THIOL-ENE IONOGELS BASED ON POLYMERIZABLE IMIDAZOLIUM IONIC LIQUID

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Introduction: Ionogels are a hybrid material consisting of an ionic liquids (ILs) immobilized by a polymer matrix. Ionogels can be obtained by a thiol-ene photopolymerization in the presence of ILs. Of particular interest is the use of polymerizable ionic liquid (PILs) as ene. PILs are characterized by a unique combination of IL properties with a macromolecular architecture. These materials can be used as gel electrolytes, double-layer capacitors, drug delivery systems.

Materials: As a PILs used geminal dicationic ionic liquids containing the same bis(trifluoromethylsulfonyl)imide anion, imidazolium cation, and different structure of spacer. Were used: 3,3'-[ethane-1,2-diylbis(oxymethanediyl)]bis(1-ethenyl-1H-imidazol-3-ium); 3,3'-[hexane-1,4-diylbis(oxymethanediyl)]bis(1-ethenyl-1H-imidazol-3-ium); 3,3'-[decane-1,4-diylbis(oxymethanediyl)]bis(1-ethenyl-1H-imidazol-3-ium). Monomers: 1,3,5-Tris(3-melcaptobutyloxethyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione, trimethylolpropane trimethacrylate and difunctional polyester urethane methacrylate. IL: 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide (70% mas.). The photoinitiator: 2,2-dimethoxy-2-phenylacetophenone (0,2% mas.).

Methods: Ionogels were obtained in-situ by thiol-ene photopolymerization carried out in ionic liquids. The kinetics of PILs-thiol-methacrylate photopolymerization in ILs was determined by using isothermal differential scanning calorimetry (photo-DSC). In order to characterize the mechanical properties of the obtained ionogels was conducted a puncture resistance test (Texture Analyzer). The ionic conductivity was investigated by electrochemical impedance spectroscopy (EIS).

Conclusions: The photopolymerization reaction was used to obtain very flexible and quite mechanically strong ionogels. These materials can be twisted and rolled-up without suffering damage. Ionogels were characterized by an ionic conductivity above 2 mS cm^{-1}, so they can be used as gel polymer electrolytes.

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

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