



Wolfson Department of Chemical Engineering Special Seminar

Lecture Hall 6, Wolfson Department of Chemical Engineering,

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Separation of Liquids and Gasses by Pervaporation and Gas Permeation and Swelling behavior of Nafion in Ionic Liquids

Gas and liquid separation was done by nanocomposite membranes, which were formed by blending of the fluoroelastomer p(VDF-HFP) with a mixture of the two room temperature ionic liquids. The impact of the ionic liquids loading and of the temperature on pure gas transport properties was studied. The fluoroelastomeric polymer p(VDF-HFP) formed the most stable gels in the ionic liquid [EMIM][TFSI], enabling the successful preparation of resistant free standing membranes by solution casting of the polymer/ionic liquid mixture, followed by controlled solvent evaporation. Gas transport properties showed a discontinuity around the melting point of the [HdMIM][TFSI]. Arrhenius behavior was observed above the melting point. At high [HdMIM] content, solidification of the IL mixture caused defective and non-selective membranes at low temperature.

During pervaporation, we illustrated how the design of three-dimensional surface reliefs microstructures at the membrane surface, with topographic modulation of features with characteristic dimensions, may lead to improved momentum and mass transport conditions at the membrane surface through promotion of local micro-turbulence. Even when poor fluid dynamics conditions are used, under conditions where solute recovery from viscous room temperature ionic liquids is envisaged, a noticeable improvement on the overall solute flux is observed.

Our new developed technique for swelling measurements reveals to be particularly adequate for studying situations where anisotropic swelling occurs; other techniques based on the over all volume or mass change are not able to account for this effect and to quantify it. The results obtained, when studying the swelling of Nafion membranes, show also how the process of molecular solubilisation and swelling can be influenced by the fabrication conditions used during the manufacturing process. This aspect is particularly important if we take into consideration that the swelling process itself may also reflect on the transport properties of the polymer.

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