



Department of Materials Science and Engineering Seminar Series 2026

Plasmon Dispersion in MXenes Measured with High Resolution Electron Spectroscopy

He Ya

Date and time: 10th September 2026, 10:00am – 12:00pm

Venue: EA-02-14

Abstract

Plasmons are collective electron density oscillations that strongly determine the optical properties of metals. So far, most plasmon research has focused on bulk metals. But with the advent of metallic two-dimensional (2D) materials, it has become possible to confine plasmons—and focus light energy—into the extreme, monolayer limit.

Here, we use conductive $\text{Ti}_3\text{C}_2\text{T}_x$ MXene monolayers to investigate how extremely confined plasmons behave in conductive 2D films. We use momentum-resolved electron energy-loss spectroscopy (EELS) in the scanning transmission electron microscope (STEM) to investigate the dispersion of plasmons at the nanoscale. We resolve two surface plasmon modes in monolayers and demonstrate a plasmon confinement ratio of ~ 310 times. Furthermore, we study the plasmon dispersion properties in the out-of-plane direction through cross-sectional samples fabricated by focused ion beam (FIB). With this, we show the occurrence of directional guiding of plasmon modes, correlated with carrier mobility measurements. The dispersion properties of conductive 2D materials such as MXenes provide guidance for optical property tuning. We also use helium ion microscopy (HIM) for resist-free nanopatterning and show control over the plasmon properties.

Biography

He Ya received her MSc. from the National University of Singapore (NUS) and is currently a Ph.D. candidate in the Department of Materials Science and Engineering at NUS under the supervision of A./Prof. Michel Bosman. Her research focuses on plasmons in 2D materials.

Please join us!

HOST: Assistant Prof Zhong Peichen