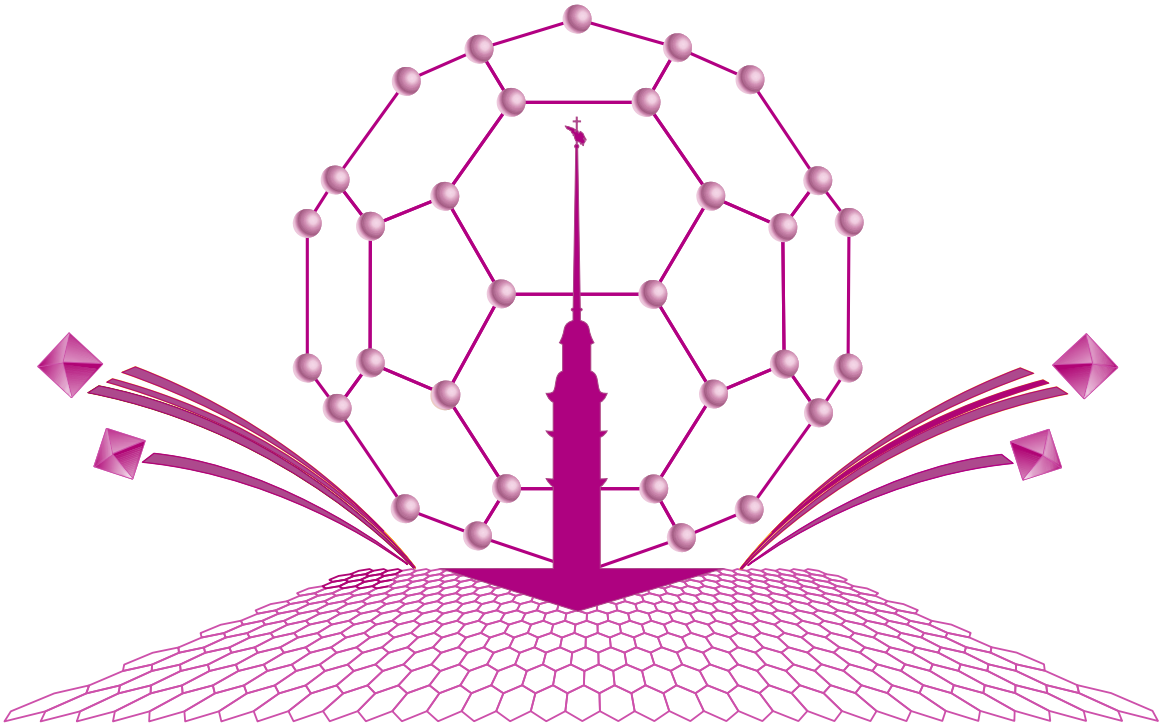
Book of Abstracts

15th International Conference

Advanced Carbon Nanostructures



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Impact of C_{60} based star macromolecules & ionic liquid as novel membrane modifiers on pervaporation performance in lactic acid dehydration

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The individual specific problems of membrane separation of liquid mixtures require special developments of diffusion membranes with a purposefully formed structure, high selectivity, and permeability. One of the urgent problems is the dehydration of lactic acid, which is the most important raw material for the production of biodegradable polymers. The known methods of lactic acid purification are not economical and environmentally friendly; therefore, membrane separation processes are attracting great attention as effective energy-saving processes.

In this work, poly(2,6-dimethyl-1,4-phenylene oxide) (PPO) membrane was modified with 5 wt% of a composition consisting of a fullerene C_{60} based star macromolecules (C_{60}-stars) and ionic liquid (IL) (1-butyl-3-methylimidazolium bis (trifluoromethylsulfonyl) imide) taken in equal amounts. The C_{60}-stars are star-shaped macromolecules in which six polystyrene chains and six chains of poly-2-vinylpyridine-*block*-poly-*tert*-butyl methacrylate are covalently attached to the common fullerene C_{60} core.

Comparative studies on the structure and physical parameters of PPO, C_{60}-stars/PPO, and (C_{60}-stars:IL)/PPO membranes were carried out. The methods of X-ray diffraction, thermogravimetric analysis, differential scanning calorimetry, and flotation method for density determination were used. The membrane transport properties were studied during sorption experiments and pervaporation of a lactic acid–water mixture. It was found that a membrane modified by (C_{60}-stars:IL) composition is characterized by a high separation factor $\alpha_{water/lactic\ acid}$ = 2560 and permeability equal to 16.2 g/m^2·h. The most thermodynamically favorable interactions between various membrane components, which explain the experimental results, have been determined by the methods of quantum-chemical calculations.

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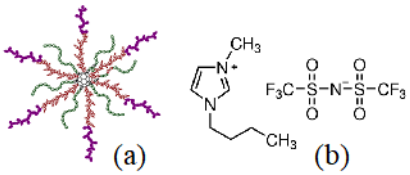

Fig.1. Star macromolecule with C_{60} core (a) and ionic liquid (b).