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Ion Conduction and Dielectric Response of Imidazolium-based Single-ion Conductors[1] U. HYEOK CHOI, Penn State University, MINJAE LEE, ANUJ MITTAL, Virginia Polytechnic Institute & State University, YUESHENG YE, YOSSEF ELABD, Drexel University, HARRY GIBSON, Virginia Polytechnic Institute & State University, JAMES RUNT, RALPH COLBY, Penn State University — We synthesized ionomers with imidazolium cations covalently attached as side groups with various ionic liquid counter-anions. Since these ionic polymers are single-ion conductors that are potentially useful for ionic actuators, it is of great interest to understand structure-property relations, such as the effect of different counterions and different imidazolium pendant structures, including tail and side chain lengths. Conductivities and dielectric properties of a range of monomers and polymers containing ionic liquid moieties are compared. The effects of counterions and side chain length are clearly observed in the T_g and ionic conductivity: larger anions and/or longer side chains lead to lower T_g and higher conductivity than smaller anions and/or shorter side chains. However, if the tail becomes too long (12 carbons) it facilitates - ion aggregation with a significantly lower dielectric constant and lower mobility for the conducting ions. Our study of counter-anions and polymer structural variations leads to insight regarding optimal design of imidazolium single-ion conductors for facile ion transport.

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