

View Abstract

ABSTRACT SYMPOSIUM NAME: General Topics: New Synthesis and Characterization of Polymers

ABSTRACT SYMPOSIUM PROGRAM AREA NAME: POLY

CONTROL ID: 3996298

PRESENTATION TYPE: Oral Preferred : Consider for Sci-Mix

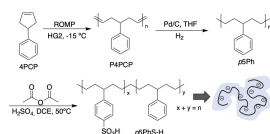
TITLE: A Modulated Approach to Sulfonated Polypentenamers Using Acetyl Sulfonation

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INSTITUTIONS (ALL): 1. Florida State University, Tallahassee, FL, United States.

ABSTRACT BODY:

Abstract: Sulfonated aromatic-containing polymers (SAPs) are promising materials for proton exchange membranes (PEMs) due to good chemical and thermal stability as well as the lower cost. In addition, all hydrocarbon SAPs circumvent safety and environmental concerns fluorinated sulfonic acid (PFSA) polymers, which are currently the industry standard. Polystyrene sulfonate (PSS) has been a widely used SAP to study proton transport for fuel cell applications because of its commercial availability and wide range of achievable molar masses. However, post-polymerization sulfonation of PS to any appreciable amount increases the glass transition temperature (T_g) above the decomposition temperature (T_d). This eliminates the use of thermal processing and often requires significant plasticization of the material. Our group has previously reported the synthesis of p5PhS-H derived from the ring opening metathesis polymerization (ROMP) of 4-phenyl cyclopentene (4PCP). Subsequent hydrogenation of the backbone produces a flexible, linear polyethylene with a phenyl branch placed precisely at every fifth carbon. Following aggressive sulfonation using sulfuric acid, this material has a remarkably low T_g (~109 C) even at ~95% sulfonation of the phenyl groups. The aromatic degree of sulfonation (DS) plays an important role in SAP performance with the goal of high proton conductivity. Therefore, a modular approach to the synthesis of p5PhS-H with varying and targetable DS is advantageous towards studying the sulfonation effects on observed material properties. Lower DS can be achieved using milder conditions via the use of the acetyl sulfate reaction to target a range of sulfonated materials. Due to the precise placement and distancing of the phenyl branches, our material presents resolved spectroscopic signals that allows us to understand well-defined sulfonation outcomes vs PSS. The differences in reactivity, thermal properties, and maximum DS possible using acetyl sulfonation will be discussed.



Presentation Preference: I wish to participate in an in-person session in New Orleans.