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Enhancing magnetic properties of cyanide based molecular magnetic materials: The role of single ion anisotrop

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Single Molecule Magnets (SMMs) are a remarkable class of molecules that display magnetic bistability of a molecular origin which arises from the combination of a high ground state electron spin (S) and a large negative zero-field splitting |D|. This magnetic bistability provides an excellent potential for molecular spintronics.

A major focus in this field is to increase the barrier to the reversal of the magnetization by tuning the anisotropy parameters and ground state spin value in order to increase the blocking temperature T_b to a range suitable for applications. Much attention has been recently directed at complexes containing heavier transition metal ions for their high spin orbit coupling terms as well as diffuse d orbitals which provide better overlap with cyanide orbitals, leading to large exchange constants |J|. In this vein, our group has previously reported a highly anisotropic building block [Re^{II}(triphos)$(CN)_3$]- (triphos = 1,1,1-tris(diphenylphosphino-methyl)ethane)) that was incorporated in a family of molecular cubes [Re^{II}(triphos)$(CN)_3]_4[M^{II}Cl]_4$ (M = Mn, Fe, Co, Ni and Cu). The [$Re^{II}_4Mn^{II}_4$] molecular cube 1 was found to behave as a SMM. Current efforts focus on enhancing the magnetic properties of these clusters by introducing more single ion anisotropy using anisotropic manganese salen-type complexes. The reaction with [$(Mn(5\text{-}Br\text{-}Salen))_3]ClO_4$ resulted in cluster 3 which exhibits very weak antiferromagnetic interactions. The [ReII(triphos)$(CN)_3$]- building block was also incorporated in a family of trigonal bipyramidal clusters (TBP) to test the hypothesis that lanthanide assemblies with axial crystal field could give rise to SMM behavior. The Re/Sm TBP 2 shows very large temperature independent paramagnetism.

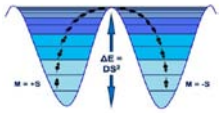

Figure 1 Energy Level Diagram for Single Molecule Magnet

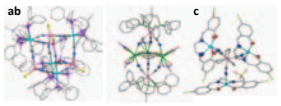

Figure 1 Structure of: a) [Re^{II}(triphos)$(CN)_3]_4[Mn^{II}Cl]_4$ (**1**) b) [Re^{II}(triphos)$(CN)_3(Sm(NO_3)_3)_3]^{2-}$ (**2**) c) [Re^{II}(triphos)$(CN)_3(Mn(5Br\text{-}Salen))_3]^{+}$(**3**)

Biography

M.R.Saber has completed his MSc from Fayoum University, Egypt. He joined Gabbai's research group at the chemistry department, Texas A&M University, as a Fulbright visiting scholar for 10 months then he started his PhD in the Dunbar research group. He has published 4 papers in reputed journals and participated in several ACS meetings as well as the Austrian Physical Society Meeting 58 [OPG 58].