Department of Materials Science and Engineering Seminar Series 2025

ENGINEERING AND STRUCTURAL STUDIES OF THE OPTICAL DEFECTS IN MULTILAYER VAN DER WALLS HEXAGONAL BORON NITRIDE

Yue Xu

Date and time: 14th Nov, 2025, 4:00pm

Venue: E2-03-32

Abstract

Point defects in semiconducting materials have been explored as promising components for the next-generation photonics due to their unique emission behaviour compared to bulk materials, especially regarding their potential applications in quantum optics. Van der Waals (vdW) materials, particularly hexagonal boron nitride (h-BN), have been a focal point in research on defect-related optical emitters because of the presence of room-temperature defect emitters within this 6 eV ultrawide bandgap semiconductor. However, a lack of structural correlation with the optical emission profile limits the development of functional optical devices based on h-BN emitters. This thesis aims to establish the relationship between the structure and properties of the optically active point defects in multilayer h-BN and to develop deterministic engineering techniques for introducing and controlling these emitters with high purity and tunability. To achieve this goal, the optical properties of h-BN emitters were investigated using optical spectroscopy, while their structural origins were examined using high-resolution microscopy and elemental analysis techniques. This work addresses the challenge of identifying the structure of defect emitters in hBN, presents deterministic methods for introducing point defects in a controlled manner, and paves the way for implementing h-BN defect emitters in future quantum optical circuits.

Biography

Xu Yue (Ashley) received her bachelor's degree in University of Chinese Academy of Sciences in Materials Science and Engineering, and her master's degree in Northwestern University in Biomedical Engineering. Ashley is currently a PhD candidate at the Materials Science and Engineering Department under the supervision of Prof. Silvija Gradečak. Her research focuses on studying the optical properties of point defects in layered van der Waals materials.

Please join us!

HOST: Asst Prof Zhao Ming