Magnetic Domains in Few-Layer Fe_5GeTe_2

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Magnetic domain formation in two-dimensional (2D) materials gives perspectives into the fundamental origins of 2D magnetism and also motivates the development of advanced spintronics devices. Here, we employ X-ray photoemission electron microscopy (XPEEM) to image domain structures in the vdW ferromagnet Fe_5GeTe_2 which shows near room temperature bulk ferromagnetism. In the bulk limit, we observe labyrinth-type domains, which form as a result of perpendicular magnetic anisotropy (PMA) and the dipolar interaction [1]. In four-layer flakes, magnetic bubbles form; in three-layer flakes, magnetic bubbles and stripe domains coexist. In bilayer flakes, a highly disordered magnetic state forms. The few-layer magnetic domain structures show a weakened PMA in the atomically thin limit, which competes with the stray field energy. Moreover, an in-plane spin-reorientation transition occurs in five-layer flakes. These few-layer magnetic domain structures demonstrate non-negligible stray field energies in Fe_5GeTe_2 for all thicknesses [2].

References

[1] Li, Q. et al. Patterning-Induced Ferromagnetism of Fe_3GeTe_2 van der Waals Materials beyond Room Temperature. *Nano Letters*, *18*(9), (2018)
[2] Fujita, R. et al. Layer-Dependent Magnetic Domains in Atomically Thin Fe_5GeTe_2. *ACS Nano*, *16*(7), (2022)

Figures

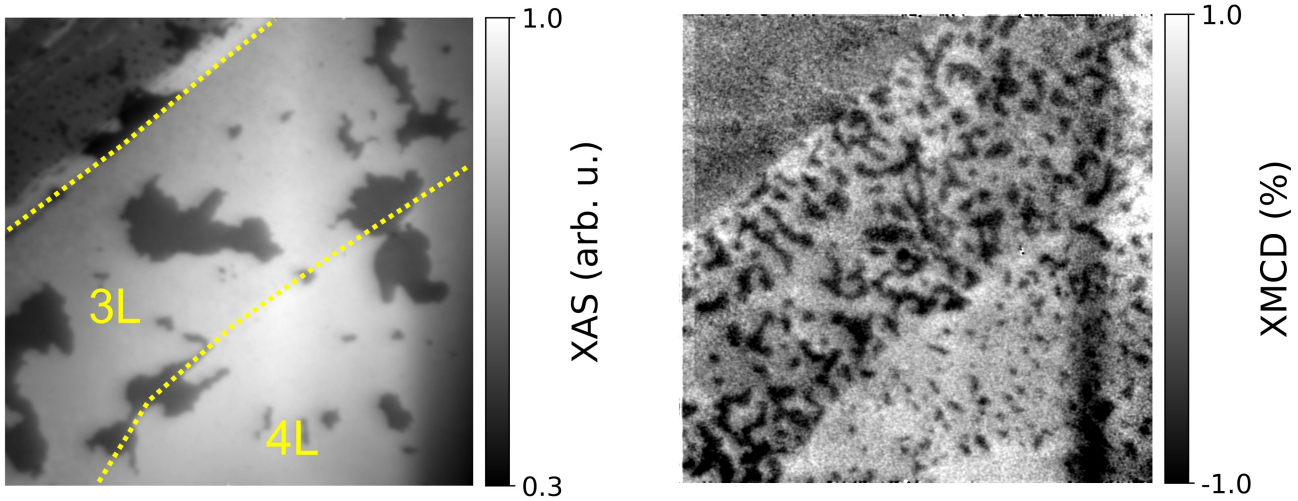

Figure 1: Spatial images of (a) X-ray absorption spectra (XAS) at the Fe L_3 edge and (b) X-ray magnetic circular dichroism (XMCD) of three (3L) and four layer (4L) Fe_5GeTe_2. Field of view = 10 µm.