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Energy relaxation between low lying tunnel split spin-states of the single molecule magnet Ni$_4$ G. DE LOUBENS, G. D. CHAVES-O'FLYNN, A. D. KENT, Department of Physics, NYU, C. RAMSEY, E. DEL BARCO, Physics Deparment, UCF, C. BEEDLE, D. N. HENDRICKSON, Department of Chemistry and Biochemistry, UCSD — We have developed integrated magnetic sensors to study quantum tunneling of magnetization (QTM) in single molecule magnet (SMMs) single crystals. These sensors incorporate a microstrip resonator (30 GHz) and a micro-Hall effect magnetometer. They have been used to investigate the relaxation rates between the 2 lowest lying tunnel split spin-states of the SMM Ni$_4$ ($S = 4$). EPR spectroscopy at 30 GHz and 0.4 K and concurrent magnetization measurements of several Ni$_4$ single crystals are presented. EPR enables measurement of the energy splitting between the 2 lowest lying superposition states as a function of the longitudinal and transverse fields. The energy relaxation rate is determined in two ways. First, in cw microwave experiments the change in spin-population together with the microwave absorption directly gives the relaxation time from energy conservation in steady-state. Second, direct time-resolved measurements of the magnetization with pulsed microwave radiation have been performed. The relaxation time is found to vary by several orders of magnitude in different crystals, from a few seconds down to smaller than 100 μs. We discuss this and the form of the relaxation found for different crystals and pulse conditions.

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