Correlation study on temperature dependent conductivity and line profile along the LLTO/LFP-C cross section for all solid-state Lithium-ion batteries

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ABSTRACT

Nanocrystalline lithium lanthanum titanate (LLTO) – lithium iron phosphate (LFP/C) layered pellets have been prepared to analyze its interface for all solid-state batteries. The conductivity of the samples as a function of temperatures was analyzed and reported. The total conductivity of the sample at room temperature is in the order of 10^{-5} S cm^{-1}. The SEM and line scan analysis of the samples have been carried out across the cross sections at different temperatures. The study gives a correlation between the line profiles across the LLTO-LFP/C interface and the temperature dependent conductivity of the sample at various temperatures for the first time. At lower temperatures up to 398 K, a narrow interface region occurs at the LLTO – LFP/C interface. At higher temperatures, the ions of elements with higher atomic mass than the lithium, such as lanthanum, iron, titanium, are also accumulate near the interface, which have been verified from the broad interface region occurring in the elemental line scan mapping across the interface. This accumulation of ions causes an additional impediment to the movement of Li^+ ions which results in the breakdown in conductivity at 448 K.

KEYWORDS
Nanomaterial; Line-scan analysis; Impedance spectroscopy; Conductivity; Interface

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