Muon spin rotation measured internal field in the magnetic ordered state of $SrRuO_3$

P.W. Klamut[1], D. Eshchenko[2], R. Khasanov[2], A. Shengelaya[3], I. Savic[4], D. DiCastro[5,6], G. Cao[7], Ch. Niedermayer[2], J.B. Budnick[8], H. Keller[5]

[1] *Institute of Low Temperature and Structure Research of the Polish Academy of Sciences, Okólna 2, 50-422 Wrocław, Poland*
[2] *Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland*
[3] *Physics Institute of Tbilisi State University, Chavchavadze 3, GE-0128 Tbilisi, Georgia*
[4] *Faculty of Physics, University of Belgrade, 11001 Belgrade, Serbia and Montenegro*
[5] *Physik-Institut der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland*
[6] *"Coherentia" CNR-INFM and Dipartimento di Fisica, Universita' di Roma "La Sapienza", P.le A. Moro 2, I-00185 Roma, Italy*
[7] *Department of Physics and Astronomy, University of Kentucky, Lexington, KY 40506, USA*
[8] *Department of Physics, University of Connecticut, 2152 Hillside Road, CT 06269-3046, USA*

We report results of investigation of the magnetically ordered state in $SrRuO_3$ single crystals and some comparable μSR data for the $Sr_{1-x}Ca_xRuO_3$ and $Sr_{0.9}(Na_{0.5}La_{0.5})_{0.1}RuO_3$ polycrystalline samples. $SrRuO_3$ is an itinerant ferromagnet with T_C ≈163 K, which crystallizes in the orthorhombically distorted perovskite structure. The ferromagnetic properties are tied to $d$electrons in the band formed by overlapping Ru and O orbitals, the itinerant character of magnetism being well founded experimentally. For the $SrRuO_3$ crystals two branches of the internal field temperature dependence, corresponding to different frequencies of spontaneous precession of muon spins, are present at lower temperatures. Whereas the precession at lower frequency follows to the T_C, there is a rapid cut-off in the higher frequency branch observed at 110 K, within magnetically ordered phase. Asymmetry factors did not support spatial separation to magnetically non-equivalent volumes in the crystal. Two different frequencies would usually reflect nonequivalent muon stopping sites with corresponding muons experiencing different local field from neighboring local magnetic moments. We note a partial transfer of the magnetic moment toward the oxygen orbitals was found in [1]. After the neutron diffraction analysis we note the bond lengths did not reveal particular changes at $0 \leq T < T_C$ [2],and an anomalous flattening of the lattice parameters at low temperatures was associated with blocking of the RuO_6 octahedral tilt in magnetically ordered state [3]. There estimated volume magnetostriction seems anomalous at the similar temperature of approximately 110 K [3].

The spectra of polycrystalline samples, for small doping at Sr site, are consistently resolved with two frequency components in comparable range of temperatures.

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