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Uniform wafer-scale growth of stencil templated, high-quality monolayer MoS2 ETHEL PEREZ-HOYOS , JUSTIN YOUNG , MICHAEL CHILCOTE , The Ohio State University, MATTHEW BARONE , University of Virginia , SARA MUELLER , ROLAND KAWAKAMI, EZEKIEL JOHNSTON-HALPERIN , The Ohio State University — With the widespread interest in transition metal dichalcogenides and the recent focus on two-dimensional (2D) vertically stacked heterostructures, a need for an inexpensive and reliable method of producing clean, high-quality, patterned 2D materials has emerged. Here, we report on a templated MoS2 growth technique by metal sulfurization where Mo is deposited through a SiN stencil onto highly-crystalline sapphire substrates. After sulfurization, the resulting MoS2 films are shown to be high-quality with thicknesses that can be tuned layer-by-layer—down to a single layer—through manipulation of the initial Mo deposition time. The quality of these films is confirmed through scanning electron and atomic force microscopies as well as Raman and photoluminescence spectroscopy. This facile growth technique results in templated, high-quality MoS2 films with centimeter-scale uniformity, feature sizes down to 100 nm, and offers both a means to easily probe MoS2 growth dynamics and a route to 2D stacked heterostructures with arbitrary geometry and pristine interfaces. We will discuss potential applications of this novel growth technique for the development of TMD heterostructures and alloys.

Ethel Perez-Hoyos
The Ohio State University

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