Department of Materials Science and Engineering Seminar Series 2026

Strategic Design of Carbon-Based Coatings for Cardiovascular Medical Implants

Ng Pei Rou

Date and time: 5 March 2026 (2 pm)

Venue: EA-02-15

Abstract

Cardiovascular disease is a leading chronic condition in an ageing global population. Some of the examples of cardiovascular disease include atherosclerosis (fatty plaque buildup that narrows arteries) and venous thromboembolism (formation of blood clots in the veins). Cardiovascular implants are treatment options for cardiovascular disease. Nevertheless, clinical complications including restenosis (re-narrowing of blood vessels) and thrombosis (formation of blood clots) arise after implantation.

This thesis explores the use of carbon-based coatings for surface modification of cardiovascular implants, with the aim of mitigating clinical complications following device implantation. Specifically, this work investigates few-layer graphene, amorphous carbon, reduced graphene oxide, and functionalized reduced graphene oxide. The thesis focuses on fabricating these coatings on metal-based cardiovascular implants and examining their interactions with various biological components, including vascular cells, blood cells, inflammatory cells, and bacteria, to determine if clinical outcomes can be improved.

The first research work explores an improved method to fabricate carbon-based coatings (few-layer graphene & amorphous carbon) directly on nitinol surface via understanding of metal-carbon interaction at high temperature. The novelty lies as the proposed method — chemical vapor deposition, permits direct fabrication of carbon-based coatings without introducing additional intermediate layers. The biological interactions are determined to evaluate the suitability of different carbon-coated candidates as stent coatings.

The second research work demonstrates the surface tunability of graphene-based coatings by incorporating copper oxide nanoparticles onto reduced graphene oxide, transforming its surface from promoting cell attachment to being cell-repellent. The biological interactions of the functionalized reduced graphene oxide are examined to confirm its cell-repellent properties while maintaining hemocompatibility and anti-inflammatory effects.

Biography

Ng Pei Rou obtained her bachelor's degree (with honours) in Chemistry and Biological Chemistry from Nanyang Technological University, Singapore. Prior to her PhD candidature, she worked as a research assistant at the Centre for Advanced 2D Materials, National University of Singapore. She is currently a PhD candidate in the Department of Materials Science and Engineering, under the supervision of Assoc. Prof. Daria Andreeva-Baeumler and co-supervised by Adjunct Assoc. Prof. Vitaly Sorokin. Her research focuses on the design of carbon-based coatings for cardiovascular implant applications.

Please join us!

HOST: Asst Prof Ahmet Avsar