KANSAS STATE UNIVERSITY
Department of Chemistry

King Hall 04
Thursday, Nov 14, 2019
1:30pm
Coffee and Cookies provided & 1:15pm

Ceramic-doped in composite polymer electrolyte for solid-state batteries

Professor Lamartine Meda
Professor
Director, NSA MIRO SHILib Center
Xavier University of Louisiana
Department of Chemistry

Abstract

Replacing liquid electrolytes with solid state Li-ion conductors is one way to achieve safe rechargeable batteries with high energy density. Composite polymer electrolyte based on semi-interpenetrating polymer network (s-IPN) was synthesized from the mixture of poly(propylene carbonate), poly(ethylene glycol) methylether acrylate, poly(ethylene glycol) diacrylate (PEGDA), and lithium bis(trifluoromethane)sulfonimide salt via one-pot thermal curing method. The crosslinker PEGDA content and salt concentration were optimized. The ionic conductivity, lithium-ion transference number and electrochemical stability window of the s-IPN electrolyte were correlated with its thermal and physical properties. Differential scanning calorimetry measurements have shown a low degree of crystallinity in this s- IPN electrolyte. The electrolyte with higher salt concentration has lower ionic conductivity, consistent with higher glass transition temperature of poly(ethylene glycol) chain. The ionic conductivity was further enhanced by dispersion of lithium-ion conductive ceramic powder, lithium lanthanum zirconate doped tantalum (LLZTO) into the s-IPN matrix. High ionic conductivity (6 x 10-4 S/cm) was obtained at 50 °C while the electrolyte was stable against lithium after stripping and plating at 0.1 mA/cm^2 at room temperature.

Biography

Dr. Meda earned a B.S. in Chemistry from Salem State University, Salem, MA in 1992 and a Ph.D. in Materials Inorganic Chemistry from Northeastern University, Boston, MA in 1998. His graduate work was on the synthesis of organometallic tungsten and ruthenium precursors for chemical vapor deposition (CVD) of thin film metal oxides nanomaterials. He served as a Postdoctoral Research Associate at The FAMU-FSU College of Engineering and the Center for Materials Research and Technology (MARTECH) at Florida State University (FSU), Tallahassee, FL under Professor Hamid Garmestani from 1999 to 2001. Dr. Meda worked in industry as a Senior Research Scientist at Excellatron Solid State, Atlanta, GA from 2002 to 2006. There, he worked on the development of all-solid state thin film batteries using plasma-enhanced metal-organic chemical vapor deposition (PE-MOCVD). He held two patents from his work in thin film batteries at Excellatron Solid State. Dr. Meda joined the chemistry faculty at Xavier University of Louisiana (XULA) in 2008 after spending two years as a Visiting Assistant Professor of Chemistry at Auburn University.