Interactions of oxygen with MoS2 crystals

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For numerous applications of microscopic MoS2 crystals, particularly in flexible nanoelectronics, one must understand their oxidation reactions in air and water. In this talk, I will present the studies of microscopic heat induced oxidation and oxidative etching in the case of thick, mechanically exfoliated, geological 2H MoS2 crystals in air. I will discuss particular reaction mechanisms and show how to differentiate MoO3 oxides and their derivatives onto such surfaces. In order to do so, we combined global and local XPS, AES, XAS, Raman and AFM (topography, friction, Kelvin Probe) measurements on single microscopic MoS2 flakes [1-4].

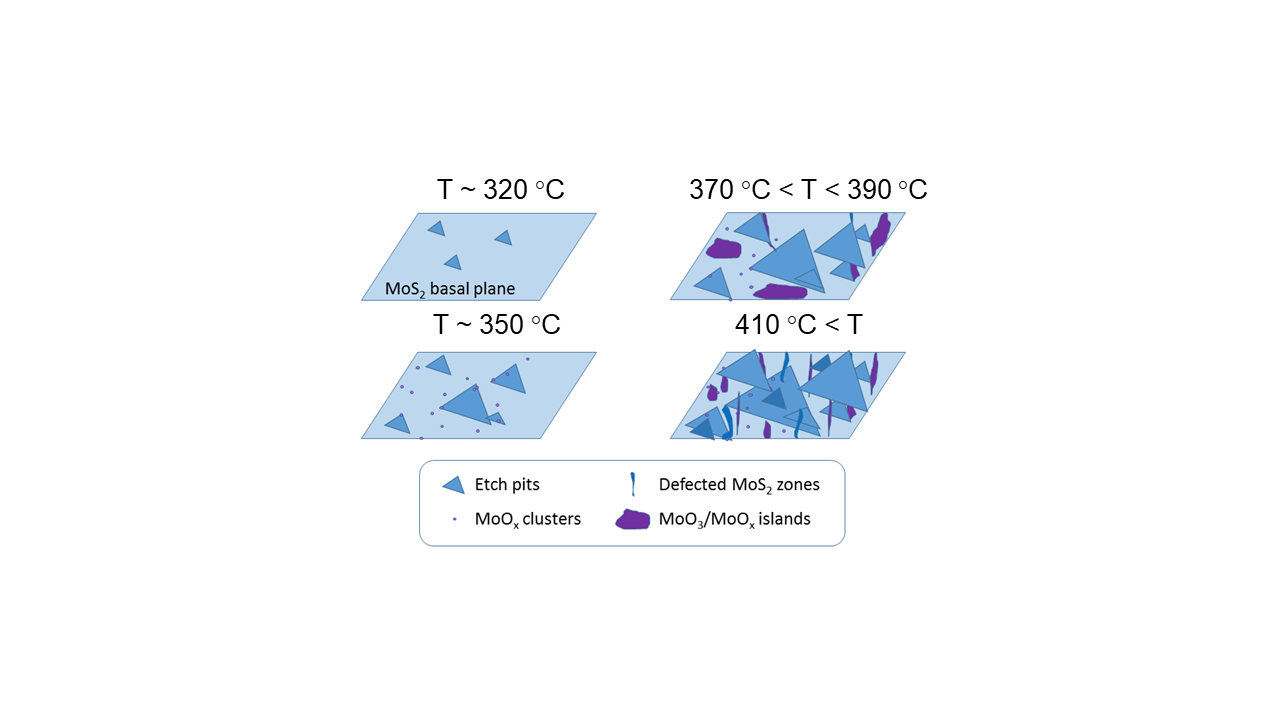


FIGURE 1. Phenomenological aspects of the MoOx formation onto MoS2 basal planes during their heating in dry air

1. R. Szoszkiewicz, Local interactions of atmospheric oxygen with MoS2 crystals, Materials, 14, 5979, 31 pages (2021).
2. M. Rogala, S. Sokołowski, U. Ukegbu, A. Mierzwa and R. Szoszkiewicz, Direct identification of surface bound MoO3 on single MoS2 flakes heated in dry and humid air, Advanced Materials Interfaces, 2100328, 11 pages (2021); Pictured on the Front Inside Cover.
3. R. Szoszkiewicz, M. Rogala, P. Dąbrowski, Surface-bound and volatile Mo oxides produced during oxidation of microscale 2H MoS2 crystals in air and high relative humidity, Materials 13, 3067, 14 pages (2020).
4. U. Ukegbu, R. Szoszkiewicz, Microscopic kinetics of heat-induced oxidative etching of thick MoS2 crystals, Journal of Physical Chemistry C, 123, 22123-22129 (2019).