3rd RPI-HU Joint Seminar on Advanced Semiconductor and Related Technologies for Future Communication and Computing

Date and Place

Wednesday, April 23
8:00am-9:00am in Japan time

Online meeting
https://rensselaer.webex.com/rensselaer/j.php?MTID=mcef5e8ad3061c9793eaab35fad36d049
Meeting number (access code): 2344 095 4852
Meeting password: NAerGDY93y3

Speakers' Information

"Large Scale Integrated Optoelectronic Devices and Systems for Photonic Computing"

Prof. Rena Huang, *Rensselaer Polytechnic Institute, USA*

Abstract: Over the past decade, integrated optoelectronic systems have emerged as a promising platform for photonic computing. Enabled by silicon photonics foundries worldwide, most photonic computing systems are fabricated through standardized foundry processes. While this area continues to grow, there is increasing interest in extending the capabilities of silicon photonics through heterogeneous integration with non-silicon materials. In this talk, I will present our recent work on Bragg grating and photonic crystal (PhC) waveguide-enabled slow-light silicon modulators for efficient matrix-vector multiplication (MVM), a fundamental operation in many computing tasks. I will also highlight emerging directions in our research, including the integration of indium tin oxide (ITO) for low-power optical switching and the use of phase-change materials to realize non-volatile photonic components. These technologies pave the way for energy-efficient, scalable photonic systems and open new opportunities for implementing unsupervised learning directly in the optical domain.

"Chemical Search and Defect Engineering of New Semiconductor Materials"

Prof. Toshihiro Shimada, *Hokkaido University, JAPAN*

Abstract: There are various types of semiconductor materials. 2D materials and organic molecular crystals are two important variations for future semiconductor devices. We have studied molecular beam epitaxy (MBE) and chemical vapor deposition (CVD) of 2D metal chalcogenides, both suffering from chalcogen vacancies. We found that high pressure might be key to controlling defect densities and developing equipment to study it. Organic semiconductors are made from molecules with vast variations, which can be chemically synthesized in a flask. They are mechanically flexible but have a trade-off relation with carrier mobilities due to strong polaron effects. We have developed the crystallization technique using naphthalene as a solvent and found interesting molecule arrangements. We discovered that semiconductor molecules in a crystal can be polymerized under very high pressure, hopefully leading to new carbon allotropes for semiconductor applications.

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Meeting link