Experimental Report

Proposal: **5-24-524** **Council:** 10/2012

Title: Neutron powder diffraction study of Sr2CrO4 and Sr3Cr2O7 in the 2-400K temperature range

This proposal is a new proposal

Researh Area: Physics

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Samples: Sr2CrO4
Sr3Cr2O7

Instrument	Req. Days	All. Days	From	To
D1B	3	3	25/03/2013	28/03/2013
D2B	3	2	15/05/2013	17/05/2013

Abstract:

We propose to perform a neutron diffraction study of the Sr3Cr2O7 and Sr2CrO4 high pressure phases using D1B and D2B instruments in the 2-300K and 2-400K ranges respectively in order to:
1) determine for the first time the magnetic structure at low temperature of both compounds
2) determine accurately the evolution of the crystallographic and magnetic structures with temperature and correlate them with our physical measurements.

Experimental report for experiment n°: 5-24-524

Title : Neutron powder diffraction study of Sr2CrO4 and Sr3Cr2O7 in the 2-400K temperature range

Instrument : D1B

Dates of experiment : From : 25/03/2013 To : 28/03/2013

Instrument : D2B

Dates of experiment : From : 15/05/2013 To : 17/05/2013

Experimental Team :	**Institut**
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We successfully synthesized at high pressure – high temperature Sr_2CrO_4 (n=1, Sr214) and $Sr_3Cr_2O_7$ (n=2, Sr327) compounds of the Ruddlesden-Popper series $Sr_{n+1}Cr_nO_{3n+1}$ using our press equipped with toroidal “Conac” anvils at Néel Institute. Our magnetization measurements suggest an AFM ordering below 210K and 320K for Sr327 and Sr214 respectively. Both samples are insulating with a slight anomaly in the transport measurement at the magnetic transition.

By neutron powder diffraction in the 2K-400K range at ILL using D1B and D2B instruments, we observed at low temperature in both Sr214 and Sr327 magnetic peaks (Fig.1a, number in brackets) confirming a long range magnetic ordering, in agreement with Néel temperatures determined on our magnetization measurements. Our magnetic Rietveld refinements show that the magnetic moment of Cr4+ cations in the Sr327 AFM phase lie in the (a,b) plane (Fig.1b).

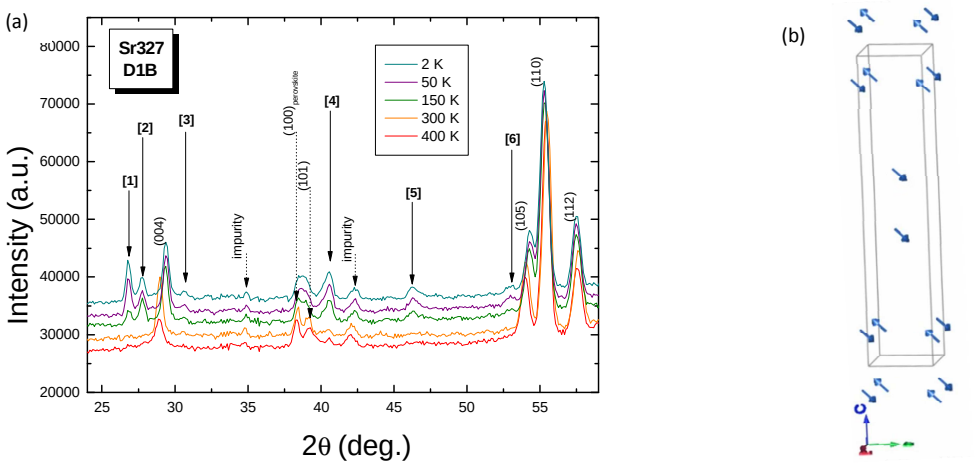

Fig. 1 : (a) Temperature dependence of neutron powder diffraction (D1B) patterns for the $Sr_3Cr_2O_7$ phase (b) refined AFM structure for $Sr_3Cr_2O_7$ at 2 K (blue arrow represents the magnetic moment of the Cr^{4+} cation).

Moreover, in Sr327 we have discovered a huge magneto-elastic coupling (Fig.2a) with a large renormalization of the lattice parameters at $T_{Néel}$=210K (decrease of c/a lattice parameters ratio by 1.7%). In the Sr214 phase such change is not observed at $T_{Néel}$=320K (Fig.2b) but we can note two anomalous changes at 150K and 75K in agreement with the appearance of magnetic peaks. We are currently working on the resolution of the corresponding magnetic structure(s).

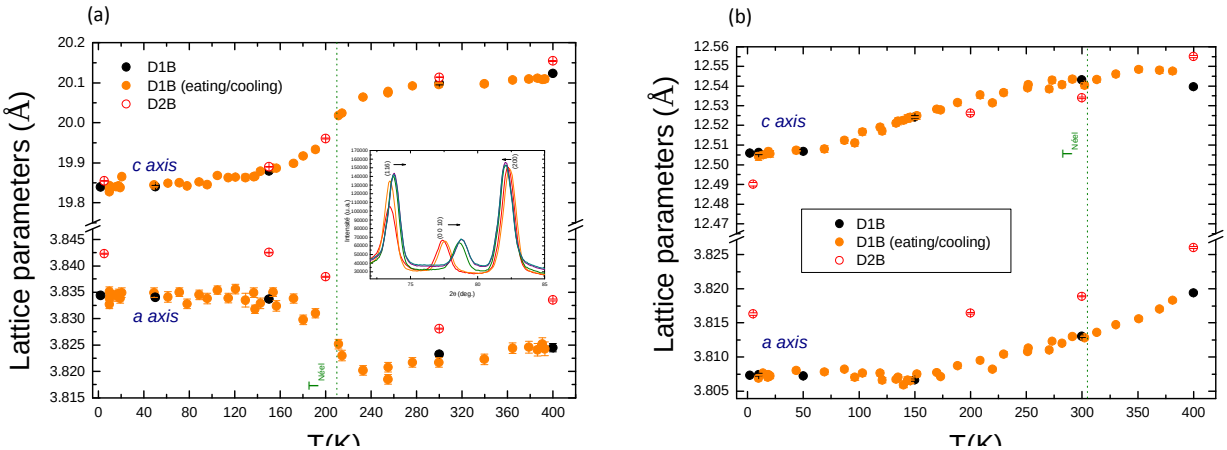

Fig. 2 : Temperature dependence of lattice parameters for (a) the $Sr_3Cr_2O_7$ phase (inset : shift of the Bragg peaks at $T_{Néel}$) and (b) Sr_2CrO_4. The dashed green line indictates the magnetic transition temperature ($T_{Néel}$).