Charge to spin conversion in epitaxial 2D $CrTe_2/Bi_2Te_3$ grown by MBE

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Abstract

2D $CrTe_2$ FM /Bi_2Te_3 TI heterostructures [1] are grown on 1 ML MoS_2 (WS_2)/sapphire substrates by MBE. Their physical properties are evaluated by in-situ RHEDD, STM and ARPES as well as Raman and XRD. A pure $CrTe_2$ phase is obtained at low T_g ~ 225 ^{0}C showing PMA and T_c ~160 K. Mixed Cr_xTe_y phases, due to Cr self-intercalation are obtained at high T_g ~ 500 C with a T_c near or above 300K. In $CrTe_2$, the topological Hall effect is observed below 100 K, indicating the presence of skyrmions [2]. Spin torque second harmonic measurements show a large field-like (FL) torque which indicates charge-spin conversion arising from the topological surface states [3]. Partial magnetization reversal is observed at 150 K (Fig.2) in an AHE configuration, induced by current pulses of ~ 1 x 10^7 A/cm^2 passing through the Bi_2Te_3 TI.

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References

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[2] J. Chen et al., Nano Lett. **19**, 6144 (2019)
[3] P.M. Haney et al., *PRB* **87**, 174411 (2013)

Figures

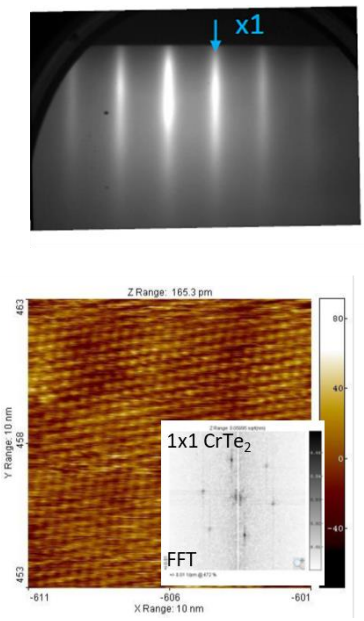

Figure 1: In situ Surface analysis showing a pure 1x1 CrTe2 phase in the epitaxial film. Top: RHEED pattern; bottom: STM and fast Fourier transform pattern

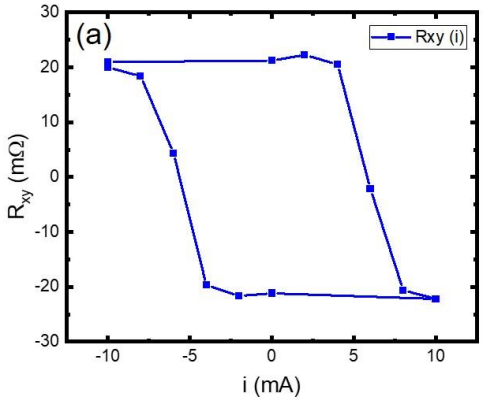

Figure 2: Magnetization reversal in $CrTe_2/Bi_2Te_3$ obtained in an AHE configuration under current pulses through the Bi_2Te_3 topological insulator