Spin Crossover-Macromolecule Composite Nano Film Material

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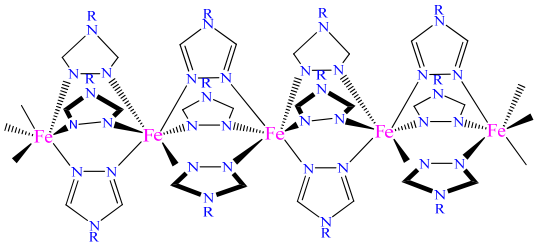
Supporting Information

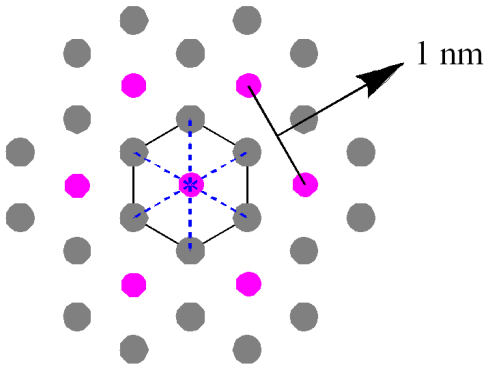
Experimental Section

General Remarks. All synthesis were carried out under nitrogen using standard Schlenk techniques. Ethanol was purigied and distilled under nitrogen before use. NH_2trz and PVP were purchased from Alfa Aesar and used as received. The **IR spectra** were recorded on Bruker TENSOR-27 infrared spectroscopy at ambient temperature. The **XPS spectra** measurements were recorded using a Kratos Axis Ultra DLD spectrometer employing a monochromated Al-Kα X-ray source, hybrid optics and a multi-channel plate and delay line detector at ambient temperature. The **X-ray diffraction** were performed on a D/Max-2500 X-ray diffractometer using Cu-Kα radiation. **Small angle X-ray scattering** experiments were performed on a Bruker AXS NANOSTAR using a monochromatic X-ray beam and a two-dimensional detector for recording the sacttering intensity. The distance between the samples and the detector was 270 mm and λ= 1.54 Å for the radiation beam. **Transmission electron micrographs (TEM) image** were taken at TecnaiG^{2}20S-TWIN microscope. **Mössbauer spectra** were measured on MS-500 Mössbauer instrument at 295, 240 and 85 K. **Magnetic susceptibility measurements.** These were performed under a helium atmosphere using Quantum Design MPMS-XL SQUID susceptometer in 2000 Oe applied field at a temperature range of 10-300 K.

Synthesis of the $[Fe(NH_2trz)_3(ClO_4)_2]$-PVP composite film. An EtOH (10 ml) solution containing NH_2trz (0.026 g, 0.3 mmol) and PVP (0.0355 g, 0.3 mmol) was added into an EtOH (10 ml) solution of $Fe(ClO_4)_2$ (0.0255 g, 0.1 mmol), the mixture was stired for 2 hours. Slight yellow transparent films were obtained after keeping the mixture in a vacuum desiccator for two days. The film can also be obtained by spin-coating on quarz substrate.



Scheme S1. Schematic structure of the $[Fe^{II}(4\text{-R-trz})_3](anion)_2$ family.



Scheme S2. View along the chains of PVP and the $[Fe(NH_2trz)_3]^{2+}$. The $[Fe(NH_2trz)_3]^{2+}$ chains are in purple and the PVP chains are gray. The blue dashed lines are the hydrogen bonds between them. Parts of the structure are omitted for clarity. A hexagonal columnar structure is formed by the six PVP chains with one $[Fe(NH_2trz)_3]^{2+}$ in the middle. The distance between iron chains is *ca.* 1 nm ($2\theta = 8.7°$).

Synthesis of the $[Fe(Htrz_3)(ClO_4)_2]$-PVP film as comparison. The procedure is similar as the synthesis of the $[Fe(NH_2trz_3)(ClO_4)_2]$-PVP composite film.

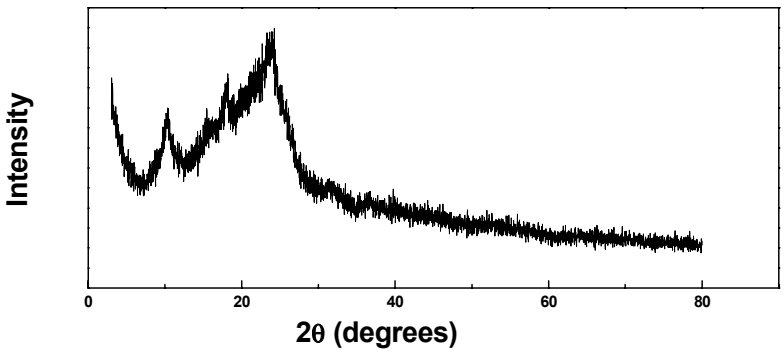


Figure S1. The XRD patterns of the film of $[Fe(Htrz_3)(ClO_4)_2]$-PVP which indicate the amorphours structure because of lack of hydrogen-bonds between the compound and PVP molecules.

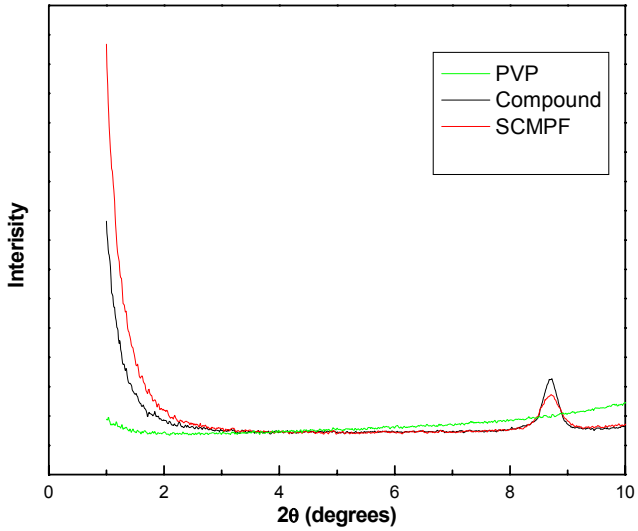


Figure S2. The small angle X-ray scatting of PVP, compound and the composite film.