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Spin-singlet dimerization in La 2RuO 5 investigated using magnetic susceptibility and specific heat measurements

Riegg S., Günther A., Von Nidda H., Loidl A., Eremin M., Reller A., Ebbinghaus S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The origin of spin-dimerization and concomitant spin-gap opening in the triclinic phase of poly- and single-crystalline La 2RuO 5 at unusually high temperatures was investigated using magnetic susceptibility and specific-heat measurements. From the low-temperature crystal structure the formation of antiferromagnetically coupled Ru4 + (S=1) dimers within the quasi-two-dimensional magnetic system can be deduced, resulting in a nonmagnetic singlet state. It was found that the antiferromagnetic coupling within the dimers is much stronger than the interaction with neighboring dimers. La 2RuO 5 exhibits a step-like change in the magnetic susceptibility at 161 K, indicating a first-order transition of combined magnetic and structural character. The size of the spin-gap has been estimated from the thermally activated behavior in the low-temperature dimerized phase and was found to be significantly different in the polycrystalline sample when compared to the results obtained from the single crystals. The magnetic entropy obtained from specific-heat measurements amounts to roughly 0.5Rln(3), reflecting solely the contribution of spin degrees of freedom to the entropy change during the phase transition. © 2012 American Physical Society.

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