CHEMICAL, BIOLOGICAL & MATERIALS ENGINEERING

100 E. Boyd, Sarkeys Energy Center, T-301
405-325-5811
The University of Oklahoma
Norman, Oklahoma

PHILLIPS 66 SEMINAR SERIES, 2017 – 2018

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44th ANNUAL HARRY G. FAIR MEMORIAL LECTURE IN CHEMICAL ENGINEERING

DR. JOAN F. BRENNECKE

COCKRELL FAMILY CHAIR IN ENGINEERING #16
PROFESSOR OF CHEMICAL ENGINEERING
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AUSTIN, TEXAS

Our seminar

"DESIGNING IONIC LIQUIDS FOR SEPARATING GASES"

Ionic liquids (ILs) present intriguing possibilities for numerous gas separations because their exceedingly low vapor pressures mean that they will not contaminate the purified gas stream and innumerable choices of cations and anions and substituents mean great flexibility in tuning capacity and selectivity. Here we will focus on designing ionic liquid systems for post-combustion CO_2 capture, as well as olefin/paraffin separations. Even by physical absorption, many ILs provide sufficient CO_2 selectivity over N_2, O_2, CH_4 and other gases. However, when CO_2 partial pressures are low, the incorporation of functional groups to chemically react with the CO_2 can dramatically increase capacity, while maintaining or even enhancing selectivity. Guided by quantum calculations, molecular modeling and process modeling, we have been able to: 1) double the reaction stoichiometry to reach one mole of CO_2 per mole of IL by incorporating an amine on the anion, 2) virtually eliminate any viscosity increase upon complexation of the IL with CO_2, by using aprotic heterocyclic anions (AHA ILs) that eliminate the pervasive hydrogen bonding and salt bridge formation that is the origin of the viscosity increase, and 3) further reduce process energy requirements by the discovery of AHA ILs whose melting points when reacted with CO_2 are more than 100 °C below the melting point of the unreacted material. Our process concept to use ILs for post-combustion CO_2 capture includes the use of a fluidized bed, where the mass transfer challenges associated with the relatively high viscosity of ILs are ameliorated by encapsulating the ILs in polymeric shells. Our process concept for olefin/paraffin separations is the use of a supported IL membrane or composite IL/polymer membrane. Olefin/paraffin separations are necessary in the dehydrogenation of light hydrocarbons to make polymers, fuels and chemicals. While most ILs do not have sufficient inherent olefin/paraffin selectivity, the addition of carriers to achieve facilitated transport can enhance the selectivity to very attractive levels. We will show that the advantages of using ILs for olefin/paraffin separations goes well beyond the stability and non-volatility of the IL membrane.

TUESDAY, APRIL 17, 2018
SEMINAR -- 3:00 P.M.
RECEPTION TO FOLLOW
SARKEYS ENERGY CENTER, A-235

THIS IS A REQUIRED SEMINAR FOR CHE 5971

Accommodations on the basis of disability are available by contacting the office.