SESSION 6: SOLID ELECTROLYTES

SODIUM PLATING FROM NA-B ″-ALUMINA CERAMICS AT ROOM TEMPERATURE, PAVING THE WAY FOR FAST-CHARGING ALL-SOLID-STATE BATTERIES

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All-solid-state batteries with an alkali metal anode have the potential to achieve high energy density. However, the onset of dendrite formation limits the maximum plating current density across the solid electrolyte and prevents fast charging. It is shown that the maximum plating current density is related to the interfacial resistance between the solid electrolyte and the metal anode. Due to their high ionic conductivity, low electronic conductivity, and stability against sodium metal, Na-β″-alumina ceramics are excellent candidates as electrolytes for room-temperature all-solid-state batteries. Here, it is demonstrated that a heat treatment of Na-β″-alumina ceramics in argon atmosphere enables an interfacial resistance <10 Ω cm2 and current densities up to 12 mA cm–2 at room temperature. The current density obtained for Na-β″-alumina is ten times higher than that measured on a garnet-type $Li_7La_3Zr_2O_{12}$ electrolyte under equivalent conditions. X-ray photoelectron spectroscopy shows that eliminating hydroxyl groups and carbon contaminations at the interface between Na-β″-alumina and sodium metal is key to reach such values. By comparing the temperature-dependent stripping/plating behavior of Na-β″-alumina and $Li_7La_3Zr_2O_{12}$, the role of the alkali metal in governing interface kinetics is discussed. This study provides new insights into dendrite formation and paves the way for fast-charging all-solid-state batteries.