Effects of Fe Deficiency and Co Substitution in Single Crystals of Fe_3GeTe_2

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Van der Waals (vdW) bonded magnetic materials are currently shaping the field of two-dimensional (2D) materials science. The presence of van der Waals bonding in these materials allows them to be cleaved down to monolayers and combined with other 2D materials to create novel heterostructures without concern for lattice matching. By modifying these heterostructures, the electrical, optical, and magnetic properties. Fe_3GeTe_2 is a 2D magnetic material that has been generating significant attention as it was the first vdW material found to be both magnetic and metallic. It also offers a significant step up in Curie temperature (Tc ~ 225 K) from previous magnetic vdW materials.

Here, we report the effects of Fe deficiency and the substitution of Co for Fe on the magnetic and structural properties of this system. We have synthesized single crystals by chemical vapor transport and the flux method. A comparison is drawn between crystals obtained by the two synthesis techniques. Composition analysis, including estimates of the Fe content in these materials, reveal a direct correlation with the observed magnetic transitions. We also find that an excess of Fe is necessary for the synthesis of Fe_3GeTe_2 to optimize the Fe content and therefore achieve the highest Tc.

References

[1] Mayoh DA et al. Effects of Fe Deficiency and Co Substitution in Polycrystalline and Single Crystals of Fe3GeTe2 Cryst. Growth Des. 2021, 21, 12, 6786.