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

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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 $g\mu$SR; 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].