ESRF	**Experiment title:** **Correlations between local structure and enhanced magnetism in off-stoichiometric polycrystalline Y3Fe5O12 thin films**	**Experiment number:** **08-01-727**
Beamline: BM08	**Date of experiment:** from: 11/12/2006 to: 15/12/2006	**Date of report:** 23/08/2008
Shifts: 9	**Local contact(s):** Dr Fabrizio BARDELLI	*Received at ESRF:*

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Report:

The target of the project was to correlate the macroscopic properties (stoichiometry and magnetization) of Yttrium Iron Garnet ($Y_3Fe_5O_{12}$ or YIG) with the microscopic structural ones and the dependence of specimen local structure from growth conditions. In particular the goal was the investigation of the oxidation state and the local symmetry of iron atoms in YIG films obtained at different values of the oxygen pressure (PO_2) and explain the peculiar magnetic properties exhibited by these YIG samples. Moreover the experimental confirmation of the presence of 2+ and 4+ valence states for the iron cations in YIG would have given insight into acceptor/donor levels, with potential interest for "spintronic" applications.

The specific aim of the experiment was twofold:

1) Investigation of the iron atoms' average oxidation state as a function of PO_2 from the analysis of XANES spectra at the Fe-K absorption threshold. We expect a clear shift of the edge value that could indicate the presence of Fe^{2+}, in samples with oxygen vacancies, and Fe^{4+}, in iron deficient specimens, as forecast by the standard ionic model. In principle, a comparison between experimental and simulated XANES could also point to a possible preferential occupation of tetrahedral or octahedral sites for the Fe^{2+} and Fe^{4+} cations.
2) Determination of the YIG local structure by EXAFS at the Fe-K absorption threshold in order to study the evolution of oxygen and iron vacancies' distribution as a function of PO_2; in the latter case, also the relative distribution among tetrahedral and octahedral sites will be investigated. Besides, a sizeable trend in the value of all interatomic distances is expected and could explain changes in Tc.

Unfortunately the comparison of the Fe EXAFS spectra at the K edge didn't show significant differences neither for the point 1) nor 2) so that we can conclude that the induced valence and structural modifications, if any are beyond the experimental sensitivity of the measurements.