IBS Center for Multidimensional Carbon Materials

Tuesday Colloquium

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Graphene-Based Membranes for Gas and liquid Separations: From Lab to Reality

Feb 6 **Tue 2 PM**	Bldg. 101 Seminar Room on the 1st floor

Membranes are thin barriers that allow selective mass transport, and form the basis of a number of separation processes typically driven by gradients in pressure, electric potential, concentration, or temperature. With the advantages of modularity, scalability, compactness, and high energy efficiency, membrane separations have become pervasive in energy, water, food, biotechnology, and chemical processing. Major applications include water desalination, natural gas purification, production of nitrogen from air, hemodialysis, bioprocessing, solvent- and petrochemical-based separations, and production of ultrapure water. Beyond separations, membranes find use in fuel cells, drug delivery, bio/chemical sensors, and energy harvesting from mixing processes. Although remarkable progress has been achieved in membrane technology, persistent challenges remain 1) overcoming the trade-off between selectivity and permeability of the membrane material, 2) control of fouling, 3) robust operation under harsh conditions. To address these challenges, the last few decades have seen the exploration of various membrane structures and materials including novel polymers, inorganic membranes (e.g., zeolites, silica, carbon, ceramics), nanomaterials (metal-organic frameworks (MOFs), carbon nanotubes, carbon nanomembranes, and polymer-inorganic membranes. Since the experimental proof of one-atom-thick graphene sheet from graphite in 2004, graphene, as a leading material opening two-dimensional world, has been tremendously investigated owing to its extraordinary physical properties. Among many promising graphene applications, it is believed that membranes might be one of the first significant applications for graphene and its derivatives. Recently, a number of simulation results and proof-of-concept experimental approaches towards graphene membranes reflect such positive prospects. With the minimum possible material thickness, high mechanical strength, chemical robustness and the ability to sustain selective nanopores in their rigid lattices, nanoporous atomically thin membranes have the potential to address persistent challenges in membrane separations and a variety of other areas. In this presentation, important theoretical and experimental developments in graphene or graphene-based membranes will be discussed, emphasizing on transport behavior, membrane formation methods, and challenging issues for actual membrane applications.

You are cordially invited to attend!