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Van der Waals hard ferromagnet VI_3

Abstract (Arial Narrow 12)
We present comprehensive measurements of the structural, magnetic, and electronic properties of layered van der Waals ferromagnet VI_3 down to low temperatures. Despite belonging to a well-studied family of transitionmetal trihalides [1, 2, 3], this material has received very little attention. We outline, from high-resolution powder x-ray diffraction measurements, a corrected room-temperature crystal structure to that previously proposed and uncover a structural transition at 79 K, also seen in the heat capacity. Magnetization measurements confirm VI_3 to be a hard ferromagnet (Figure 1. 9.1 kOe coercive field at 2 K) with a high degree of anisotropy, and the pressure dependence of the magnetic properties provide evidence for the two-dimensional nature of the magnetic order. Optical and electrical transport measurements show this material to be an insulator with an optical band gap of 0.67 eV—the previous theoretical predictions of d-band metallicity then lead us to believe VI_3 to be a correlated Mott insulator. Our latest band-structure calculations support this picture and show good agreement with the experimental data. We suggest VI_3 to host great potential in the thriving field of low-dimensional magnetism and functional materials, together with opportunities to study and make use of low-dimensional Mott physics.

References

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Figures

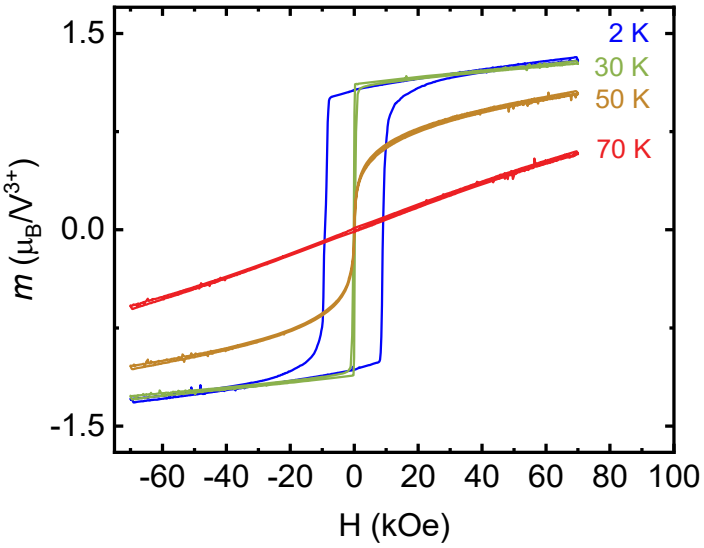

Figure 1: Field-dependent ionic magnetic moment of VI_3, showing clear ferromagnetic hysteresis loops below Tc