University of Colorado
TECHNOLOGY TRANSFER OFFICE

Cationic Polymers Based on Room-Temperature Ionic Liquids and Use as Gas Separations Gels

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Patent pending; available for exclusive or non-exclusive licensing.

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Background

Gas separation membranes are used in a number of commercial gas separations - some examples include separation of nitrogen or oxygen from air, hydrogen recovery in oil refining, and natural gas sweetening.

Nanoporous polymeric membranes separate gases based on their differences in solubility and diffusivity in the polymer. Nanoporous membranes are commonly a polymer of a glassy nature. The diffusivity of gases through the membrane is largely dependent on the structure of the polymer membrane, specifically the amount of free volume of the polymer and the distribution of charge. Porous membranes are also used in gas separation; however, the pore diameter must be smaller that that of the gas molecules to be separated thus limiting the diversity of their utility.

Technology

A University of Colorado research group led by Richard Noble and Douglas Gin has developed a new gas separation membrane consisting of Room Temperature Ionic Liquid (RTIL) and a polymer composite. The use of RTIL allows the membrane to become reactive, giving it unique capabilities. It can selectively permeate one gas over another (i.e. CO2/CH4, CO2/N2, SO2/CH4, etc) or separate products from a reaction mixture such as during a transesterification reaction.

These membranes can be customized for specific applications. For example, one can add active agents to give the membrane the desired reactivity and properties. Capture agents can include both strong bases or strong acids. Agents can be designed to be tethered or untethered into the polymer to enhance their compatibility with the membrane. RTILs also have negligible vapor pressures, so they can be impregnated into existing porous polymer membranes to improve processing and properties.

A stable, solid composite gas separation membrane composed of a poly(RTIL) and a free RTIL was fabricated and studied for its gas permeability and separation properties with CO2, N2, and CH4. This class of materials is very promising for future work and is expected to be potentially competitive with materials such as PEG for these separations.

Key Document

"Cationic Polymers Based on and Interfaced with Room-Temperature Ionic Liquids and Their Use as Gas Separations and Gels." Provisional patent application filed July 24, 2009.