PHOSPHONIUM BASED POLY(IONIC LIQUID)/ IONIC LIQUID MEMBRANES FOR HIGH TEMPERATURE ION CONDUCTANCE: INFLUENCE OF IONIC LIQUID STRUCTURE AND LOADING ON MEMBRANE STABILITY AND PERFORMANCE

Alexander Lopez, University of Colorado Boulder
Alexander.lopezrosa@colorado.edu
Doug Gin, University of Colorado Boulder
Richard Noble, University of Colorado Boulder

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Ionic liquids are novel materials for use in catalysis, electrochemistry, and energy storage due to their high thermal and chemical stability as well as high ion conductivity. Development of ionic liquid monomers allows the production of polymeric ionic liquid materials which combine the versatility of ionic liquid materials with the mechanical stability of traditional polymeric membranes. Previous research has shown that inclusion of non-polymerizable free-ionic liquid in polymer and ionic liquid monomer formulations allows an increase in mechanical stability and ionic liquid properties. Further, free-ionic liquid loading improves the flexibility of membrane materials through hybridization of material properties. This research focused on the influence of ionic liquid structure and loading in poly(ionic liquid)/ionic liquid materials with regards to ion conductivity and mechanical stability. This material complex has been successful at the development of free-standing membranes with thicknesses down to 10 µm. Reduction of ionic liquid alkyl chain length resulted in increased thermal stability of membrane materials with negligible changes in ion conductivity performance at high temperatures. Further, an increase of free-ionic liquid loading resulted in an increase in overall ion conductivity and membrane mechanical stability. However, at ionic liquid loadings greater than 40 wt%, mechanical stability diminishes due to ionic liquid leakage. Through the use of poly(ionic liquid)/ionic liquid composite materials, novel membranes can be developed for a multitude of applications with greater flexibility, tunability, and performance.

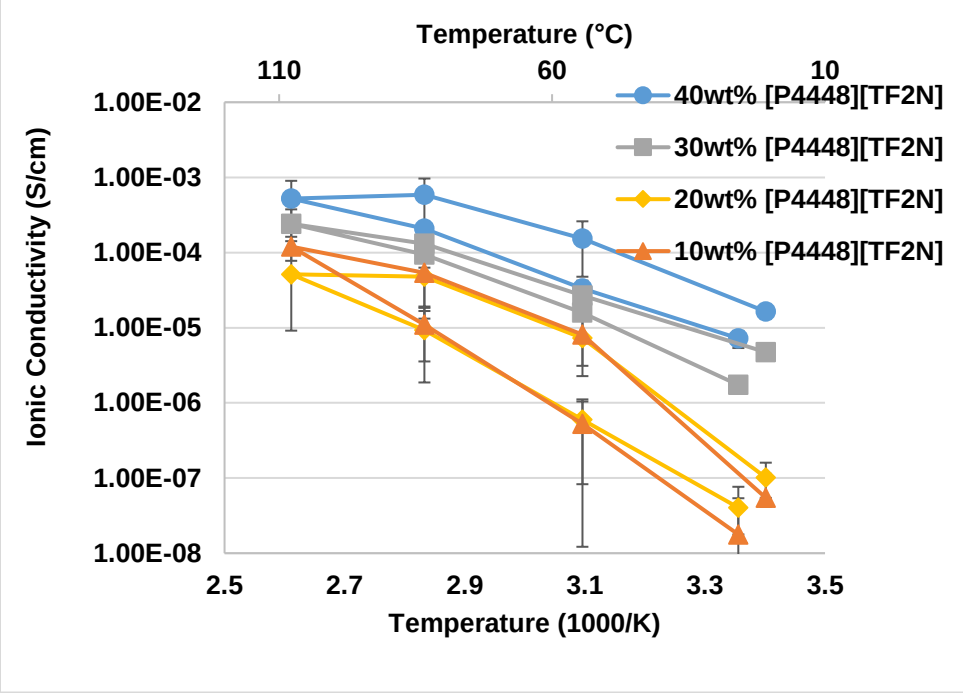

Figure 1 – Ion Conductivity of Membranes containing [P4448][TF_2N] in [P444VB][TF_2N]