Yale Institute for Nanoscience and Quantum Engineering

Friday-September 16, 2016

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Ge Yuan

Department of Electrical Engineering, Yale University

"Optical Engineering of Modal Gain in III-Nitride Laser with Nanoporous GaN"

Nanoporous (NP) GaN is prepared to address the long-standing challenge in GaN edge-emitting laser diode: the lack of transverse mode confinement in conventional AlGaN/GaN-based waveguide design due to the limited index contrast and large lattice mismatch. By introducing air pores into GaN, we attain unprecedented index tunability without introducing any strain. We therefore are capable to engineer the waveguide's modal gain by changing its design and demonstrate record high optical confinement factor (Γ) ~ 9%, all by using NP-GaN as the cladding layer. Under optical pumping, a threshold material gain is reduced to 400 cm^{-1}, which is more than two times lower than previously reported (> 1,000 cm^{-1}).

Jongho Lee

Department of Chemical & Environmental, Yale University

"Nanostructure Architectures for Omniphobic Desalination Membranes"

Despite the high resource potential of shale-gas reservoirs, the vast consumption of freshwater by hydraulic fracturing significantly increases the environmental footprint and results in generation of large volumes of hyper-saline wastewaters. Conventional membrane technologies such as reverse osmosis are incapable of treating such high salinity. Membrane distillation (MD), a hybrid approach of thermal distillation and membrane process using hydrophobic membranes, is an alternative technology. However, current MD technology cannot treat shale-gas wastewaters because of pore wetting of the membranes by organic contaminants. We find that the nanostructure architecture of MD membranes can significantly improve surface omniphobicity and subsequently wetting resistance. Specifically, nanofiber membranes grafted with nanoparticles possess multi-level re-entrant structures and exhibit excellent wetting resistance against water and organic liquids. We demonstrate the potential of omniphobic membranes to desalinate highly saline, low surface tension feedwater by MD and to treat various challenging industrial wastewaters.

Host: Professor Eric Altman