On the Quest for Intrinsic Magnetic Semiconductor Layers: Two-dimensional Transition-Metal Oxides

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Future nanoscale technological applications in spintronics require research on two-dimensional materials with combined semiconductor and magnetic properties. Semiconductor layers made of boron nitride BN [1] and silicon-carbon sulphides [2] were designed following an isoelectronic strategy from well-known 2D compounds such as graphene [3] and phosphorene [4]. Magnetic properties are currently being added to layers by having some traditional magnetic transition metal in the basic composition [5]. Here, we investigate transition metal dioxides in the form of layers, and we report on the structural and electronic properties of selected late transition metal d-elements [6]. With half-filled d states, the MnO2 layers are magnetic semiconductors, and for side d-elements the CrO2 and FeO2 layers become half metals. These magnetic materials in 2D must be synthesized in order to assess their usefulness in future electronic and spintronic devices.

References

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Figures

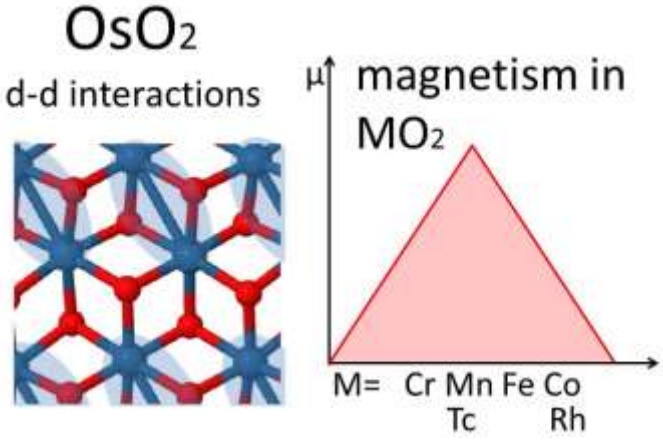

Figure 1: Structural deformations and general magnetic trends found for MO_2 being M a transition metal.