SYNTHESIS OF TRIAZOLIUM IONIC LIQUIDS AND THEIR USE FOR THE SYNTHESIS OF THIOL-ENE IONOGELS

Aneta Lewandowska, Piotr Gajewski, Katarzyna Szcześniak, Mariola Sądej, Andrzej Skrzypczak, Adam Voelkel, Agnieszka Marcinkowska

Institute of Chemical Technology and Engineering, Department of Chemical Technology, Poznan University of Technology, 60-965 Poznan, Poland

Abstract: Ionic liquids (ILs) with their unique properties (negligible vapor pressure, high thermal, mechanical and electrochemical stability) make them interesting for many applications such as separation processes, solvents in chemical processes, additives, thermal fluids, or electrolytes. ILs immobilization in an organic matrix, results in obtaining a material that allows the properties of the ionic liquid to be maintained while providing good mechanical properties due to the matrix. This type of materials with polymeric matrix, ionogels, can be used as membranes, actuators, sensors, or gel polymer electrolytes. In previous studies, we synthesized iongels with imidazolium ILs, and now we obtain iongels also with other ILs, such as with a triazolium cation.

Materials and methods: The aim of this work was the synthesis of triazolium ionic liquids with bis(trifluoromethanesulfonyl)imide (NTf_2^-) anion and their use in ionogels preparation. The synthesis of ILs was two stage process. In the first step, the appropriate triazolium halide was obtained. In the second, an ion exchange of the halide with the NTf_2^- anion was performed. The structure of the obtained ILs was confirmed by NMR study. They were also characterized by FTIR, DSC, and impedance spectroscopy (EIS) investigations. The Kamlet-Taft parameters was also determined. Then ionogels by thiol-ene photopolymerization in synthesized triazolium ILs were obtained. The polymerization of trimethylolpropane tris(3-mercaptopropionate) and triallyl isocyanurate (equimolar ratio of monomers) was carried out in 70 wt.% of IL. The influence of triazolium ILs on the conductivity of ionogels (ESI), the course of thiol-ene polymerization (poto-DSC) and intermolecular interactions (FTIR) were investigated.

Conclusion: Triazolium ionic liquids increase the polymerization rate; the higher the concentration of IL in composition, the faster the reaction is. The ionic conductivity of the tested materials depend on the phase separation between the ionogel components (matrix and IL) and exceeds 1 $mS \cdot cm^{-1}$. For ionogels with phase separation, the relative conductivity reaches 50% of pure ionic liquid conductivity.

This research was funded by National Science Centre, Poland, grant number 2017/27/B/ST8/00762