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Coherent spin manipulations in Yb³⁺: CaWO₄ at X - And W -band EPR frequencies

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Abstract

Coherent spin dynamics of impurity Yb³⁺ ions in the CaWO₄ single crystal has been studied using X - and W -band EPR. Rabi oscillations of the sample magnetization with damping times comparable to their period, driven by pulses of the microwave field with duration up to 5 μs, were observed. The largest value of the single-qubit figure of merit (~6400) is obtained for the high-field component in the Y 171 b X -band EPR spectrum. The spin-lattice relaxation time of the Yb³⁺ ions shortens with the increasing resonance frequency while the phase memory time, in contrast, grows noticeably. Variations of the phase memory times are interpreted in terms of spectral and instantaneous diffusions. The increase of the coherence time at the W band can be used for the application of rare-earth ions as qubits in quantum computing as it has been proposed recently. © 2009 The American Physical Society.

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