Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Raman study of atomically thin GaSe: photo induced oxidation and identification of polar vibrational modes ALARIC BERGERON, JOHN IBRAHIM, Polytechnique Montreal, RICHARD LEONELLI, Universite de Montreal, SEBASTIEN FRANCOEUR, Polytechnique Montreal — GaSe is a direct gap 2D material with strong non-linear optical coefficients and distinctive interband selection rules, making it interesting for optoelectronic and spintronic applications. In this presentation, we use Raman spectroscopy to address two important issues relating to GaSe. First, we investigate the rapid photo-oxidation of GaSe in ambient conditions and the emergence of several oxidation products: Ga_2Se_3, Ga_2O_3 and Se. Oxidation rates increase exponentially with illumination power and no safe optical power threshold exists for atomically thin GaSe. Since this process simultaneously requires oxygen, humidity, and optical excitation, removing one of these three effectively protects GaSe. Second, the assignment of polar phonons remains conflicted in the literature. Here, we measure and model the polarization-resolved Raman signal as a function of wave vector orientation. We find that two features in the 230-260 cm^{-1} range exhibit unexpected selection rules and wave vector dependence. We develop a polar phonon model to explain this behavior and identify the crystalline vibrational modes.

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Date submitted: 11 Nov 2016 Electronic form version 1.4