Dynamics of Mononuclear Fe(II) Spin Crossover Complexes – Muon Studies

Y. Garcia[1], S. J. Campbell[2] J. S. Lord[3] and P. Gütlich[4]

[1] *Unité de Chimie des Matériaux Inorganiques et Organiques, Département de Chimie, Faculté des Sciences, Université Catholique de Louvain, Place L. Pasteur 1, 1348 Louvain-la-Neuve, Belgium*

[2] *School of Physical, Environmental and Mathematical Sciences, The University of New South Wales, Australian Defence Force Academy, Canberra, ACT 2600, Australia*

[3] *ISIS, Rutherford Appleton Laboratory, Chilton, Didcot, OX11 OQX, UK*

[4] *Institut für Anorganische Chemie und Analytische Chemie, Universität Mainz, 55099 Mainz, Germany*

We have explored a series of iron(II) spin crossover complexes by temperature (4.2-400 K) and field dependent (0-2000 Oe) muon spin relaxation (μSR) at ISIS, U.K [1-4]. Interest has focused on the mononuclear complexes [Fe(1-propyl-tetrazole)$_6$](ClO$_4$)$_2$ and [Fe(1,10-phenanthroline)$_2$(NCS)$_2$] which exhibit gradual ($T_{1/2}$ ∼150 K; width∼100 K) and abrupt ($T_{1/2}$ ∼177 K; width∼10 K) spin crossover behaviour respectively on cooling [2, 3]. The magnetic and optical properties of these compounds are particularly significant in the emerging fields of molecular electronics and nanotechnologies [5].

Here we focus on understanding the magnetic fluctuation behaviour of these iron(II) mononuclear systems including fast dynamics between the available spin states around the spin transition temperature [3] as determined via the time window provided by gμSR; this enables us to extend the information available from routine techniques applied to the study of iron(II) spin crossover compounds. We will also show how muons can be sensitive to iron spin dynamics driven by lattice distortions (e.g. order-disorder transition of the counter-anion) [2].

[1] Y. Garcia et al., Inorg. Chim. Acta (2008, in press)
[2] S. J. Campbell et al., J. Phys. Chem B 107 (2003) 14289
[3] Y. Garcia et al., J. Phys. Chem B 108 (2004) 17838
[4] Y. Garcia et al., J. Phys. Chem B 111 (2007) 11111
[5] P. Gütlich et al., Chem. Soc. Rev. 29 (2000) 419