Abstract Submitted
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Spin-dependent intergranular hopping transport in very thin highly spin-polarized CoS_2 thin films[1] M. MANNO, A. GUNAWAN, A. BARUTH, R. FRAKIE, A. MKHOYAN, C. LEIGHTON, University of Minnesota, DEPARTMENT OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE COLLABORATION — The $Co_{1-x}Fe_xS_2$ alloy system has been shown to exhibit high, composition tunable, spin polarization (-56 % $<$ P $<$ +85 %) in bulk, demonstrating great promise for fundamental studies in spintronics. Incorporation in heterostructures requires reliable thin film deposition routes, which have recently been developed. We present here a detailed study of the thickness (t) dependence of the structural, magnetic, and electronic properties of polycrystalline CoS_2 thin films (70 – 1600 Å). As t is decreased, we observe a suppression in magnetic properties accompanied by a metal-insulator transition. A distinct 3D to 2D crossover is evident in the conductance-voltage curves and intergranular tunneling magnetoresistance. At t of order 70 Å we observe granular metal conduction, in the presence of a Coulomb charging penalty. We demonstrate quantitative agreement between experiment and proposed models. The very thin film data are understood in terms of enhanced grain boundary resistance, due to S accumulation, which is evidenced via several modes of structural characterization.

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