Scaling of the anomalous Hall effect of MBE-grown Cr_2Te_3 thin films

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We performed a systematic study on the magneto-transport properties of Cr_2Te_3 thin films. Cr_2Te_3 is a van der Waals type layered structure with unique ferromagnetic characteristics [1-3]. Studies have shown that the Curie temperature of Cr_2Te_3 can reach room temperature with the increase of film thickness [1]. We have grown Cr_2Te_3 thin films using molecular beam epitaxy (MBE). The film structure is characterized by RHEED, scanning transmission electron microscope (STEM) and X-ray diffraction (XRD). The RHEED patterns show sharp streaks during the growth, indicating the smooth surface of the films. A 2:3 ratio of Cr and Te is confirmed from STEM measurement. Typical Bragg diffraction peaks associated with the hexagonal (0001) planes are observed in XRD spectrum. The position and amplitude of the peaks are in good agreement with tabulated data in the database, suggesting successful preparation of high quality Cr_2Te_3 films.

The magneto-transport properties of the films were studied using micro-fabricated Hall bars. The anomalous Hall resistance R_{AH} is measured against the out of plane magnetic field. A square hysteresis loop is observed at low temperature, indicating the existence of the ferromagnetic phase. The Curie temperature of the films is ~175 K. R_{AH} is found to vary with the measurement temperature. Interestingly, the sign of R_{AH} changes as the temperature is increased. To identify the origin of the sign change, we studied the resistivity ρ_{xx} dependence of R_{AH}. From these results, we discuss possible contributions to the anomalous Hall resistance which causes its sign change. Details of the analysis will be discussed in the presentation.

References: [1] *Li et al.*, ACS Appl. Nano Mater, 2, 6809 (2019). [2] *Lee et al.*, ACS Appl. Nano Mater, 4, 4810 (2021). [3] *Zhong et al.*, Nano Res., 15, 1254 (2022).