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SnS_2: An Emerging Layered Metal Dichalcogenide Semiconductor YUAN HUANG, PETER SUTTER, Center for Functional Nanomaterials, Brookhaven National Laboratory — Layered materials are of interest for new physics and due to their promise for device applications. Recent research has extended from graphene to transition metal metal dichalcogenides, with a strong focus on MoS_2. Here, we report a comprehensive study of a new group IV metal dichalcogenide, tin disulfide (SnS_2) [1]. Using flakes exfoliated from bulk crystals, we establish the characteristics of single- and few-layer SnS_2 in optical and atomic force microscopy, Raman spectroscopy and transmission electron microscopy. Band structure study show that SnS_2 is an indirect gap semiconductor over the entire thickness range from bulk to a single layer. Ultrathin transistors screened by a liquid gate show promising characteristics, such as on-off current ratios $>10^6$, high carrier mobilities (up to 230 cm^2 $V^{-1}s^{-1}$), minimal hysteresis and near-ideal subthreshold swing. SnS_2 transistors are efficient photodetectors, but similar to other dichalcogenides show a relatively slow response to pulsed irradiation, likely due to adsorbate-induced long-lived extrinsic trap states.

[1] Y. Huang et al., ACS Nano 8, 10343 (2014).

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