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Oxidation-derived two-dimensional MoO_3/MoS_2 heterostructures TAEG YEOUNG KO, Department of Chemistry, Kyung Hee University, AREUM JEONG, Department of Applied Chemistry, Kyung Hee University, SUNMIN RYU[1], Department of Chemistry, Division of Advanced Materials Science, Pohang University of Science and Technology — In order to explore the efficient formation of MoO_3/MoS_2 heterostructures, we systematically investigated the course of surface oxidation of mechanically exfoliated single and few-layer MoS_2 induced by oxygen plasma treatment using photoluminescence (PL) and Raman spectroscopy, atomic force microscopy (AFM) and X-ray photoelectron spectroscopy (XPS). Raman and PL spectra served as sensitive indicators for defects generated by the plasma oxidation, showing Raman peak broadening and drastically reduced intensities for both Raman peaks and PL bands. XPS detected Mo^{6+} as the major Mo species in the oxidized samples, confirming the conversion of MoS_2 into amorphous MoO_3. The AFM studies also revealed that the thickness of MoS_2 layers more than doubles when oxidized and that the vertical reaction from the top dominates with a negligible contribution from the lateral attack when combined with the Raman measurements. Our results show that the oxygen plasma treatment can be successfully used in generating atomically thin MoO_3 or two-dimensional MoO_3/MoS_2 heterostructures that may be useful for future electronic and optoelectronic application.

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