

*Heavy metal: magneto-structural relationships in Ir and Os Oxides.*Brendan James Kennedy¹, Paula Kayser¹¹*School Of Chemistry, The University Of Sydney, Sydney, Australia*E-mail: Brendan.Kennedy@Sydney.edu.au

Ir and Os oxides are of interest due to their novel magnetic properties and potential applications. The oxidation state of the cation confers a nominal spin, S , which can be strongly modified by spin-orbit coupling. The ground state is further influenced by the on-site Coulombic interaction (U) and bandwidth (W) both of which are sensitive to the symmetry of the cation. Crystallography, and in particular neutron diffraction, plays a critical role in establishing precise and accurate structures for Ir and Os oxides and in determining their magnetic structures.

Both Ir and Os form double perovskites of the type A_2YMO_6 , where $A = Ba$ or Sr . Structural studies of solid solutions of the type $Ba_{2-x}Sr_xYMO_6$ demonstrate these two series exhibit the same sequence of structures with the symmetry lowering from cubic to monoclinic associated with increased tilting of the corner sharing octahedra induced by increasing the amount of the smaller Sr cation present. Magnetic susceptibility measurements between 2 and 300 K for the Ir oxides showed no evidence for long range magnetic ordering, an observation that was supported by neutron diffraction measurements, rather strong spin-orbit coupling results in a $J_{eff} = 0$ ground state [1].

Conversely the Os oxides are magnetic. Magnetic susceptibility measurements show a well-defined maximum corresponding to an antiferromagnetic transition for all compositions. The Neel temperature decreases from 74 to 54 K as the Ba content, and hence symmetry, is increased. The observed magnetic moment is insensitive to the precise Ba content but is significantly reduced from that expected a half-filled t_{2g}^3 electron configuration, from 3.87 to $\sim 3.0 \mu_B$ due to the combined effects of spin-orbit coupling and covalency.

The structures and magnetic properties of these and related Ir and Os oxides will be discussed.

[1] Ranjbar, B., Reynolds, E., Kayser, P., Kennedy, B. J., Hester, J. R., and Kimpton, J. A. (2015) *Inorganic Chemistry* 54, 10468.

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