OPTICAL SCIENCE & ENGINEERING
University of New Mexico

SPECIAL OSE SEMINAR SERIES

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Tailoring core/shell heterostructure of colloidal quantum dots for high performance electroluminescent devices

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CHTM, Room 101 from 1:00 PM – 2:00 PM

Abstract:

Colloidal quantum dots (QDs) with core/shell heterostructure are promising active materials for novel optoelectronic devices that demand high photoluminescence quantum yield, ultra-narrow linewidth, and extended stability under chemical/physical stress. On the basis of their promise, vigorous research has been continued over the past decade to employ colloidal QDs as light emission layer in electroluminescent devices [*i.e.*, QD-based light emitting diodes (QD-LEDs)]. The device performance has rapidly improved, in terms of peak external quantum efficiency (EQE, ~20%) and brightness (more than 100,000 candelas/m^2).

Despite such rapid advance, a depression in device performance with increasing current, so-called efficiency droop, has remained an unsolved problem in QD-LEDs. We have revealed that the nonradiative processes in QD films such as dot-to-dot energy transfer or Auger decay are behind this impediment and have explored the core/shell structure and interface structure of colloidal QDs to suppress those detrimental effects. Elaborate synthetic strategies enable us to realize novel core/shell heterostructure QDs, which suppresses Auger recombination by smoothened confinement potential and minimizes dot-to-dot energy transfer by increasing shell thickness. Applying these advanced QD emitters to QD-LEDs results in improved quantum efficiency and reduced droop behavior. This further suggests the general direction of QD material engineering which should help boosting the performance of QD-LEDs, and potentially, QD-based high-power LEDs or diode lasers.

Biography: **Jaehoon Lim** joined Los Alamos National Laboratory (LANL) in 2014 as a postdoctoral research associate in the Nanotechnology and Advanced Spectroscopy Team of the Center for Advanced Solar Photophysics. His research focuses on the synthesis of engineered semiconductor QDs and their optoelectronic applications, such as LEDs or diode lasers. He received his Ph.D. in Chemical & Biological Engineering in 2013 from Seoul National University (SNU), Korea for a thesis titled “Shape control of semiconductor nanocrystals and their applications to optoelectronic devices”. Before joining LANL, he had a postdoctoral appointment at the Inter-University Semiconductor Research Center (ISRC) through SNU

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