Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Nanoscale Thermal Mapping in Two-Dimensional Materials using Electron Energy Loss Spectroscopy (EELS)[1] XUAN HU, Deparment of Physics, University of Illinois at Chicago, POYA YASAEI, Mechanical Engineering Department, University of Illinois at Chicago, JACOB JOKISSARI, SERDAR ÖĞÜT, Deparment of Physics, University of Illinois at Chicago, AMIN SALEHI, Mechanical Engineering Department, University of Illinois at Chicago, ROBERT KLIE, Deparment of Physics, University of Illinois at Chicago — While 2D materials such as graphene and transition metal dichalcogenides (TMDs) are of significant interest for the applications in electronics and optoelectronics, heat removal in such devices can be detrimental to their performance and reliability. As the node sizes in such devices shrink, understanding the power dissipation and thermal transport properties in 2D materials requires thermometry techniques which can provide a nm-scale spatial resolution. Here, we introduce a method for measuring the local temperature gradients in low dimensional materials using a combination of scanning transmission electron microscope and electron energy loss spectroscopy (EELS). More specifically, we find a relationship between the plasmon energies and the sample temperatures for different free-standing 2D materials (graphene, MoS_2, $MoSe_2$, WS_2, WSe_2), which can now be used to map the temperature gradient across interfaces and particle surfaces. We also perform first-principles calculations for the low-loss EELS signal to interpret the experimental findings.

[1]Supported by NSF EFMA-1542864 (EFRI)

Xuan Hu
Deparment of Physics, University of Illinois at Chicago

Date submitted: 11 Nov 2016 Electronic form version 1.4