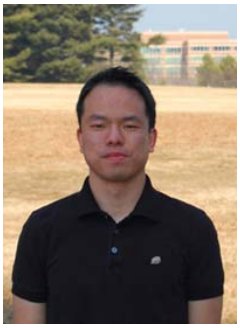
# Dr. Edwin P. Chan



Materials Science & Engineering Division
National Institute of Standards and Technology (NIST), Gaithersburg, Maryland

**"Network Structure of Polyamide Water Desalination Membranes "**

**November 12, 2014**
**3:25 p.m.**
**202 Gavett Hall**

Polyamide thin film composite represents the state-of-the-art nanofiltration and reverse osmosis membranes used in water desalination. The performance of these materials, such as their perm-selectivity, is intimately linked with extent of swelling of the polyamide crosslinked network. Thus, quantifying the swelling behavior of the polyamide is a useful and simple route to understanding the specific network structural parameters that control membrane performance. In this work, we study the network structure of model polyamide ultrathin layers using X-ray and neutron scattering techniques. The first part of the talk will describe our molecular layer-by-layer (mLbL) approach to synthesizing model polyamide thin films. The mLbL approach is analogous to atomic layer deposition or polymer layer-by-layer where two different monomers are alternately deposited and reacted with each other thus enabling nanoscale control of the film thickness with well-defined chemical composition and surface roughness. The second part of the talk will focus on studying the swelling behavior of these ultrathin layers as a function of water hydration using X-ray reflectivity. By applying the blob model to describe the network swelling, we quantify the polyamide network properties including Flory interaction parameter and the monomer units between crosslinks. The results suggest that these highly crosslinked networks are inhomogeneous and they swell via a combination of chain expansion and topological rearrangement. Finally, we validate these results by directly measuring the network structure using small angle neutron scattering (SANS) in order to quantify the particular length-scales that contribute to the swelling of these polyamide networks.