Transition metal chalcogenides in the 2D limit: superconductivity in 2H-TaS_2

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Abstract

Graphene [1] is one of the most studied materials due to its unique properties such as hardness, flexibility and high electric and thermal conductivity. However, probably the best quality of graphene is that it has opened the field to many other 2D crystals [2] including superconductors and topological insulators.

In this work, the synthesis and characterization of metal chalcogenides from bulk to thin layers are discussed. As an example, transport measurements in thin layers of 2H-TaS2 are presented: it is observed a superconducting critical temperature enhancement by decreasing the number of atomic layers (from 0.8 K in the bulk sample to ca. 2K in a ~3 nm layer; Figure 1). This behaviour is the opposite of the one reported in other superconductor 2D crystals [3]. This result brings superconductivity into the flatland and may open the door for their future use in magnetic sensors or low energy applications.

References

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Figures

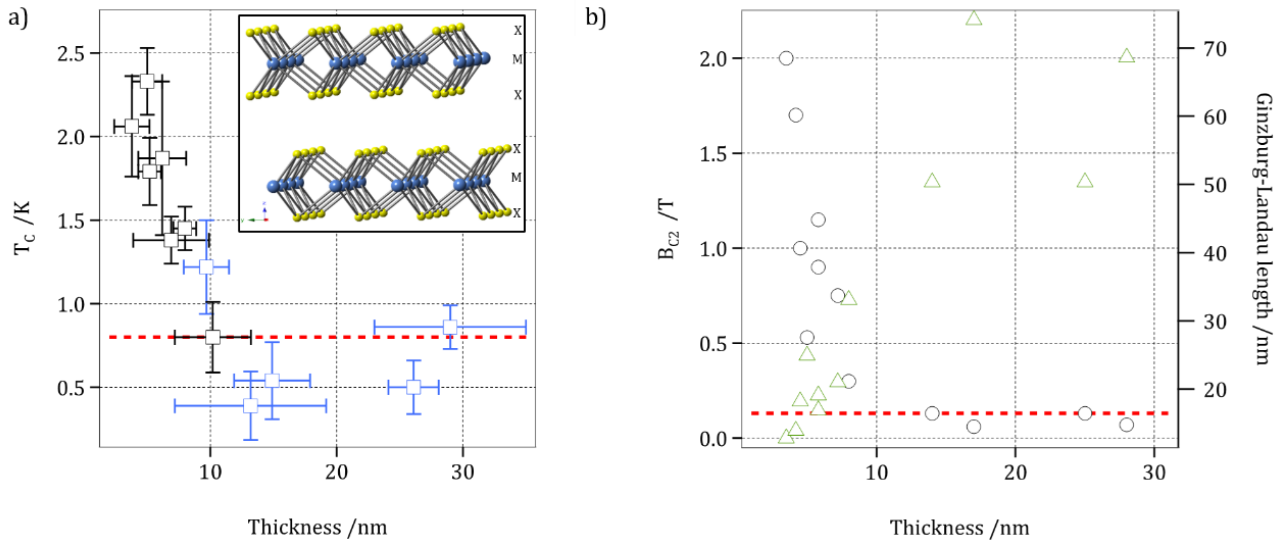

Figure 1.- a) Variation of the Tc as a function of the thickness of the TaS2 layers. Devices exhibiting non-zero RRR are plotted in blue. **Inset:** Stack of two layers of 2H-TaS_2 made out of sulfur (X) and tantalum (M). **b)** Variation of Bc2 (circles) and G-L length values (triangles) as a function of thickness. A dashed red line has been placed at the Tc and Bc_2 values found for bulk flakes to serve as a reference for establishing the thick layer limit.