Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Oxidation of atomically thin MoS_2 on SiO_2 MAHITO YAMAMOTO, WILLIAM CULLEN, THEODORE EINSTEIN, MICHAEL FUHRER, Materials Research Science and Engineering Center, University of Maryland, College Park, MD 20742-4111 — Surface oxidation of MoS_2 markedly affects its electronic, optical, and tribological properties. However, oxidative reactivity of atomically thin MoS_2 has yet to be addressed. Here, we investigate oxidation of atomic layers of MoS_2 using atomic force microscopy and Raman spectroscopy. MoS_2 is mechanically exfoliated onto SiO_2 and oxidized in Ar/O_2 or Ar/O_3 (ozone) at 100-450 °C. MoS_2 is much more reactive to O_2 than an analogous atomic membrane of graphene and monolayer MoS_2 is completely etched very rapidly upon O_2 treatment above 300 °C. Thicker MoS_2 (> 15 nm) transforms into MoO_3 after oxidation at 400 °C, which is confirmed by a Raman peak at 820 cm^{-1}. However, few-layer MoS_2 oxidized below 400 °C exhibits no MoO_3 Raman mode but etch pits are formed, similar to graphene. We find atomic layers of MoS_2 shows larger reactivity to O_3 than to O_2 and monolayer MoS_2 transforms chemically upon O_3 treatment even below 100 °C. Work supported by the U. of Maryland NSF-MRSEC under Grant No. DMR 05-20741.

Mahito Yamamoto
Materials Research Science and Engineering Center,
University of Maryland, College Park

Date submitted: 13 Nov 2012 Electronic form version 1.4