Supplementary information

A charge neutral iron (II) complex with above room temperature spin crossover (SCO) and hysteresis loop

Kuppusamy Senthil Kumar, Ivan Šalitroš, Benoît Heinrich, Olaf Fuhr and Mario Ruben*

*a Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS), CNRS-Université de Strasbourg, 23, rue du Loess, BP 43, 67034 Strasbourg cedex 2, France.

*b Institute of Inorganic Chemistry, Technology and Materials, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, 81237, Slovak Republic.

*c Institute of Nanotechnology, Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, 76344, Eggenstein-Leopoldshafen, Germany.

*Email: mario.ruben@kit.edu

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Scheme S1 Synthesis of [Ru(L\textsuperscript{1})\textsubscript{2}]

Synthesis of [Ru(L\textsuperscript{1})\textsubscript{2}]

L\textsuperscript{1}H (0.108g, 0.4 mmol) was added to 10 ml of dry DMF under Ar. To this 55 µL (0.4 mmol) of Et\textsubscript{3}N was added and stirred for 15 mins. To this Ru(DMSO)\textsubscript{4}Cl\textsubscript{2} (0.097g, 0.2 mmol) was added and the mixture stirred at 120°C for 12 hrs and cooled. A precipitate was obtained which was filtered and washed with 2x10ml each of H\textsubscript{2}O and MeOH and dried under vacuum to yield 32 mg (25%) of dark yellow-orange powder. ESI-MS in CH\textsubscript{2}Cl\textsubscript{2}/CH\textsubscript{3}OH (Da): m/z, (assigned structure) = 665.04 (C\textsubscript{22}H\textsubscript{16}N\textsubscript{14}O\textsubscript{4}RuNa, calc. = 665.04). Elemental Analysis of the powder: Calc. for: [Ru(L\textsuperscript{1})\textsubscript{2}]. 1H\textsubscript{2}O (C\textsubscript{22}H\textsubscript{18}N\textsubscript{14}O\textsubscript{4}Ru) C, 40.06; H, 2.75; N, 29.73; Found: C, 40.28; H, 2.7; N, 29.9. UV-vis in 7:3 CH\textsubscript{2}Cl\textsubscript{2}/CH\textsubscript{3}OH; \(\lambda_{\text{max}}/\text{nm (}\varepsilon/10^4 \text{ cm}^{-1} \text{ M}^{-1})\): 428 (0.78), 308 (1.07), 299 (1.13), 265 (1.8) and 255 (1.9).
Figure S1 $^1$H NMR spectrum of [Fe(L)$_2$] in CHCl$_3$/CH$_3$OH solvent mixture (top). Expanded version of the top spectrum in the 10 -11.5 ppm spectral range (bottom).
**Figure S2** $^1$H NMR spectrum of $[\text{Fe}(\text{L})_2]$ in DMSO solvent. The spectrum at the top is 100 times magnified version of the below spectrum.
Figure S3 UV-vis absorption spectrum of $[\text{Fe}(\text{L})_2]$ in DCM/MeOH solvent mixture.

Figure S4 UV-vis absorption and PL spectra of $[\text{Fe}(\text{L}^1)_2]$ in DCM/MeOH solvent mixture.
Figure S5 UV-vis absorption and PLE spectra of (a) L^1H and (b) [Fe(L^1)_2] in DCM/MeOH solvent mixture.
**Figure S6** (a) UV-vis absorption and (b) PL spectra of $[\text{Fe}(L^1)_2]$ and $[\text{Ru}(L^1)_2]$ in DCM/MeOH solvent mixture. The UV-vis spectra are normalized at MLCT maxima for comparison purpose and the optical densities of the complex solutions were fixed at ca. 0.09 for PL measurements.
Figure S7 UV-vis absorption and PL spectra of (a) $L_1^1H$ and (b) $[Fe(L_1^1)_2]$ in solid state. The small peaks around 430 and 470 nm are originated from the light source. The excitation wavelengths are 338 and 334 nm for $L_1^1H$ and $[Fe(L_1^1)_2]$ respectively.
Figure S8  $\chi T$ vs. $T$ plot of crystalline form of $[\text{Fe}(L^1)_2]$ under standard measurement conditions, this form of the complex is photomagnetically inactive upon either red or green light irradiation ($\lambda = 637$ nm or 532 nm, 10 mW cm$^{-2}$).