Electrochemical properties of composite cathode with bimodal solid electrolyte for all-solid-state batteries

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Due to the demand for large scale lithium ion batteries such as electric vehicles (EV) and energy storage systems (ESS), the safety of lithium ion batteries is being taken very seriously. All-solid-state lithium ion batteries are considered candidate for post lithium ion batteries that have high electrochemical stability and excellent safety due to their nonflammability of inorganic solid electrolyte compared to conventional lithium-ion batteries using flammable organic liquid electrolytes. However, all-solid-state lithium ion batteries still require an improvement of electrochemical performances.

The electrodes of all-solid-state lithium ion batteries have composite structure with the electrode active materials, the inorganic solid electrolytes and the conducting agents. A major problem of composite cathode is the lack of contact between the electrode active materials and the solid electrolytes.

In this study, the composite electrode layer were fabricated using the bimodal type solid electrolyte. The pores in the composite cathode layer were filled with the small-size inorganic solid electrolyte to lower the interface resistance and to widen the contact areas between the solid electrolyte and the cathode material. The electrochemical properties of composite electrodes for all-solid-state batteries with different structures were evaluated. The bimodal type solid electrolyte for composite cathode layer provides improved all-solid-state battery performances while maintaining excellent stability and durability.

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