MONASH University

MONASH CENTRE FOR ELECTRON MICROSCOPY

Incoherent and coherent cathodoluminescence spectroscopy – a versatile tool to study nanoscale light distribution

Date: Friday, 6th December 2024
Time: 11:00 – 12:00PM
Venue: Theatre S1,
16 Rainforest Walk, Monash Clayton Campus

Dr. Saskia Fiedler,

Photonic Materials, NOW-Institute AMOLF, Science Park 104, 1098 XG Amsterdam, The Netherlands

Abstract

The fabrication of nanostructures with ever-decreasing sizes has increased the demand of suitable characterization methods allowing to determine their shape and size at the nanoscale and enable the investigation of their optical properties beyond the diffraction limit. Due to the high spectral and spatial resolution, cathodoluminescence spectroscopy (CL), has become a powerful characterization tool to study plasmonic and dielectric nanostructures as well as incoherent processes in semiconductors at the nanoscale.

In this talk, I will present how CL can be used to probe the nanoscale distribution of light fields in the optical spectral range. In the first part, I will cover incoherent CL of perovskite films where we demonstrate direct correlation of electron backscatter diffraction (EBSD) and CL for the first time. We furthermore theoretically study the light outcoupling to complement the CL experiments. In the second part, I will focus on coherent CL where we theoretically and experimentally explore the excitation and radiation profile into the far-field of Mie resonances in individual silicon nanospheres (NPs). Furthermore, I will present the newest results towards pump-probe CL using these resonant NPs for nanothermometry. Here, we inject laser light into the SEM chamber to optically heat the NP and use the electron beam as a local probe, observing a temperature-dependent spectral shift of the Mie modes in the Si NP.

S. Fiedler[1], Evelijn Akerboom[1], Theo Soler[1], I. Schuringa[1], R. Schot[1], L.L. Nguyen[2], L.Y. Ming[2], B. Ehrler[1,4], Hiroshi Sugimoto[3], Minoru Fujii[3], and A. Polman[1]

[1]Photonic Materials, NOW-Institute AMOLF, Science Park 104, 1098 XG Amsterdam, The Netherlands

[2]School of Materials Science and Engineering, Nanyang Technological University, Singapore

[3]Department of Electrical and Electronic Engineering, Kobe University, Rokkodai, Nada, Kobe 657-8501, Japan

[4]Zernike Institute for Advanced Materials, University of Groningen, The Netherlands

Biography

Saskia Fiedler received her PhD from University of Technology Sydney, where she designed and built light injection into a SEM-CL system to study the coupling mechanism of plasmons and excitons in wide bandgap semiconductors. During her first postdoc at Southern University of Denmark, her research focused on coherent CL of plasmonic and dielectric nanostructures, as well as autocorrelation measurements of excitons in 2D materials and single photon emitters. At AMOLF, Saskia has been working on light in-coupling into a SEM to facilitate pump-probe experiments, pumping the sample via short laser pulses and probing locally with electron pulse. During her Marie Curie Fellowship, she will extensively study perovskite thin films with electron beams under different types of stress, such as light exposure, electrical bias as well as the effect of FIB milling on the optical properties at the nanoscale.

Convener: Dr Zhou Xu
Email: mcem@monash.edu Tel: 9905 5563