High Frequency Electron Paramagnetic Resonance Studies of High Spin Co(II) Complexes

JON LAWRENCE, University of Florida, Physics Dept., CHRIS BEEDLE, EN-CHE YANG, JAMES MA, University of California at San Diego, Chemistry Dept., STEPHEN HILL, University of Florida, Physics Dept., DAVID HENDRICKSON, University of California at San Diego, Chemistry Dept. — Variable-High-Frequency Electron Paramagnetic Resonance (HFEPRe) data have been collected for single crystals of \([\text{Zn(hmp)}(\text{dmb})\text{Cl}_4](1)\) doped with a small quantity of high-spin Co(II), and an isostructural tetranuclear cobalt complex \([\text{Co}^{II}(\text{hmp})(\text{dmb})\text{Cl}_4](2)\). Crystals of complex 2 exhibit low temperature hysteresis, suggesting that it may be a single molecule magnet (SMM).\(^1\) However, HFEPRe data for complex 2 cannot be fit to a standard Giant Spin model, as is routinely the case for other SMMs. HFEPRe data obtained for complex 1 indicate that the ground state of the Co\(^{II}\) ions is an effective spin \(S' = \frac{1}{2}\) Kramers’ doublet with a highly anisotropic \(g\)-tensor. The anisotropy is of the easy-axis type, with the individual easy axis directions tilted away from the crystallographic \(c\) direction by \(58^\circ\). We will attempt to rationalize the EPR spectrum obtained for complex 2 (as well as its possible SMM behavior) in terms of a simple model involving anisotropic exchange coupling between four effective spin \(S' = \frac{1}{2}\) Co\(^{II}\) ions, with the local anisotropy entering only through the anisotropic \(g\)-tensor at each Co\(^{II}\) site. \(^1\) E.-C. Yang, J. Appl. Phys. \textbf{91}, 7382 (2002).