Experimental report

15/02/2018

Proposal: **INTER-355** **Council:** 10/2016

Title: Internal time on D4

Research area:

This proposal is a new proposal

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Simon RIBEROLLES

Local contacts: Henry FISCHER

Samples: SrGd2O4
SrNd2O4

Instrument	Requested days	Allocated days	From	To
D4	4	4	05/02/2017	09/02/2017

Abstract:

Experimental report: D4 (Exp. No. INTER-355) Magnetic PDF analysis of the low temperature magnetic correlations of $SrGd_2O_4$, Gd_2O_3 and $SrNd_2O_4$ (Feb. 5th to 9th 2017).

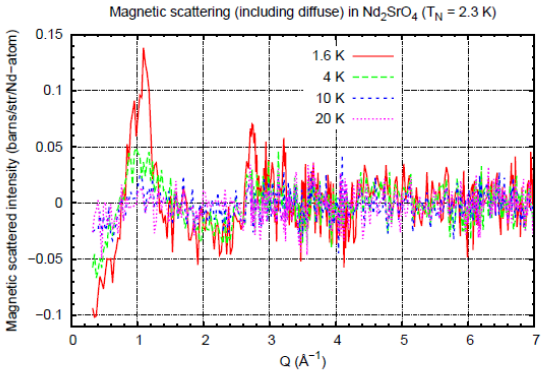
This PND experiment was performed on the D4 hot neutrons diffractometer equipped with a standard orange cryostat. We have measured diffractograms of powder samples of $SrGd_2O_4$ (nat. Gd), $SrGd_2O_4$ (^{160}Gd), $SrNd_2O_4$ and Gd_2O_3 with a monochromatic neutron beam set at 0.5 Å up to large Q values. The temperature evolution of the scattering properties of these materials has been investigated by performing a series of measurements at several temperatures from 50 K to 1.6 K for each samples. The data have then been corrected for absorption and for the presence of small quantities of water present in the polycrystalline samples. For each samples, a high temperature background measured at 50 K was subtracted from the data sets measured at lower temperature in order to isolate the magnetic signal. A clear temperature evolution of the magnetic signal was obtained by plotting the data as a function of Q(Å^{-1}). By Fourrier transforming the signal we have then obtained the temperature evolution of the magnetic PDF signal as a function of r(Å) for the four different samples. The magnetic PDF study of the magnetic correlations present in these materials is currently being carried out employing numerical simulations using the Spinvert software[1].

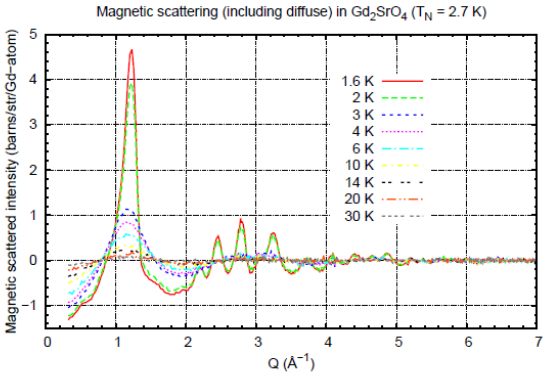
For $SrGd_2O_4$ containing natural Gd, measurements were performed at 1.6, 2.0, 3.0, 4.0, 6.0, 10.0, 14.0, 20.0, 30.0 and 50.0 K, for $SrNd_2O_4$ and for Gd_2O_3 at 1.6, 4.0, 10.0, 20.0 and 50.0 K. The results obtained for $SrGd_2O_4$ containing the ^{160}Gd isotope are similar to the one obtained for $SrGd_2O_4$ containing natural Gd however, the isotopically enriched sample contains approximately 10 % of Gd_2O_3 as an impurity thus only the results obtain for the sample containing natural Gd being of better quality are presented here after.

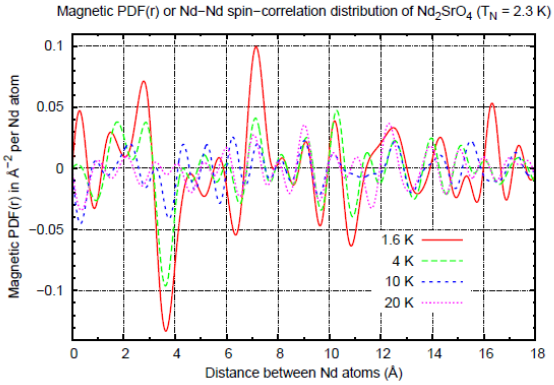
The temperature evolutions of the magnetic signal of these materials are plotted here after as a function of Q(Å^{-1}) and r(Å).

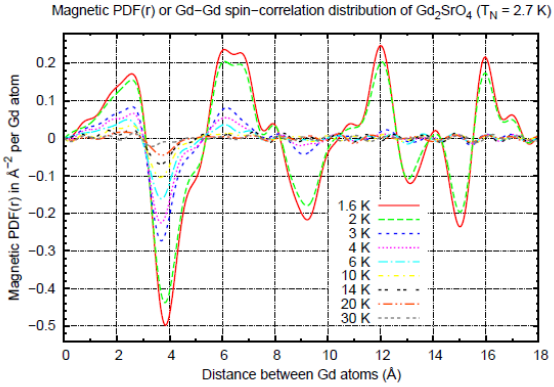
Reference:

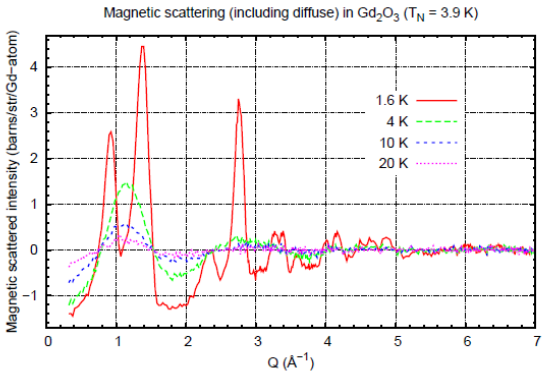
1-SPINVERT: A program for refinement of paramagnetic diffuse scattering data. J Phys: Cond Matt **25**, 454220 (2013)

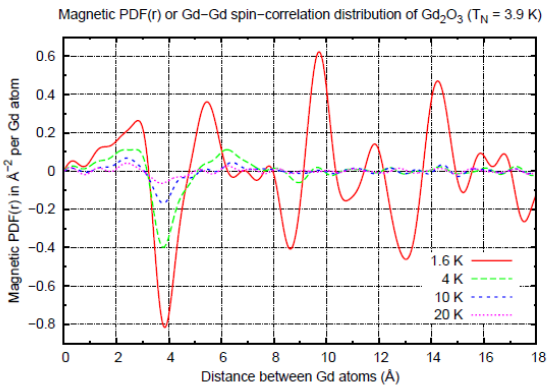

Magnetic scattering (including diffuse) in Nd_2SrO_4 (T_N = 2.3 K)
Magnetic scattered intensity (barns/str/Nd−atom)
Q (Å^{-1})
1.6 K
4 K
10 K
20 K


Magnetic scattering (including diffuse) in Gd_2SrO_4 (T_N = 2.7 K)
Magnetic scattered intensity (barns/str/Gd−atom)
Q (Å^{-1})
1.6 K
2 K
3 K
4 K
6 K
10 K
14 K
20 K
30 K


Magnetic PDF(r) or Nd−Nd spin−correlation distribution of Nd_2SrO_4 (T_N = 2.3 K)
Magnetic PDF(r) in Å^{-2} per Nd atom
Distance between Nd atoms (Å)
1.6 K
4 K
10 K
20 K


Magnetic PDF(r) or Gd−Gd spin−correlation distribution of Gd_2SrO_4 (T_N = 2.7 K)
Magnetic PDF(r) in Å^{-2} per Gd atom
Distance between Gd atoms (Å)
1.6 K
2 K
3 K
4 K
6 K
10 K
14 K
20 K
30 K


Magnetic scattering (including diffuse) in Gd_2O_3 (T_N = 3.9 K)
Magnetic scattered intensity (barns/str/Gd−atom)
Q (Å^{-1})
1.6 K
4 K
10 K
20 K


Magnetic PDF(r) or Gd−Gd spin−correlation distribution of Gd_2O_3 (T_N = 3.9 K)
Magnetic PDF(r) in Å^{-2} per Gd atom
Distance between Gd atoms (Å)
1.6 K
4 K
10 K
20 K