Thermal properties, molecular and electrophoretic dynamics of ionic gels based on low molecular weight gelators

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Research project objectives and methodologies

The ongoing search for materials for energy storage and transport is of great importance due to its various applications in modern electronics and electronic devices. In recent years much attention was given to fuel cells and photovoltaic cells, however these solutions although very advanced, can't met all criteria. Continuous technical development demands for searching of new solutions. Especially interesting group of materials are so called solid electrolytes, however the solidification process is very complicated, time and money consuming. One of alternatives might be ionic gels, which have mechanical properties similar to solid state and at the same time they retain some properties characteristic for liquids, like high electric conductivity. There are already known electro gels based on polymers. Other solution can constitute so called physical gels based on low molecular weight organic gelators (which molar mass is below 1000 Da), capable to immobilize huge amount of liquid molecules with very small amount of gelator molecules (even below 1% wt. %). Additionally these systems are thermoreversible, cheap and relatively easy to produce. Although physical gels are known since many years and number or papers about them is growing, the idea to use them for production of electrically conducting gels is new. Thus these systems are almost unknown, even with assumption that many of their properties should be similar to normal physical gels, the electric properties and the influence of charge carriers on the molecular dynamics and intermolecular interaction remains an open question.

The aim of proposed PhD thesis will be creation of ionic gels based on low molecular weight gelators, investigations of molecular and electrophoretic dynamics as well as thermal properties of created systems. The try to answer basic questions such as: how the molecular dynamics and electric conductivity can be influenced by the gelator matrix.

The objectives of the thesis will be realized with use of nuclear magnetic resonance method with CP-MAS, diffusometry, FFC NMR and eNMR techniques, electric conductometry, phase transition measurements (T_{GS}), optical spectroscopy methods (FT-IR and Raman techniques) and optical microscopy.

Key words: ionic gels, electrophoretic NMR, solid electrolytes, ionic liquids, conductometry, molecular gels