9.7 cm

QUANTITATIVE EXPLANATION OF THE TEMPERATURE DEPENDENCE OF ELECTRICAL CONDUCTIVITY IN $La_{1/3}Nd_{1/3}Ca_{1/3}MnO_3$ PEROVSKITE

J. Baszyński, T Toliński, B. Idzikowski

Institute of Molecular Physics, PAS, Smoluchowskiego 17, 60-179 Poznań, Poland

The temperature dependence of the resistivity, magnetoresistance and magnetic structures has been measured on single-phase $La_{1/3}Nd_{1/3}Ca_{1/3}MnO_3$ ceramic samples in the temperature range from LHe up to RT. The resistivity shows activated insulating behavior above the T_C and a transition to metallic behavior around a characteristic temperature T_{tr}, 15 K below T_C. On the basis of the neutron diffraction results we model the conductive properties as regions: coexistance of the para- and antiferromagnetic structure (semiconductivity) at high temperature and coexistance of ferro- and antiferromagnetic domains (metallic) at low temperatures. Around T_{tr} we are considering a model with coexisting metallic and non-metallic phases. It has been shown that T_{tr} marks the temperature at which the metallic volume fraction V_m reaches about 80% as a result of progressive increasing of the ferromagnetic domains. It is shown that the electrical conductivity can be explained quantitatively for the whole temperature and magnetic field range studied. The transport behavior is shown to be consistent with the predictions for charge transport by conventional small polaron hopping in the paramagnetic phase and due to scattering by static disorder and first-second-order magnon processes in the ferromagnetic phase.

13.4 cm

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Corresponding author :
J. Baszyński

Address for correspondence :
Institute of Molecular Physics, PAS
Smoluchowskiego 17, 60-179 Poznań
Poland

Email address :
jbasz@ifmpan.poznan.pl