

Unexpected Phase Transitions in AMO₄ scheelites.

Monday, 2 December 2019 14:00 (15 minutes)

The vast majority of solid state oxides contain transition metals in an octahedral, or a distorted variant thereof, environment and the interconnectivity and distortions of the MO₆ units drive their interesting and occasionally technologically important physical properties. Oxides where the transition metal has a tetrahedral geometry are less well studied. The Scheelite structure is one such example and this presentation will describe some of our recent studies on two classes of scheelites; the 3:5 oxides Ln₃Nb₅O₄ and the 1:7 oxides A₁M₇O₄ (A = K, Rb, Cs, Tl; M = Tc, Ru, Re and Os).

The synthesis, structures and magnetic properties of the Ru and Os salts AMO₄ (A = K, Rb and Os) are described. Both K salts adopt the ideal tetragonal Scheelite structure and contain isolated MO₄ tetrahedra. Both show AFM ordering along [001] described by $k = 000$ at low temperature and neutron diffraction measurements reveal a reduced moment ~ 0.5 due to a combination of covalency and spin-orbit coupling. RbOsO₄ displays the same tetragonal structure and is an antiferromagnet with $T_N \sim 20$ K. RbOsO₄ has an orthorhombic structure in Pnma as a consequence of rotations of the OsO₄ and this transforms to the tetragonal structure upon heating above 400 K; both Rb salts are AFM. At room temperature the two Cs salts are both orthorhombic and both undergo additional transitions upon cooling.

Temperature dependent structural studies of ATcO₄ (A = Ag, Tl, Rb and Cs) from 90 K to their melting points reveal unexpected phase transitions in RbTcO₄ that displays a I4₁/a to I4₁/amd transition and in TlTcO₄ where the orthorhombic (Pnma) to tetragonal (I4₁/a) transformation proceeds via an intermediate orthorhombic phase. Like the Ru and Os oxides CsTcO₄ undergoes a first order orthorhombic (Pnma) to tetragonal (I4₁/a) transition upon heating.

Level of Expertise

Experienced Researcher

Do you wish to take part in the poster slam

No

Travel Funding

No

Speakers Gender

Male

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