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Preparation and characterization of spin crossover thin solid films

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Iron(II) spin crossover (SCO) complexes indicate a reversible transition from the low-spin state (LS, S=0) to a high-spin state (HS, S=2) by e.g. variation of temperature, pressure or by irradiation with light [1]. Therefore, these materials are promising candidates for information storage [2]. However, practical device applications require thin films with these properties.

The SCO-compound [Fe(Htrz)₂(trz)] (BF₄) (**1**) switches between the LS and the HS state with a 30 K wide thermal hysteresis loop above room temperature [3]. We prepared thin films of **1** on a SiO₂ substrate by spin coating. The spin states of the films were characterized by Mössbauer spectroscopy in reflection mode using a MIMOS II spectrometer. A low quadrupole splitting (LS state) at 300 K and a high quadrupole splitting (HS state) at 400 K were found for the films, as well as for bulk powder of **1**. This confirms a LS –HS transition above room temperature. Furthermore, synchrotron based nuclear resonance scattering measurements from 80 K to 400 K indicate that the hyperfine parameters as well as the Fe-vibrational density of states of the film are similar to those of the bulk powder of **1**. These studies show that the SCO films prepared by spin coating have similar SCO properties as the bulk complex.

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[2] J. Kröber, et al., Chem. Mater. 6, (1994), 1404-1412

[3] F. Guillaume, et al., Chemical Physics Letters 604, (2014), 105-109

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