ESRF	**Experiment title:** Polarized XAS and XMCD study of the pressure induced magnetoelectric phase transitions on multifferoic $TbMnO_3$	**Experiment number**: HC1594
Beamline:	**Date of experiment**: from: 22/04/2015 to: 28/04/2015	**Date of report**: 11/09/2015
Shifts:	**Local contact(s)**: Vera Cuartero	*Received at ESRF:*

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Report:

The application of high pressure on $TbMnO_3$ recently opened a breakthrough on the field of multiferroic magnetoelectric materials, showing magnetic ordering and a spontaneus electric polarization of the order of standard ferroelectrics for the first time [1].

Our aim with this experiment was to fully describe for the first time the local environment around Mn and Tb ions through the high pressure and low temperature magnetoelectric transition newly found on $TbMnO_3$[1]. EXAFS will provide information on the local distortions and fluctuations which will allow us to describe the ferrodistortive transition at the atomic-scale. In adittion, chemical selective magnetometry measurements (XMCD) will be carried out to track Tb magnetic ordering onset with temperature under pressure, separated from Mn contribution.

To achieve this, the section selected in red on the phase diagram needs to be fully explored.

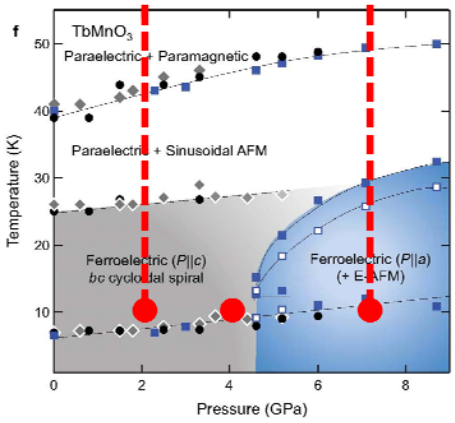

Fig. 1. Temperature/Pressure phase diagram of $TbMnO_3$.

Despite we managed to get XMCD spectra at TbL_3 edge at low temperature and high pressure, as demonstrated in figure 2, the cryostat showed a leak on the circuit of liquid He, which not possible to repair before the end of the beamtime. Therefore, we were not able to complete our working program due to a technical failure.

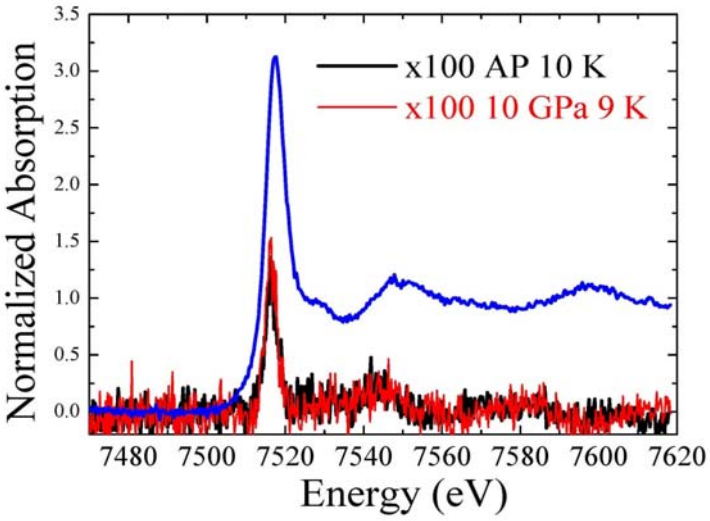

Fig. 2. XAS and XMCD spectra of $TbMnO_3$ powder at ambient pressure and 10 GPa at 10 K.

Nevertheless, the feseability of these measurements encourage us for doing a next try when a new cryostat fully performing will be available.

[1] T. Aoyama, et al., Nature Comm **5** 4927 (2014)