LOCAL STRUCTURE OF Mn IN $(La_{1-x}Ho_x)_{2/3}Ca_{1/3}MnO_3$ USING X-RAY ABSORPTION FINE STRUCTURE

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Manganese perovskite-based oxides have attracted a renewed interest due to their unusual colossal magnetoresistance CMR. They exhibit a great variety of magnetic and transport properties that strongly depend on the stoichiometry and the structure of the materials.

The $La_{1-x}Ca_xMnO_3$ is one of the most thoroughly studied manganites. The pure compounds like $LaMnO_3$ and $CaMnO_3$ are antiferromagnetic insulators. When $LaMnO_3$ is doped with a divalent element such as Ca^{2+}, substituting for La^{3+}, holes are introduced in the filled Mn *d* orbitals, which leads to strong ferromagnetic coupling between Mn sites. Ca ions in $La_{1-x}Ca_xMnO_3$ introduce crystal lattice distortion and mixed valence Mn ions (Mn^{3+} and Mn^{4+}). Compounds in the doping range $0.2<x<0.5$ show both ferromagnetic and metallic behavior, together with colossal magnetoresistance effect near the Curie temperature. The highest value of T_C = 270 K has been obtained for $La_{2/3}Ca_{1/3}MnO_3$ [1].

In this study we present results of the X-ray Absorption Fine Structure (XAFS) measurements in manganites $(La_{1-x}Ho_x)_{2/3}Ca_{1/3}MnO_3$ in the doping range $0.15<x<0.50$. Substitution of La for Ho without varying the proportion of Mn^{3+} to Mn^{4+} changes the local lattice distortion due to a difference in atomic size which alters the Curie temperature. This deformation influences the Mn-O-Mn angle, which is the parameter that determines the magnetic and transport properties in these compounds. Thus, the determination of the local atomic structure around Mn ions plays a crucial role in understanding of the Ho doping effect.

Manganese K-edge absorption has been measured by the transition method at HASYLAB synchrotron facility in Hamburg (E4 beamline). EXAFS data analysis provides information on the local structure around Mn (the bond lengths, the coordination numbers and Debye-Waller factor). The charge state of Mn is determined from the XANES data. Also an attempt to find the Mn-O-Mn angle is made. XAFS results are in good agreement with the magnetic characteristics of the studied materials.

References

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