environmental technologies highly requests on the development of rechargeable batteries with high energy density. As responses for increasing demand on the batteries with high energy density, there are two huge approaches in battery fields. The first approach is to design cathode material for gravimetric energy density and the second approach is to realize the solid-state battery for volumetric energy density. In this talk, I will introduce a new design principle for cathode material that can expand the chemical space and boundaries of cathodes to overcome the bottle neck of gravimetric energy density of current Li-ion batteries. In solid-state batteries, I will introduce the critical issues at interface between cathode and solid electrolyte such as chemical reaction, physical contact loss, and suggest a diagnosis tool for chemical interfacial degradation. Further, a new type of solid electrolyte with pliable character that can maintain physical contact with cathode will be introduced.