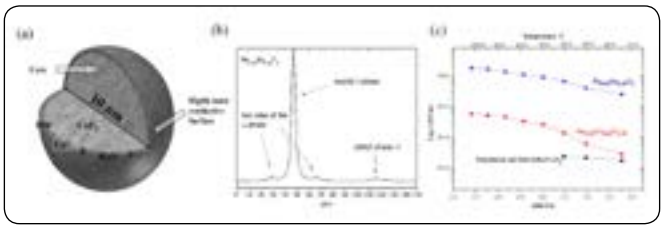
Palanivel Molaiyan et al., Innov Ener Res 2018, Volume 7
DOI: 10.4172/2576-1463-C1-003

Advances in room temperature fluoride-ion batteries

Palanivel Molaiyan[1], **I Mohammad**[1] and **Raiker Witter**[1, 2]
[1]Tallinn University of Technology, Estonia
[2]Karlsruhe Institute of Technology, Germany

All-solid-state secondary batteries employing solid electrolytes are potentially more stable and safer than conventional batteries. At present, investigations and improvements of the ionic conductivities of solid electrolytes are attracting great attention. Here, we discuss the creation of defects (vacancy or point defects) in $Pb_{x-1}Sn_xF_2$, $Ba_{x-1}Sn_xF_2$, CaF_2 and (interstitial defect) $Sm_{1-x}Ca_xF_{3-x}$ systems. Also, we discuss the introduction of additional surface defects to enhance conductivities at grain boundaries and nano-particle surfaces. Our samples were prepared by high-energy planetary ball-milling. Structural, morphology and conductive properties of the synthesized electrolytes were examined. Crystal structure, crystal/particle sizes and local molecular environment were examined with X-ray diffraction (XRD), high-resolution field emission scanning electron microscope (FESEM) and nuclear magnetic resonance (NMR) studies. At room temperature, the ionic conductivities of the systems were obtained to be between 10^{-3} to 10^{-5} S/cm. Finally, based on these solid-state electrolytes, different fluoride ion batteries (FIB) at room temperature performance (RT-FIB) were prepared and electrochemical cycling behavior studies carried out.



Recent Publications:

1. Rongeat, C., Anji Reddy, M., Witter, R. & Fichtner, M. Solid electrolytes for fluoride ion batteries: Ionic conductivity in polycrystalline tysonite-type fluorides. ACS Appl. Mater. Interfaces 6, 2103–2110 (2014).
2. Rongeat, C., Anji Reddy, M., Witter, R. & Fichtner, M. Solid Electrolytes for Fluorides Ion Batteries: Ionic Conductivity in Polycrystalline Tysonite-type Fluorides. ACS Appl. Mater. Interfaces 6, 2103–2110 (2014).
3. Mohammad, I., et al., Synthesis of Fast Fluoride-Ion-Conductive Fluorite-Type Ba1– xSbxF2+x ($0.1 \leq x \leq 0.4$): A Potential Solid Electrolyte for Fluoride-Ion Batteries. ACS Applied Materials & Interfaces, 2018.

Biography

Palanivel Molaiyan obtained his Master's in Materials Science (2010) at PSG College of Technology, India. During a three years period in the industrial sector he worked as a Technician and Application Scientist at Hind High Vacuum Co. Pvt. Ltd., Bangalore, India. Currently, he is pursuing his PhD in Science (2014-2018) from Tallinn University of Technology, Tallinn, Estonia. His research topic is on fluoride-ion based batteries using solid-state electrolytes under the supervision of Prof. (Associate) Dr. Raiker Witter, TUT, Estonia and KIT, Germany. His research expertise is in materials science and electrochemistry, especially working on new solid-state electrolytes based on rare earth and alkali fluoride materials for the development of room temperature fluoride-ion based batteries.

Palanivel.Molaiyan@ttu.ee