NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Materials Science and Engineering

Seminar Topic:
Configuring the Properties of 2D Materials by Stacking and its Application in 2D Homo-junction Devices

Professor Shen Zexiang

Abstract

It is well-known that the optical and electronic structures of two-dimensional transition metal dichalcogenide (2D TMD) materials and perovskites often show very strong layer-dependent properties. However, it is less well-known that the properties can also be tuned by stacking order, which allows us to build electrical and optical devices with the same material and thickness. Detailed understanding of inter-layer interactions will help greatly in tailoring the properties of 2D TMD materials for applications in p-n junctions, transistors, solar cells and LEDs. Raman/photoluminescence (PL) spectroscopy and imaging have been extensively used in the study of nanomaterials and nano-devices. They provide critical information for the characterization of the materials, such as electronic structures, optical properties, phonon structures, defects, doping and stacking sequences.

In this talk, we use Raman/PL techniques and electrical measurements, as well as simulation, to study 2- and 3-layer 2D TMD samples. The Raman/PL spectra also show clear correlation with layer-thickness and stacking sequence. Electrical experiments and *ab initio* calculations reveal that differences in the electronic structures mainly arise from competition between spin-orbit coupling and interlayer coupling in different structural configurations.

Biography

Professor Shen's research areas include carbon-related materials, especially graphene. His work involves spectroscopic and theoretical studies of few-layer and folded graphene, graphene intercalation studies, graphene-based composites for energy harvesting (Li-ion batteries and supercapacitors) and nanoelectronics. In addition, he works on developing near-field Raman spectroscopy/imaging techniques and the study of plasmonics structures where some fundamental questions remain unanswered. He has been active in the study of 2D materials and perovskites using ultra-low wavenumber Raman spectroscopy, PL techniques and time-resolved spectroscopy in combination with high pressure and low temperature. Professor Shen was awarded the Nanyang Award for Research and Innovation in 2009 as well as the Gold Medal for Research Excellence by the Institute of Physics, Singapore in 2011.

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Venue: MSE Meeting Room (N4.1-01-28)
Hosted by: Associate Professor Xue Can

Office of Associate Chair (Research)
Email: vd-mse@ntu.edu.sg
www.ntu.edu.sg/mse