Yale Institute for Nanoscience and Quantum Engineering

Friday-January 26, 2018

12:00-1:00 PM

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

Sung Woo Sohn
Department of Mechanical Engineering and Materials Science, Yale University

"Crystallization of Metallic Glass Forming Nanorods"

Metallic glasses (MGs) provide ideal material platforms to study crystallization due to their simple metallic bonds and sluggish crystallization kinetics. But even for MGs, a direct observation of the crystallization process has been challenging, partly due to limitations in fabricating samples appropriate for characterization methods. We have recently demonstrated the fabrication of metallic glass nanorods via thermoplastic forming, enabling us to directly observe crystallization using a transmission electron microscope (TEM). Here, we investigate crystallization of MG forming liquids by in-situ heating size-controlled MG nanorods down to ~5 nm inside a TEM. We show that the MG nanorod diameter affects the crystallization kinetics strongly. With decreasing nanorod diameters, crystallization temperature decreases initially, exhibits a minimum at ~ 30 nm, and then rapidly increases with decreasing size. In addition, we show unexpected crystallization phenomena at the nanoscale, which significantly deviate from the classical-framework. By controlling the sample size and the crystallization kinetics of MG nanorods, we can tune the nuclei population and tailor the resulting crystallization phases from the expected to a new phase. In this talk, I will discuss this unusual crystallization kinetics. Factors are experimentally verified by slowed grain growth and scatter in crystallization temperature with decreasing diameters.

Alexander Bruch
Department of Electrical Engineering, Yale University

"Single Crystalline Aluminum Nitride for Visible Nonlinear Photonics"

III-Nitrides have risen as the second most widely used semiconductor, making a phenomenal transition from laboratory discoveries to commodity applications of flat panel displays, Blu-ray DVDs, and solid-state lighting. AlN, in particular, is a unique material for nonlinear optics, possessing a wide bandgap and relatively strong quadratic and cubic optic nonlinearities. The presence of both nonlinear effects allows the production of a broad wavelength spectrum from a single IR pump laser. In this talk I will introduce epitaxial-AlN as a new platform for nonlinear optics, opening applications for optical physics and spectroscopy on a chip scale platform. I will first demonstrate how nonlinear AlN optical resonators facilitate simultaneous second harmonic generation and four wave mixing, enabling frequency comb generation at both IR and near-visible wavelengths. I will then show how this process can be extended across the visible spectrum to calibrate spectrographs for exoplanet research.

Host: Professor Corey O'Hern