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In situ photothermal oxidation kinetics in MoS2 RAHUL RAO, AHMAD ISLAM, UES Inc., Air Force Research Laboratory, PHILLIP CAMPBELL, ERIC VOGEL, Georgia Tech University, BENJI MARUYAMA, Air Force Research Laboratory — It is important to understand the thermal and chemical stability of mono- and few-layer MoS_2 for their use in applications. Oxidative environments are of particular interest due to the potential for use of MoS_2 in electronics, sensing and energy storage. Here we present an in situ study of the oxidation kinetics of few-layer MoS_2 over a wide range of temperatures. In situ monitoring of the MoS_2 Raman spectra under oxidation revealed a decrease in intensity of the peaks following sigmoidal decay kinetics and that was initiated at temperatures as low as 300 ^{o}C. Ex situ resonance Raman spectroscopy, scanning electron and atomic force microscopy analysis indicated breaking up and thinning of the MoS_2 films down to mono- and bi-layer regions. The process likely originated at defect sites in the film, and based on the Raman peak frequencies, resulted in p-doped islands. From the temperature dependence of the data we extracted a reaction energy of ˜0.54 eV, which can be attributed to oxidation of the MoS_2 at defect sites. Finally, oxidation of films with varying defect densities revealed a clear dependence of oxidation rate and reaction energy on structural defects.

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