# IBS Center for Multidimensional Carbon Materials

Tuesday Colloquium


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## Molecular and Ionic Transport through Graphene based Membranes

**Tuesday, Oct 4**
**2 PM**

Bldg. 101
Seminar room on the 1st floor


Severe strain on the fresh water supply – due to industrial development, population growth and shifting weather patterns – recently precipitated a strong research interest in new materials for water purification and desalination. Graphene-based membranes, exhibiting ultra-high water flux, have been recently attracting significant attention as molecular and ionic sieves. Particularly, nanostructured graphene-oxide (GO) membranes are enticing candidates for the next-generation, high-performance separation membranes. GO-based lamellar nanoporous membranes were recently revealed to have ultrahigh water permeability, while ionic and molecular permeability has a sharp size cutoff at hydration radii of ~ 4.5 Å. GO stack consists of percolative network of channels with narrow height distribution in sub-nanometer regime; it has been postulated that the size-exclusion mechanism is governing the membrane's filtration properties. Here, we demonstrate that the charge-selection is an important transport mechanism, which could be used to further enhance the membrane's properties. Using microscopic drift-diffusion experiments, we demonstrate the ultra-high charge selectivity for GO membranes, with more than order of magnitude difference in the permeabilities of cationic and anionic species of equivalent hydration radii. By measuring diffusion of a wide range of ions of different size and charge, we were able to clearly disentangle different physical mechanism contributing to the ionic sieving in GO membranes. We also identified size-selective cation exchange capacity from smaller interlayer spacing which is realized by covalently bonding the layered GO nanosheets with small-sized molecules. We believe that the charge-selectivity allows us to rationally design membranes with increased ionic rejection, and opens up the field of ion exchange and electrodialysis to the GO membranes.


***You are cordially invited to attend!***