# Experimental report

13/12/2022

**Proposal:** CRG-2501 **Council:** 4/2018

**Title:** 160GdMn2O5 under pressure, a good canditdate for multiferroics

**Research area:**

**This proposal is a new proposal**


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**Samples:** GdMn2O5

| Instrument | Requested days | Allocated days | From | To |
|---|---|---|---|---|
| D1B | 5 | 5 | 06/06/2018 | 11/06/2018 |

**Abstract:**

**Experimental report of Proposal: CRG 25-01**

$RMn_2O_5$ are multiferroic compounds which are promising for applications in data storage. In $TbMn_2O_5$, a strong magneto-electric effect has been evidenced. In this compound, a succession of phase transitions and in particular a spin-induced ferroelectric transition which occurs in a CM magnetic phase with always the same propagation wave vector $q_{CM}$=1/2 0 1/4. The influence of the rare earth on the multiferroic properties is obvious. The role of the $R^{3+}$ size has been emphasized. $GdMn_2O_5$ with intermediate $R^{3+}$ size is at the boundary between ferroelectric and nonferroelectric compounds. This compound is particularly interesting due to its strong electric polarization and its giant tunability (ΔP = 5000 µC/m2) with magnetic field. In addition, the electric polarization is also increased under pressure. In order to investigate a possible phase transition associated with the large magnetoelectric effect under pressure, we would like to study the magnetic ordering of $^{155}GdMn_2O_5$ under pressure and compare the results with other $RMn_2O_5$ compounds such as $TbMn_2O_5$ and $YMn_2O_5$.

The PND experiment was conducted with a wavelength of $\lambda$ = 2.52 Å of D1B on a sample $^{160}$GdMn2O5. We used a Paris-Edinburgh pressure cell with a sample volume of about 50 mm3, with ethanol-methanol as the pressure-transmitting medium to obtain hydrostatic compression up to 10 GPa. Lead (Pb) was placed inside the anvil cell enabling pressure estimation using a Pb diffraction pattern combined with its equation of state. We obtained a very good result showed in figure 1. The magnetic structure at the propagation wave vector $q_{CM}$ is thus replaced under pressure by a PCM (1/2 0 ½) magnetic order. The refinement of the nuclear and magnetic structures were carried out using the FULLPROF program. A paper as been published : W. Peng, V. Balédent, C. V. Colin, T. C. Hansen, M. Greenblatt, and P. Foury-Leylekian, Phys. Rev. B 99, 245109 (2019)

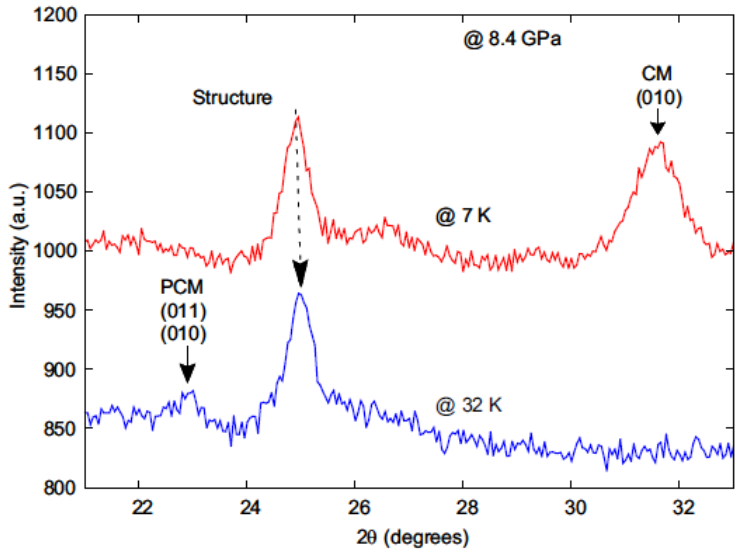


Figure 1 : Temperature evolution of the main reflections of the CM: (010) and PCM: (010) & (011) phases at 8.4 GPa.