Molecular Beam Epitaxy of van der Waals $Cr_{1+x}Te_2$

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Achieving the large-scale growth of 2D ferromagnetic materials with above room temperature Curie temperature and perpendicular magnetic anisotropy is highly desirable for the development of future magnetic sensors or magnetic memories based on van der Waals heterostructures. In this context, $Cr_{1+x}Te_2$ appears as a promising candidate [1].

In this poster, I present large-scale (1x1 cm^2) deposition by molecular beam epitaxy of $Cr_{1+x}Te_2$ on graphene/SiC substrates.

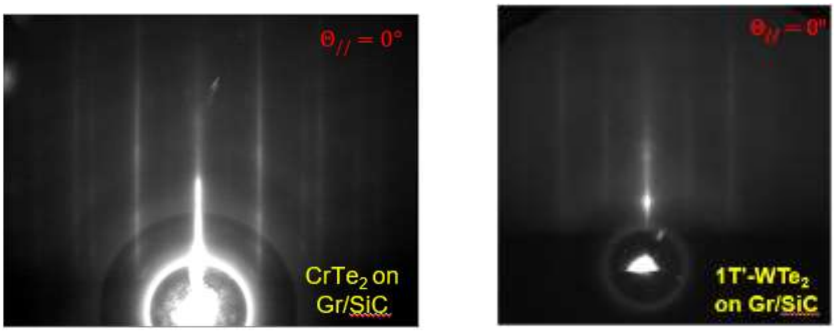

Figure 1: RHEED images of the layers grown by MBE

The crystalline quality was verified in-situ by RHEED (see Fig. 1), post-growth x-ray diffraction and Raman spectroscopy. The samples were capped with amorphous Te to prevent any oxidation in air. The magnetic properties of the $Cr_{1+x}Te_2$ layers were measured by SQUID magnetometry in out-of-plane and in-plane geometries and normalized in units of Bohr magneton per Cr atom. We obtained a perpendicular magnetic anisotropy with a Curie temperature of 180 K down to a thickness of 2 nm corresponding to 1-2 monolayers.

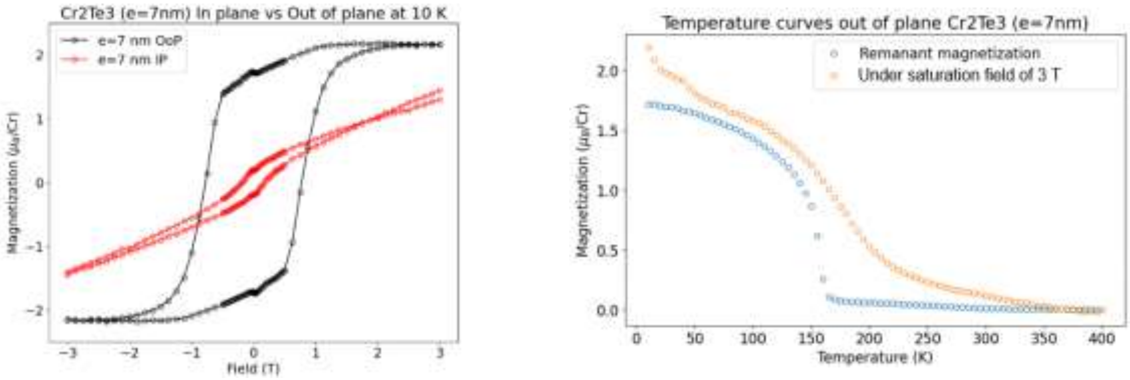

Figure 2: SQUID data of a 7 nm-thick Cr_2Te_3 layer grown on graphene in out-of-plane and in-plane geometries.

I also present preliminary data on the epitaxial growth of 1T'-WTe_2 on graphene by MBE. For its exotic spin texture and strong spin-orbit coupling, this material is a good candidate to generate spin currents from charge currents to switch the magnetization of an adjacent 2D ferromagnet like Cr1+xTe2.

[1] Purbawati et al. ACS Appl. Mater. Interfaces **12**, 30702–30710 (2020)