Poster-2-26

Metal-insulator transition in isotope substituted Vanadium Oxide

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Vanadium oxide VO_2 is a transition metal oxide showing a metal-to-insulator transition (MIT) close to room temperature at around 340 K [1]. The decrease in electrical conductivity is accompanied by a structural change from monoclinic to a rutile lattice. Despite its discovery in the 1960s the origin of the phase transition is still debated and scenarios based on electron-lattice correlations (Peierls transition) or electron-electron correlations (Mott transition) have been proposed.
In order to explore the effect played by phonons in this phase transition, we studied the MIT in isotope-substituted $V^{18}O_2$. Single crystalline $V^{16}O_2$ and $V^{18}O_2$ microtubes were grown by thermal oxidation through resistive heating of vanadium foil [2]. XRD analysis show that the crystal structure remains unchanged upon isotope substitution. Raman spectroscopy shows the expected phonon shift towards lower energies for $V^{18}O_2$. The MIT observed in electrical transport measurements shifts by around 1.5 K towards higher temperatures upon isotope substitution. A possible explanation for this shift is an increased lattice entropy in $V^{18}O_2$ making the insulating state thermodynamically more stable.

[1] Morin, Phys. Rev. Lett. 3, 1 (1959).
[2] Zhao et al., Communications Materials 1, 28 (2020).