Magnetic Ground State of RuO_2 Inferred From μSR

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Rutile RuO_2 has long been regarded as a Pauli paramagnetic metal, but recent neutron diffraction and resonant X-ray scattering experiments have suggested the presence of an antiferromagnetic (AFM) order with a high Neel temperature (> 300 K) [1, 2]. However, the reported Ru magnetic moment ~0.05μ_B is close to the detection limit in these measurements, necessitating verification by other experimental techniques. Thus, we investigated the magnetic ground state of a high-quality RuO_2 single crystal (residual resistivity ratio RRR > 1500) using muon spin rotation and relaxation (μSR) technique.

We found no clear evidence of quasi-static AFM order from 5 K to 400 K, as shown in Fig. 1 [3]. Our DFT calculations using dilute hydrogen simulating muon as pseudohydrogen ruled out the possibility for muons to occupy sites where the internal magnetic field accidentally cancels out for the reported AFM structure. Thus, we concluded that the AFM order reported in previous studies is unlikely to exist in the bulk crystal. In the presentation, we will also discuss simulation results of the internal magnetic field at the muon site and the upper limit of the Ru moment size.

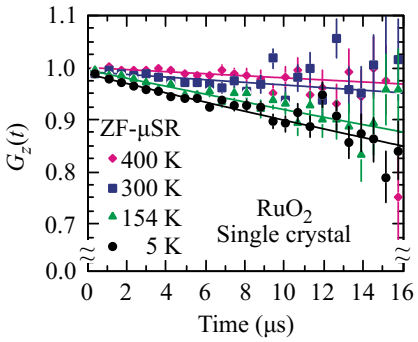

Fig. 1 Zero field μSR time spectra of RuO_2.

References

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