Department of Materials Science and Engineering Seminar Series 2025

MULTI-FUNCTIONAL 2D MATERIALS MEMBRANES: FABRICATION AND APPLICATIONS

WANG QIAN

Date and time: 13th Feb 2025 (Thursday) 2pm- 4pm

Venue: S9 level 9 Conference room

Abstract

The increasing demand for advanced materials with customizable properties has driven extensive research into the integration of organic and inorganic materials for targeted functionalization. This thesis focuses on the development of smart devices based on two-dimensional (2D) material membranes, specifically graphene oxide (GO) and $Ti_3C_2T_x$ MXene, due to their excellent tunability. Modifications in the membrane fabrication process, ranging from nanostructural tuning to three-dimensional morphological engineering, significantly enhance membrane performance and expand their potential applications.

These smart devices based on 2D material membranes have a broad spectrum of applications, including smart architecture, soft electronics, and healthcare devices. Specifically, nanostructure-modified flat membranes with actuation capabilities enable programmable responses for smart architecture and soft robotics. Innovative curved membranes enhance structural adaptability for acoustic diaphragms. Crumpled membranes with unique nanostructures and surface morphologies enable high-sensitivity pressure sensing for human motion monitoring, function as stretchable antennas for stable wireless communication, and improve gas separation efficiency. These advancements highlight the importance of structural design in fully utilizing the potential of 2D material membranes, opening up new possibilities for the development of next-generation multifunctional smart devices.

Biography

WANG QIAN received her B.Eng. degree from Sichuan University and the M.Sc. degree from National University of Singapore. She is currently a Ph.D. candidate in the Department of Materials Science and Engineering under the supervision of Prof. Sir Konstantin Sergeevich Novoselov and Assoc. Prof. Daria Andreeva-Baeumler. Her research focuses on the development of smart devices utilizing two-dimensional material membranes.

Please join us!

HOST: Prof Ding Jun