Poster Presentation

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Effect of doping and defects in pyrochlore compounds

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Interest in compounds that have the Pyrochlore structure (A2B2O7) has resurfaced following the discovery of magnetic monopoles in spin ice (e.g. Ho2Ti2O7 and Dy2Ti2O7), spin-liquid phases (e.g. Tb2Ti2O7), and metal–insulator transitions (e.g. Nd2Ir2O7). Among the known cubic pyrochlore compounds, titanates (RE2Ti2O7) have been extensively studied, however their magnetic properties are highly sensitive to tiny amounts of site mixing or stuffing [1]. For example, in the case of Yb2Ti2O7 the identity of the ground state is highly dependent on the quality of the sample.

To study the effect of doping, we have prepared two sets of titanate pyrochlore single crystals: (i) rare earth element substituted on the titanium site and vice versa; (ii) Sc3+ substituted to the Ti4+ side. In both cases, the pyrochlore structure was stable and a slight variation in the magnetic saturation field was observed. Other possible defect come from the oxygen deficiency which arises due to the reduced oxidation state of A or B sites. For example, in the case of Tb2Ti2O7 system, Tb could be in a mixed valency state (3+ and 2+) which reduces the oxygen stoichiometry in order to balance the charge. In this case a change in colour of the crystal is observed.

In this talk, I will discuss the recent findings on doped and disordered pyrochlore single crystals including titanates [2], stanates [3] and iridates.

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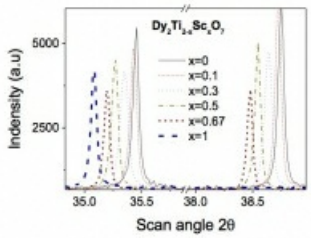
[2] D. Prabhakaran and A.T. Boothroyd, J Crystal Growth 318 (2011) 1053.
[3] D.Prabhakaran, S. Wang and A.T. Boothroyd J Crystal Growth (2017) in press



Powder XRD pattern

As grown and annealed $Tb_2Ti_2O_7$ single crystal

Keywords: Crystal growth, Pyrochlores, Sc doped