SPIN STATE EVOLUTION OF TRANSITION METALS IN THE CO DOPED MANGANESE PEROVSKITES

M. Sikora [1,2], K. Knizek [3], Cz. Kapusta [2], Z. Jirak [3], V. Prochazka [4], D. Rybicki [2], P. Glatzel [1]

[1] *European Synchrotron Radiation Facility (ESRF), BP220, F-38043 Grenoble Cedex, France*

[2] *Solid State Physics Department, Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, Av. Mickiewicza 30, 30-059 Cracow, Poland*

[3] *Institute of Physics, Cukrovarnická 10, 162 53 Prague 6, Czech Republic*

[4] *Faculty of Mathematics and Physics, Charles University, V Holešovičkách 2, 180 00 Prague 8, Czech Republic*

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**) e-mail: sikora@esrf.fr*

The solid solution system $LaMn_{1-x}Co_xO_3$ reveals ferromagnetic interactions that are dominating for intermediate values of x, which is in contrast to the behavior of the end members that are either antiferromagnetic, $LaMnO_3$, or diamagnetic, $LaCoO_3$. The net magnetic moment possibly arises from a complex set of oxygen mediated Mn-Co interactions. Among them the ferromagnetic Mn^{3+}-O-Mn^{4+}, Mn^{3+}-O-Mn^{3+}, Co^{2+}-O-Mn^{4+} and antiferromagnetic Mn^{4+}-O-Mn^{4+}, Co^{2+}-O-Co^{2+}, Mn^{3+}-O-Co^{2+} superexchange interactions are most likely.

In order to determine, which of the mentioned interactions dominates the properties of the series the study of effective charge and spin state of manganese and cobalt have been performed by means of high resolution X-ray K_β emission and fluorescence detected K-edge absorption spectroscopy (XANES).

The absorption spectra recorded at the Mn K-edge reveal a gradual shift to higher energy with simultanous decrease of the first moment of the K_β emission line with increasing Co content. The evolution is more pronounced for compounds with higher manganese content.

Also the Co K-edge absorption spectra shift to higher energies with increasing Co content, while the emission spectra of Co reveal a distinct K_β' (low-energy satellite) feature, characteristic for high spin configurations. This is especially pronounced at low Co content.

The observed effects are unambiguously attributed to a charge transfer from Mn to Co sites accompanied by a change of the spin state of the cobalt ions. The relation between bulk magnetic properties and effective spin moments of Mn and Co, derived from combined analysis of the absorption and emission data, is discussed.