30 minute talk by Jamie Shaw Stewart:

The relationship between elastic and magnetic property variations through the Verwey transition in Magnetite

ABSTRACT:

The low temperature elastic and magnetic properties of synthetic polycrystalline, multi-domain magnetite have been analysed using Dynamic Mechanical Analysis (DMA), Resonant Ultrasound Spectroscopy (RUS), Multi-function Kappabridge (magnetic susceptibility), and Transmission Electron Microscopic (TEM) techniques of Lorentz Microscopy and Electron Holography. The Verwey transition (T_v ~124ºK) has been observed with all the techniques. The nature of the structural transition has been characterised as pseudo-ferroelastic, due to the rhombohedral strain, with distinct stiffening below T_v, with at least one other order parameter for the transition. A volume strain preceding T_v is observed to increase the magnetocrystalline anisotropy, and cause an isotropic point (T_k ~130ºK) that also appears to affect the elastic properties. The magnetic domain organization is seen to affect the elastic constants above T_v, and reorganization is observed primarily at T_v, not T_k. Preliminary observations of twinning and magnetic domain wall relationships have been made, and basic analysis carried out using micromagnetic modelling simulations.