ABSTRACT INSTRUCTIONS

Title: **Development of Nanofiller-Modulated Polymeric Oxygen Enrichment Membranes for Reduction of Nitrogen Oxides in Coal Combustion**

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OBJECTIVE(s)

The overall goal of this project is to further improve upon our existing technology and further optimize the nanofiller-modulated polymer formula for the oxygen-enrichment for the coal combustion and gasification applications. The major objectives are: (1) Develop a multipurpose filled polymer material system that incorporates functional nanofillers to achieve novel oxygen-enrichment properties; (2) Document the fundamental microstructure-property relationship of the nanofiller-modulated polymer material system.

ACCOMPLISHMENTS TO DATE

Our G3P-8 programmable spincoater is used for coating the polymeric membrane on the substrate. The substrate is made up of stainless steel, which has a pore size of 0.2 microns. The membrane holder or the diffusion cell has two compartments, the feed side and the permeate side. Pure gas permeability measurements is made. Using oxygen permeability data, membrane selectivity with respect of oxygen is computed.

FUTURE WORK

To develop nanofiller-modulated polymer formulations through which we can manipulate the apparent diffusivity of gas molecules in a polymer by creating tortuousness in diffusional paths for dissolved gas molecules and further influence the apparent solubility of the gas molecules by virtue of nanofiller-gas interactions. Since polymer matrix can be relatively easily tailored to different cross-linking density (free volume) as well as different apparent solubility for different gas species by incorporating surface-sensitive nanoscale fillers such as carbon nanotubes, there is a very wide range in which we could achieve unprecedented selectivity. By varying the chemical nature of the polymer as well as the gas-filler interactions, one can change the size distribution of the randomly occurring gaps to retard the movement of one species, while allowing the movement of the other. A similar mobility control can be exercised in the filled polymers by controlling the size distribution in the network of available passages to favor one of the components relative to the other. An understanding of this “mobility selectivity” relies upon an integrated knowledge of thermodynamics, phase separation kinetics, and interphase mass transfer. Integration of non-equilibrium thermodynamics and non-Fickian transport phenomena would be essential for molecular modeling and

simulation of the relative transport of components through polymeric membranes.

LIST OF PAPER PUBLISHED

J. Lou, V. Harinath, “Separation of polysaccharides from industrial syrup using tubular membranes”, Journal of Liquid Chromatography & Related Technologies. 2005 28(3), 357-367.

Irulappan, S., Roberts, C., Ilias, S., “Developments of Pt-based Ternary and Quaternary Metal Catalysts for PEM Fuel Cell,” Chem. Eng. Trans., 2004 (4) 397-402.

U.S. PATENT/PATENT APPLICATION(S) n/a

CONFERENCE PRESENTATIONS n/a

AWARDS RECEIVED AS A RESULT OF SUPPORTED RESEARCH n/a

STUDENTS SUPPORTED UNDER THIS GRANT James Zhang – PhD candidate