

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

K. P. Abhilash^{a,b,c}, P. Christopher Selvin^d, B. Nalini^e, Rajan Jose^f, Xia Hui^{a,b}, Hendry Izaac Elim^g, M. V. Reddy^{c,h}

^a School of Materials Science and Engineering, Nanjing University of Science and Technology, Nanjing 210094, China

^b Herbert Gleiter Institute of Nanoscience, Nanjing University of Science and Technology, Nanjing 210094, China

^c Department of Physics, National University of Singapore, 117542, Singapore

^d Department of Physics, Bharathiar University, Coimbatore 642046, India

^e Department of Physics, Avinashilingam University for Women, Coimbatore 641 043, India

^f Nanostructured Renewable Energy Materials Laboratory, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Kuantan, Malaysia

^g Department of Physics, Faculty of Mathematics and Natural Sciences, Pattimura University, Ambon 97233, Indonesia

^h Centre of Excellence in Transportation Electrification and Energy Storage (CETEES), Hydro-Québec, 1806, Lionel-Boulet Blvd., Varennes, QC J3X 1S1, Canada

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 $10^{-5} \text{ S cm}^{-1}$. 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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