ON THE STRENGTH OF THE DOUBLE EXCHANGE AND SUPEREXCHANGE INTERACTIONS IN $La_{0.67}Ca_{0.33}Mn_{1-y}Fe_yO_3$ - AN NMR AND MÖSSBAUER STUDY

J. Przewoźnik[a], Cz. Kapusta[a], J. Żukrowski[a], K. Krop[a], M. Sikora[a], D. Rybicki[a], D. Zając[a], B. Sobanek[a], C. J. Oates[a], P. C. Riedi[b]

[a]Faculty of Physics and Applied Computer Science, AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Cracow, Poland

[b]Department of Physics and Astronomy, University of St. Andrews, St. Andrews KY 16 9SS Scotland, United Kingdom

9.7 cm

A combined study of $La_{0.67}Ca_{0.33}Mn_{0.97}{}^{57}Fe_{0.03}O_3$ compound by means of zero field ^{55}Mn and ^{57}Fe NMR as well as ^{57}Fe Mössbauer spectroscopy (MS) is reported. The ^{55}Mn NMR spectra exhibit a single double exchange line up to the magnetic ordering temperature, 200 K, determined from magnetization measurements. The hyperfine field (HFF) remains finite at the magnetic ordering temperature, which reveals discontinuous character of the transition and the occurrence of a ferromagnetic - paramagnetic phase segregation. The Mössbauer ^{57}Fe HFF decreases much faster with increasing temperature than the Mn HFF, which indicates a much lower strength of magnetic interaction of the Fe moments. Application of a molecular field model to the temperature dependence of the Mn and Fe HFF provides values of the Mn-Mn and the Fe-Mn exchange integrals, which amount to 1.24(2) meV and -0.62 meV, respectively. In addition, the Curie temperatures $T_C{}^*$ of ferromagnetic metallic clusters were derived as 297(4) K for the Fe doped and 344(5) K for the undoped compounds. Such values are considerably higher than T_C originally obtained from magnetization measurements.

13.4 cm

Subject category :

3. Transition Metals, Alloys and Compounds

Presentation mode :
oral

Corresponding author :
J. Przewoźnik

Address for correspondence :
al. Mickiewicza 30, 30-059 Kraków

Email address :
januszp@uci.agh.edu.pl