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# Carbon Nanotube Nanofluidics

Carbon nanotubes are an excellent platform for the fundamental studies of transport through channels commensurate with molecular size. Water transport through carbon nanotubes is also believed to be similar to transport in biological channels such as aquaporins. I will discuss the transport of gas, water and ions through microfabricated membranes with sub-2 nanometer aligned carbon nanotubes as ideal atomically-smooth pores. The measured gas flow through carbon nanotubes exceeded predictions of the Knudsen diffusion model by more than an order of magnitude. The measured water flow exceeded values calculated from continuum hydrodynamics models by more than three orders of magnitude and is comparable to flow rates extrapolated from molecular dynamics simulations and measured for aquaporins. More recent reverse osmosis experiments reveal ion rejection by these membranes. Based on our experimental findings, I will discuss our current understanding of the fundamentals of water and gas transport and of ion rejection. I will also explore the potential application space that exploits these unique nanofluidic phenomena. The extremely high permeabilities of these membranes, combined with their small pore size will enable energy efficient filtration and eventually decrease the cost of water desalination and of separations of industrial gases and biomolecules.

Prof. Oglica Bakajin

Lawrence Livermore
National Laboratory

香港科技大學
THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY