ISGD7

7th International Symposium on Graphene Device
25 - 28 July, 2022 / WASHINGTON, D.C

Probing Phonon Polaritons in Nanomaterials using an Electron Microscope

Maureen Joel Lagos1

1Department of Materials Science and Engineering,
McMaster University, Hamilton, Ontario, Canada

Van der Waals (VdW) materials have attracted significant attention due to their unique polaritonic properties. Spectroscopy studies of their polaritonic behavior are dominated by optical-based techniques, which have provided remarkable physical information with sub 100 nm spatial resolution. Recent advances in a new generation of monochromators have pushed the limits of energy resolution in electron microscopes allowing studies with sub-10 meV energy resolution in the infrared/visible range and with nanometer spatial resolution [1]. For instance, spatially-resolved electron energy loss spectroscopy (EELS) studies have allowed the detection of surface phonon polaritons in single nanostructures [2], mapping strongly-coupled plasmon-phonon modes [3], plasmon-drive enhancement of vibrational signal [4], spectroscopy of plasmon-exciton, etc. [5] In this talk I will survey recent results from EELS studies in α-MoO3 nanocrystals. The focus will be on discussing the excitation of (dark) polaritonic modes. We will show the large variety of surface phonon polaritons that a nanocrystal can support and image their spatial distribution with nanoscale resolution.

[1] O. Krivanek, et al, Nature 514 (2014) 209
[2] M. J. Lagos, et al, Nature 543 (2017) 529
[3] M. J. Lagos et al., ACS Photonics 8 (2021),1293–1300.
[4] L. H. G. Tizei et al., Nano Letters 20 (2020), 2973-2979.
[4] M. J. Lagos et al., Microscopy 71 (2022), i174–i199.