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Synthesis and Characterization of Large-Area and Highly Crystalline Molybdenum Disulphide Atomic Layer by Chemical Vapor Deposition

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The Isolation of few-layered transition metal dichalcogenides has mainly been performed by mechanical and chemical exfoliation with very low yields. in particular, the two-dimensional layer of molybdenum disulfide (MoS2) has recently attracted much interest due to its direct-gap property and potential application in optoelectronics and energy harvesting. However, the synthetic approach to obtain high-quality and large-area MoS2 atomic thin layers is still rare. In this account, a controlled thermal reduction-sulfurization method is used to synthesize large-MoOx thin films are first deposited on Si/SiO2 substrates, which are then sulfurized (under vacuum) at high temperatures. Samples with different thicknesses have been analyzed by Raman spectroscopy and TEM, and their photoluminescence properties have been evaluated. We demonstrated the presence of mono-, bi-, and few-layered MoS2 on as-grown samples. It is well known that the electronic structure of these materials is very sensitive to the number of layer, ranging from indirect band gap semiconductor in the bulk phase to direct band gap semiconductor in monolayers. This synthetic approach is simple, scalable, and applicable to other transition metal dichalcogenides. Meanwhile, the obtained MoS2 films are transferable to arbitrary substrates, providing great opportunities to make layered composites by stacking various atomically thin layers.

Keywords: transition metal dichalcogenides, molybdenum disulfide, direct bandgap

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Interfacial Magnetic Anisotropy of Co90Zr10 on Pt Layer

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Spin Transfer Torque (STT) is of great interest in data writing scheme for the Magneto-resistive Random Access Memory (MRAM) using Magnetic Tunnel Junction (MTJ). Scalability for high density memory requires ferromagnetic electrodes having the perpendicular magnetic easy axis. We investigated CoZr as the ferromagnetic electrode. It is observed that interfacial magnetic anisotropy is preferred perpendicular to the plane with thickness dependence on the interfaces with Pt layer. The anisotropy energy (Ku) with thickness dependence shows a change of magnetic-easy-axis direction from perpendicular to in-plane around 1.2 nm of CoZr. The interfacial anisotropy (Ki) as the directly related parameters to switching and thermal stability, are estimated as 1.64 erg/cm^2 from CoZr/Pt multilayered system.

Keywords: Cobalt-Zirconium alloys, perpendicular magnetic anisotropy, interfacial magnetic anisotropy, thermal retention stability