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Hopping conduction and spin glass behavior of $\text{La}_2\text{FeMnO}_6$

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ABSTRACT

We report the existence of a charge localized state in a distorted, low-temperature phase of the perovskite $\text{La}_2\text{FeMnO}_6$ below a charge localization temperature (T_{CL}) ~ 133 K, from the detailed analysis of dc resistivity, supported by magnetic and specific heat capacity measurements. We observe that variable range hopping conduction is active below T_{CL} while small polaron hopping conduction governs dc transport both above and below T_{CL} , however with different activation energies. Evidence for the presence of Fe^{2+} is obtained from the X-ray photoelectron spectroscopic analysis, along with Fe^{3+} , Mn^{3+} , and Mn^{4+} ions which eventually result in various types of magnetic exchange interactions within the system. As a result, $\text{La}_2\text{FeMnO}_6$ exhibits a spin glass state, which is confirmed by ac susceptibility measurements, zero-field cooled memory and aging tests.

Keywords: Double perovskite; Spin glass; Memory and aging; $\text{La}_2\text{FeMnO}_6$

1 Introduction

The magnetism in transition element (TM) oxides greatly depends on the local electronic configuration of each TM cation. The exchange interaction between the TM cations mediated by the oxygen anion introduces complex magnetism in $\text{A}_2\text{BB}'\text{O}_6$ (A=Alkaline-earth/rare-earth elements, B&B'=TM elements) type double perovskites when

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