

Abstract Submitted
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Controlled synthesis of single-layer MoSe₂ nanostructures YUXUAN CHEN, CHENDONG ZHANG, Univ of Texas, Austin, PING CUI, ZHENYU ZHANG, Univ. of Science and Technology of China, CHIH-KANG SHIH¹, Univ of Texas, Austin — Group VIB transition metal dichalcogenides (TMD), such as MoSe₂, WS₂, etc., are a family of layered materials with weak van der Waals (vdW) interaction between neighboring layers. A transition from indirect to direct bandgap semiconductor takes place for most of these materials when they become single layer (SL), and the values of these direct band gap are comparable to visible light. This makes SL TMDs attractive candidates for 2D electronic and optoelectronic devices. Though epitaxial SL TMDs have been successfully prepared, there is controversy in their growth conditions and in their edge structures. Moreover, some intriguing theoretical predictions about the finite-size effect on SL TMDs are still awaiting experimental proof. Here we report systematic studies of the thermodynamics/ kinetics of SL MoSe₂ formation on a vdW surface (namely, highly oriented pyrolytic graphite) using molecular beam epitaxy (MBE). We also report the controlled creation of various nanostructures of MBE SL MoSe₂. The edge properties and the influence of the in-plane confinement on the electronic structure are addressed by in-situ STM and STS. Theoretical calculations have been carried out to help understanding the experimental discoveries.

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