MBE growth of atomically-thin chromium telluride films with robust out-of-plane magnetization

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Atomically-thin, layered two dimensional (2D) van der Waals materials have attracted considerable attention due to their emerging properties from electronic and optical viewpoints, while 2D ferromagnetism, which plays an important role on 2D spintronics, has been unexplored until recent studies on exfoliated $Cr_2Ge_2Te_6$ [1] and CrI_3 [2]. Combining ferromagnetic properties with electronic and optical properties could open huge application opportunities in magnetoelectric and magneto-optics fields. Transitional-metal dichalcogenides (TMDCs) are one of most promising candidates, which already showed great potential in electronic and optoelectronic applications. Recent study has also revealed possible room temperature ferromagnetism in VSe_2 [3], while there are still many discussions and enigma on ferromagnetism in TMDCs. We have been focusing on exploring novel properties in TMDC thin films using molecular-beam epitaxy (MBE) method (Fig. 1). Recently we succeeded in growing atomically-thin chromium telluride epitaxial thin films on insulating sapphire substrates by MBE (Fig. 2). In this presentation, we will introduce our growth recipe, structure identification, then discuss structure, transport and magnetic properties of those MBE-grown chromium telluride epitaxial thin films.

[1] C. Gong *et al., Nature* **546**, 265 (2017); [2] B. Huang *et al., Nature* **546**, 270 (2017); [3] M. Bonilla *et al., Nat. Nanotechnol.* **13**, 289 (2018)

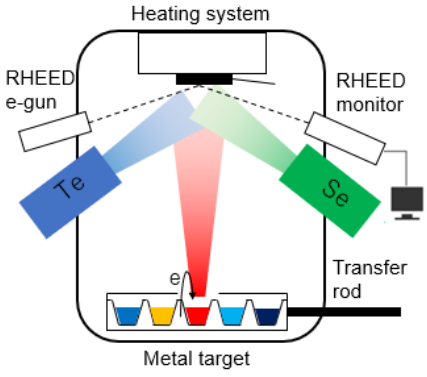

Fig. 1. Schematic structure figure of MBE system

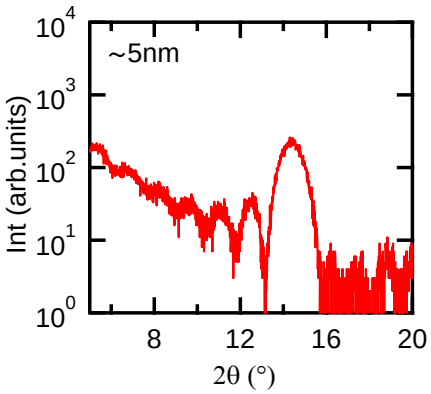

Fig. 2. XRD data of chromium telluride thin film