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Facile Synthesis of MoS_2 and $Mo_xW_{1-x}S_2$ Triangular Monolayers ZHONG LIN, MICHAEL THEE, ANA ELIAS, SIMIN FENG, CHANJING ZHOU, KAZUNORI FUJISAWA, NESTOR PEREA-LOPEZ, VICTOR CAROZO, Pennsylvania State Univ, HUMBERTO TERRONES, Rensselaer Polytechnic Institute, MAURICIO TERRONES, Pennsylvania State Univ — Single- and few-layered transition metal dichalcogenides (TMDs) such as MoS_2 and WS_2 are emerging two dimensional materials exhibiting numerous and unusual physico-chemical properties that could be advantageous in the fabrication of unprecedented optoelectronic devices. Here we report a novel and alternative route to synthesize triangular monocrystals of MoS_2 and $Mo_xW_{1-x}S_2$ by annealing MoS_2 and MoS_2/WO_3 precursors, respectively, in the presence of sulfur vapor. In particular, the $Mo_xW_{1-x}S_2$ triangular monolayers show gradual concentration profiles of W and Mo whereby Mo concentrates in the islands' center and W is more abundant on the outskirts of the triangular monocrystals. These observations were confirmed by atomic force microscopy (AFM), and high-resolution transmission electron microscopy (HRTEM), as well as Raman and photoluminescence (PL) spectroscopy. The presence of tunable PL signals depending on the $Mo_xW_{1-x}S_2$ stoichiometries in 2D monocrystals opens up a wide range of applications in electronics and optoelectronics.

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