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Molecular Magnetism – Magnetic Exchange Coupling of Octahedral Cobalt(II) Ions

Molecular nanomagnets have been studied intensively during the past 20 years and are still of growing interest towards the development of molecular magnetic storage devices, magnetic refrigeration and quantum information processing. A particularly important property to achieve a magnetic memory effect is a large axial magnetic anisotropy. One possibility to increase magnetic anisotropy is the use of magnetic ions with a unquenched orbital angular momentum such as octahedral cobalt(II). Spin-orbit coupling leads to a large effective splitting in zero-field, but a simplistic spin-only interpretation of magnetic exchange interaction is not sufficient any longer, and very little is understood on the exchange coupling of cobalt(II) ions. A series of dimetallic cobalt(II) compounds, both ferro- and antiferromagnetically coupled, has been studied with various techniques on powder and single crystal samples. Detailed experiments including magnetic measurements, multifrequency EPR spectroscopy and inelastic neutron scattering, which provide information about the splitting in zero-field, and the effective "g-value" of the dimetallics, will be a major step towards the development of a theoretical model that describes the coupling within cobalt(II) oligomers. One experimental example is show below: The paramagnetic ground state of the cobalt (II) dimetallic $[Co_2(H_2O)(O_2C^tBu)_2(HO_2C^tBu)_2(py)_2]$ (structure in R.E.P. Winpenny et al, *Chem. Eur. J.* 9, 5142 (2003)) leads to unusually rich multifrequency EPR spectra.

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