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Synthesis of Monolayer MoS_2 by Chemical Vapor Deposition SAJEEVI WITHANAGE, MIKE LOPEZ, KENNETH DUMAS, YEONWOONG JUNG, SAIFUL KHONDAKER, University of Central Florida — Finite and layer-tunable band gap of transition metal dichalcogenides (TMDs) including molybdenum disulfide (MoS_2) are highlighted over the zero band gap graphene in various semiconductor applications. Weak interlayer Van der Waal bonding of bulk MoS_2 allows to cleave few to single layer MoS_2 using top-down methods such as mechanical and chemical exfoliation, however few micron size of these flakes limit MoS_2 applications to fundamental research. Bottom-up approaches including the sulfurization of molybdenum (Mo) thin films and co-evaporation of Mo and sulfur precursors received the attention due to their potential to synthesize large area. We synthesized monolayer MoS_2 on Si/SiO_2 substrates by atmospheric pressure Chemical Vapor Deposition (CVD) methods using sulfur and molybdenum trioxide (MoO_3) as precursors. Several growth conditions were tested including precursor amounts, growth temperature, growth time and flow rate. Raman, photoluminescence (PL) and atomic force microscopy (AFM) confirmed monolayer islands merging to create large area were observed with grain sizes up to 70μm without using any seeds or seeding promoters. These studies provide in-depth knowledge to synthesize high quality large area MoS_2 for prospective electronics applications.

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