Interfaces in Solid-State Batteries and Their Influences on the Battery Performance

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Solid-state batteries are expected to be a fundamental solution to the safety issues of lithium-ion batteries, which originate from their organic-solvent electrolytes. Although the solid-state batteries had been suffering from the low power density due to low ionic conductivities of solid electrolytes, the highest ionic conductivities have reached 10^{-2} S cm^{-1} among sulfides recently. As a result, a recent paper reports that solid-state batteries have become to exhibit higher power density than conventional lithium-ion batteries [1]. However, it should be noted that some materials used in the high-power solid-state batteries are not highly-conductive. Surface of the cathode material, $LiCoO_2$, is covered with $LiNbO_3$, although it is a poor ionic conductor. In addition, $Li_4Ti_5O_{12}$ used as the anode is an insulator. It has revealed computationally that the $LiNbO_3$ suppresses lithium depletion resulting in high resistance at the cathode interface, and transport properties in the $Li_4Ti_5O_{12}$ are enhanced at the interface to $Li_7Ti_5O_{12}$, which is a charged state of $Li_4Ti_5O_{12}$ [2].

References:

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