



Department of Materials Science and Engineering Seminar Series 2025

TOPOGRAPHIC SCANNING ELECTRON MICROSCOPY FOR ADVANCED MATERIALS CHARACTERIZATION

Date and time: 28th Oct 2026, 9:30AM-11.30AM

Venue: E1-06-03

Abstract

Scanning electron microscopy (SEM) is widely used to characterize the surface morphology and microstructure of materials. However, SEM imaging of non-conductive materials remains challenging due to surface charging. Conventional metal sputtering, such as Au, Pt, and Au/Pd sputtering, can reduce charging but may provide discontinuous coverage of complex three-dimensional surfaces. This may lead to localized charge accumulation, image distortion, and loss of structural details. To address these limitations, Topographic Scanning Electron Microscopy (ToSEM) is developed as a sample preparation method using conformal coatings of the conductive polymer poly(3,4-ethylenedioxythiophene) (styrenesulfonate) (PEDOT:PSS). The conductivity, wettability, and film formation of the polymer coatings are systematically optimized. These coatings effectively reduce surface charging while preserving the original surface morphology. Compared with conventional metal sputtering, ToSEM provides more uniform surface coverage by solution process and reduces nanoscale coating artifacts. This allows clearer visualization of fine surface features and complex structures. Further formulation optimization extends ToSEM to materials with different surface properties. Its applicability is demonstrated across various materials, including microelectronic devices, energy materials, nanostructured materials, polymers, and biological materials. ToSEM also enables multiscale characterization of complex structures and supports investigations of mechanical fracture under different conditions. Therefore, ToSEM provides an alternative to conventional metal sputtering for sample coating preparation and offers new opportunities for characterizing complex non-conductive materials.

Biography

Sun Wen received her bachelor's degree in chemical engineering and technology from Fuzhou University in 2021 and her master's degree in Materials Science and Engineering from the National University of Singapore (NUS) in 2022. She is currently a Ph.D. candidate in the Department of Materials Science and Engineering at NUS, under the supervision of Prof. Ouyang Jianyong. Her research focuses on Topographic Scanning Electron Microscopy (ToSEM) for advanced materials characterization.

Please join us!

HOST: A/Prof. Daria Andreeva-Baeumler