New Functionalized Polymers as Membrane Materials

C. Staudt-Bickel[C, S]
Institute for Organic and Macromolecular Chemistry, Functional Materials, University of Duesseldorf, Duesseldorf, Germany
staudt@uni-duesseldorf.de

Biological membranes are present nearly everywhere, in plants as well as in human organisms. They consist of biopolymers with specific functional groups providing an extremely high selective permeation of single components. Synthetic polymers which are able to be processed in thin films or composites can be used as membranes for the separation of industrial relevant gaseous or liquid mixtures. If the pores of the polymeric material are much smaller than one nanometer, the transport mechanism for the components is based on a solubility diffusivity mechanism. Thereby it is possible that the component with a large kinetic diameter is able to permeate preferably through the polymeric membrane. Cross linked polymer structures gain increasing attention as membrane materials because they can fulfill the demands for industrial applications. For membranes not only good separation characteristics, which means high flux and superior selectivity, but also high temperature stability and chemical resistance are required. Furthermore it is very important that the membrane materials are plasticization resistant because it is found that this phenomenon causes a strong increase in permeability with a drastic loss in selectivity. Plasticization effects occur i.e. with polyimide membranes in the presence of high CO_2 concentrations, hydrocarbons as propylene, propane or aromatics. Unfortunately these components are present in mixtures with high relevance being separated economically by membrane units or hybrid processes. The advantages of cross linked 6FDA (4,4´Hexafluoro isopropylidene diphthalic acid anhydride)-copolyimides are discussed based on experimental results for various polymer structures in the separation of different gaseous and liquid mixtures [1-3]. Additionally opportunities for implementing the membrane units in conventional separation processes are discussed.

[1] Frank Pithan and Claudia Staudt-Bickel, Crosslinked copolyimide membranes for phenol recovery from process water by pervaporation, *ChemPhysChem*, 4 (9), 2003, 967
[2] Daniela Katarzynski and Claudia Staudt-Bickel, Separation of multi component aromatic/aliphatic mixtures by pervaporation with copolyimide membranes Desalination, in print, 2006
[3] S. Heb, C. Staudt-Bickel and R.N. Lichtenthaler, Propylene/propane separation with copolyimide membranes containing silver ions, *Journal of Membrane Science*, in print, 2006