MIT Chemical Engineering Department
Fall 2018 Seminar Series
http://cheme.mit.edu/seminar-series/

Opening the Door to Energy-Efficient Chemical Separations with a Carbon Key

William J. Koros, Ph.D.

Roberto Goizueta Chair for Excellence in Chemical Engineering and Georgia Research Alliance Scholar
Georgia Institute of Technology

Friday, November 16, 2018
3:00pm (Reception at 2:45pm)
66-110

Abstract: Advanced separation approaches can reduce energy consumption and CO_2 emissions in huge separations complexes that tend to be invisible to the public, but which consume close to 50% of energy used in the chemical industry. Carbon molecular sieve (CMS) membranes greatly reduce energy intensity of such separations by using precise size and shape discrimination to avoid phase change-driven processes. I will discuss a self-consistent description of pyrolytic carbon structural evolution, by which random coil polyimides transmute into molecular sieving CMS entities with sub-angstrom size and shape discrimination. Control of penetrant motions in diffusion-activated state, reflected in entropy of activation of subtly different penetrants, enables the exquisite molecular sieving selectivity of such membranes. This control, plus the ability to form flexible highly productive CMS hollow fibers with excellent stability under aggressive feeds truly, makes such carbon membranes the key for diverse challenging and energy intensive separations.