

Experimental report

30/09/2016

Proposal: 5-31-2415

Council: 4/2015

Title: Relaxor ferromagnetism in nickel perovskites

Research area: Chemistry

This proposal is a new proposal

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Samples: La₃Ni₂TaO₉
SrLa₂Ni₂WO₉
SrLa₂Ni₂TeO₉
Dy₂CoGe₄O₁₂

Instrument	Requested days	Allocated days	From	To
D2B	3	3	04/12/2015	07/12/2015
D1B	2	2	02/12/2015	04/12/2015

Abstract:

We have previously shown that La₃Ni₂SbO₉ behaves as a relaxor ferromagnet below ~100 K. There are many other A₃B₂MO₉ oxides that do not show this behaviour. We want to understand what features of the crystal structure play a role in determining whether relaxor behaviour is observed, with the eventual aim of producing a compound with a higher transition temperature. We also want to determine what other magnetic behaviours are observed when an A₃B₂MO₉ compound is not a relaxor. We propose to study three A₃B₂MO₉ oxides all with B = Ni and with M = Te, W, or Ta. Our magnetometry experiments suggest that one is a relaxor but the other two are not. We hope to be able to understand this by determining the details of the crystal structures, including the degree of cation ordering. In the case of the two non-relaxors we hope to determine what kind of magnetic ordering, if any, they do show below the transition temperatures that are clearly present in their magnetic susceptibilities.

The following is the abstract of a paper that has been published as *Journal of Solid State Chemistry* **243** 304 – 311 (2016).

Structural Chemistry and Magnetic Properties of the Perovskite $\text{SrLa}_2\text{Ni}_2\text{TeO}_9$

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Abstract

A polycrystalline sample of $\text{SrLa}_2\text{Ni}_2\text{TeO}_9$ has been synthesized using a standard ceramic method and characterized by neutron diffraction, magnetometry and electron microscopy.

The compound adopts a monoclinic, perovskite-like structure with space group $P2_1/n$ and unit cell parameters $a = 5.6008(1)$, $b = 5.5872(1)$, $c = 7.9018(2)$ Å, $\beta = 90.021(6)^\circ$ at room temperature. The two crystallographically-distinct B sites are occupied by Ni^{2+} and Te^{6+} in ratios of 83:17 and 50:50.

Both ac and dc magnetometry suggest that the compound is a spin glass below 35 K but the neutron diffraction data show that some regions of the sample are antiferromagnetic. Electron microscopy revealed twinning on a nanoscale and local variations in composition. These defects are thought to be responsible for the presence of two distinct types of antiferromagnetic ordering.