Abstract Submitted
for the TSF13 Meeting of
The American Physical Society

Two Dimensional Transition Metal Dichalcogenides Synthesis and Exfoliation MARINA PAGGEN, Univ of Texas, El Paso, KANOKPORN CHATTRAKUN, BRIAN LEROY, Univ of Arizona — Transition metal dichalcogenides (TMDCs) are layered crystals that can be exfoliated to a monolayer while maintaining their electronic properties. Since the demand for high performing smaller electronic components is on the rise, the ability for the compounds to maintain electronic properties at the atomic level makes them appealing for various state-of-the-art applications. However, most TMDC compounds are not naturally abundant and must be synthesized in order to evaluate their electronic properties. An efficient and reliable method is required to synthesize the TMDC material. To determine the best techniques, methods of crystal synthesis and exfoliation were coupled to see which materials were best suited for this process. The chemical vapor transport method and sublimation methods were successful synthesis procedures and consistently created layered structured crystals. Micromechanical cleavage is the cleanest and simplest method for exfoliating monolayers. The compounds evaluated through this process were two semiconductors: tungsten disulfide and tungsten diselenide, as well as a superconductor: tantalum disulfide. For the semiconductors, photoluminescence was used to determine the number of layers and confirm the direct bandgap in exfoliated monolayer samples. For all compounds, atomic force microscopy was used to confirm the number of layers once exfoliated. All materials exhibit a potential for clean synthesis through mechanical exfoliation, simplifying the process to synthesize samples for TMDC research.

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Date submitted: 10 Sep 2013 Electronic form version 1.4