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Electron spin resonance and exchange paths in the orthorhombic dimer system Sr2VO4

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Abstract

We report on susceptibility and electron spin resonance (ESR) measurements at X- and Q-band frequencies of Sr2VO4 with orthorhombic symmetry. In this dimer system, the V4+ ions are in tetrahedral environment and are coupled by an antiferromagnetic intradimer exchange constant J/kB≈ 100 K to form a singlet ground state without any phase transitions between room temperature and 2 K. Based on an extended Hückel tight-binding analysis, we identify the strongest exchange interaction to occur between two inequivalent vanadium sites via two intermediate oxygen ions. The ESR absorption spectra can be well fitted by a single Lorentzian line and the temperature dependence of the ESR intensity, and the dc susceptibility can be modeled by using the Bleaney-Bowers approach for independent dimers. The temperature dependence of the ESR linewidth at X-band frequency can be modeled by a superposition of a linear increase with temperature with a slope α =1.35 Oe/K and a thermally activated behavior with an activation energy Δ/kB =1418 K, both of which point to spin-phonon coupling as the dominant relaxation mechanism in this compound.

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