Experimental Report

Proposal: **4-01-1243** **Council:** 10/2012

Title: Magnetic excitations of Sr2-xLaxFeO4

This proposal is a new proposal

Researh Area: Physics

Main proposer: **KOMAREK ALEXANDER CHRISTOPH**

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Samples: Sr2FeO4, Sr1.85La0.15FeO4

Instrument	Req. Days	All. Days	From	To
IN12	4	4	19/07/2013	23/07/2013

Abstract:

Sr2FeO4 is a negative charge transfer compound which is isostructural to the high-temperature superconducting (HTSC) cuprates but much less studied so far. This might be owed to the difficulties of crystal growth of this iron oxide with an unusual Fe4+ oxidation state. Powder neutron diffraction studies report the absence of any magnetic reflections. However, the magnetic susceptibility in the same studies exhibits antiferromagnetic properties of this material. We managed to grow sizeable single crystals of Sr2FeO4 and the charge carrier doped compounds Sr2-xLaxFeO4. Therefore, magnetism could be studied much more precisely by means of single crystal neutron diffraction now. Here, we propose to study the magnetic excitation spectra of at least two layered iron oxides including the tetravalent parent compound Sr2FeO4 and a slightly electron doped compound. We expect to uncover the so far fully unknown spectra of these compounds and to compare the resulting spectra of the electron doped compound with the spectra of isostructural layered transition metal oxides that exhibit a so-called “hour-glass” magnetic excitation spectrum.

Experimental Report

Experimental Team: Z. W. Li, Y. Drees, and W. Schmidt

For similar reasons as in N°-Ex : 5-41-709 the initial composition was, finally, impossible to measure properly. For successful measurement performance, we measured the sample of N°-Ex : DIR-116 and N°-Ex : 7-01-356 and N°-Ex : 4-01-1368 in more detail with polarized neutrons at the IN12 spectrometer.

Our sample was aligned with [100]/[010] orientation in the scattering plane. PG monochromator with double focusing mode and horizontally focusing Heusler analyzer were used for the measurement. The incident neutron beam was polarized with a polarizing cavity. A set-up with Helmholtz coils for linear polarization analysis was installed. The flipping ratio amounts to as high as 17.4. To remove the higher order neutron contaminations, a velocity selector was used (suppression was better than 10^{-4}).

To learn the nature of the incommensurate magnetic peaks, we performed elastic neutron scattering scans across the two satellite magnetic peaks with polarization analysis. The almost same peak intensity for SFzz and SFxx, and the absence of the peak intensity in the SFyy channel indicate that the magnetic moments are in plane in nature. The En-scan shown in **Fig. 1** mesured at the magnetic peak position shows that the magnetic excitations are partially gaped with a very rough gap size of ~2 meV and the polarization analysis shows that the magnetic excitations are mainly in-plane excitations.

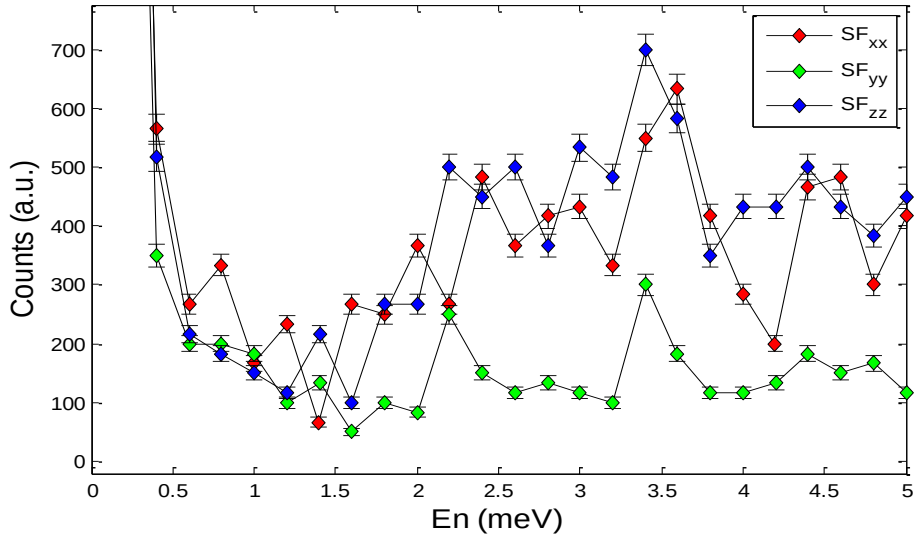

Fig. 1 Energy scans at th incommensurate magnetic peak position with polarization analysis; all spin flip channels (SF) are shown.