Таблица 2

Значения изотропных и анизотропных компонент локального поля на ядрах Cr^{3+} (B), кЭ

Первая B-сфера	c	Δ	d	h
$2Li^+-4Fe^{3+}$	−311,16	−0,62	4,39	5,02
$2Li^+-3Fe^{3+}-Cr^{3+}$	−310,96	−0,62	5,02	7,68

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A.A. Shemyakov

HYPERFINE INTERACTIONS AT CHROMIUM NUCLEI IN $Li_{0,5}Fe_{2,37}Cr_{0,13}O_4$ FERRITE

Cr^{3+} (B) NMR spectra in monocrystalline sample of $Li_{0,5}Fe_{2,37}Cr_{0,13}O_4$ ferrite at 4,2 K were measured. The isotropic and anisotropic components of local fields were defined at chromium nuclei non-equivalent by neighboring octahedral surroundings. A value of indirect hyperfine field created by chromium ions was found.

Fig. 1. Fe^{3+} NMR spectra in $Li_{0,5}Fe_{2,5}O_4$ (*a*) and $Li_{0,5}Fe_{2,37}Cr_{0,13}O_4$ (*б*)

Fig. 2. Cr^{3+} (B) NMR spectrum in $Li_{0,5}Fe_{2,37}Cr_{0,13}O_4$

M.M. Savosta[1], V.A. Borodin[1], P. Novák[2], Z. Jirák[2], J. Hejtmánek[2], M. Maryško[2]

CHARACTER OF CHARGE CARRIERS AND NATURE OF MAGNETIC PHASE TRANSITION IN MIXED-VALENCE FERROMAGNETIC MANGANITES: NMR STUDY (ABSTRACT)

[1]Donetsk Institute of Physics & Technics, the Academy of Sciences of Ukraine, 72 Roza Luxembourg St., 340114 Donetsk, Ukraine

[2]Institute of Physics, Academy of Sciences of the Czech Republic, Cukrovarnická 10, 162 00 Praha 6, Czech Republic

Recently, a lot of attention was given to mixed-valence manganese perovskites because of a close connection between their magnetic and transport properties and, in particular, because of the presence of the colossal magnetoresistance near the magnetic phase transition temperature,

which has a maximum for samples containing ~ 30% of tetravalent Mn. A number of papers appeared recently in which this behavior was studied. At the same time the nature of the magnetic transition is far from being clear. Of particular interest is the character of charge carriers in these compounds. Nuclear magnetic resonance can show unambiguously whether they are localized or delocalized and in a favourable situation NMR may be used to study the transition between the localized and delocalized behavior. Until now only a few measurements of ^{55}Mn NMR in the manganite perovskites at low temperatures were reported [1–3]. These compounds were found to be metallic for the content of Mn^{4+} ions of 20–40% and a single NMR line was observed. It is believed that this line is caused by a motional narrowing – the electron holes hop over the manganese sites with a frequency much higher than the NMR frequency and, as a result, all the ^{55}Mn nuclei feel the same average hyperfine field.

In our recent papers [4,5] the temperature dependence of ^{55}Mn NMR in several ferromagnetic manganites was reported. In one of them, namely, $Pr_{0.7}Ba_{0.3}MnO_3$, the lines corresponding to Mn^{3+} and Mn^{4+} ions (localized holes or holes with $f_{hop} < f_{res}$), were detected at 77 K. It is to be noted that this is the first case where the NMR spectrum differs from the motionally narrowed line in a manganite containing such a large concentration of Mn^{4+} ions. In this compound the increase of temperature leads to an increased rate of electron holes hopping. As a consequence, the motional narrowing of the NMR spectrum is observed resulting in a single line for $T > 140$ K. The temperature dependence of the NMR frequency in $La_{1-x}Na_xMnO_3$ ($x = 0.1, 0.15, 0.2$), $Pr_{0.7}Ba_{0.3}MnO_3$ and $Pr_{0.7}Ca_{0.15}Sr_{0.15}MnO_3$ ferromagnetic perovskites is compared with that of the magnetic moment determined from the measurements by the SQUID magnetometer. In the region close to T_C, the NMR relaxation rate is also determined. From the results it follows that the phase transition is continuous in (La, Na) system, independent of the Na concentration, while it is of the first order in (PrBa) and (Pr, Ca, Sr) compounds, despite the continuos character of $M(T)$. The continuity of the $M(T)$ dependence is the consequence of the decrease of the ferromagnetic phase volume with increasing temperature in (Pr, Ba) and (Pr, Ca, Sr) compounds. In this situation NMR is a unique tool to ascertain the type of the phase transition. Hwang et al. [6] constructed a phase diagram in which the dependence of the magnetic transition temperature on the tolerance factor $t = \left(d_{A-O}\right)\big/\sqrt{2\left(d_{Mn-O}\right)}$ was established for a number of $AMnO_3$ manganites, with fixed Mn^{4+} concentration of 30%. The change of the Mn–O–Mn bond angle was proposed as the main reason for the variation of the transition temperature for $t < 0.93$. Our results suggest that the reason for the decrease of the transition temperature in (Pr, Ca, Sr) compound ($T_t = 180$ K, $t = 0.914$) and (Pr, Ba) compound ($T_t = 175$ K, $t = 0.938$) relative to (La, Na) compound ($T_t = 315$ K, $t = 0.921$) is the change of the nature of the phase transition connected with the distortions in the lattice (Pr, Ca, Sr) or with the disorder at the sublattice of A-ions (Pr, Ba), though the change of the bond angle may also play a part.

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