Magneto-Luminescent d–f Complexes: from Tunable Emission to Non-Invasive Optical Thermometry of Single Molecule Magnets

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Single molecule magnets (SMMs) based on trivalent lanthanide ions (Ln^{III}) stand at the research forefront of molecular magnetism owing to the large magnetic anisotropy of a single molecule origin, leading to the magnetic memory effect at molecular level. Additionally, thanks to the unique electronic structure of 4f elements, Ln^{III} shows characteristic emission transitions, offering various intriguing luminescent functionalities. My research works have been focusing on the combination of these two functionalities, i.e., Ln^{III}-centered SMM behavior and Ln^{III}-centered luminescence, into a single-phase material by embedding Ln^{III} ion into cyanido-bridged bimetallic d–f coordination assemblies. Such d–f coordination system can be readily constructed from Ln^{III} (as bifunctional center), diamagnetic polycyanometallate $[M^{n+}(CN)_x]^{-(x-n)}$ (as bridging linker), and organic ligand (as crystal field tailor), and we have reported a plethora of luminescent SMMs, exploring their magneto-luminescent functionalties.[1–5] Furthermore, by playing with the non-innocent solvent molecules within the coordination system, the luminescent SMMs can be additionally endowed with switching character,[3] or even a third dimension of functionality of proton-conductivity.[2] In this talk, I will present several featured luminescent SMMs based on cyanido-bridged d–f complexes (**Fig 1**), and discuss their interesting luminescent functionalities, including 1) yellow–white–blue color-tunable emission in Dy–Co/Dy–Rh SMMs,[4] 2) NIR luminescence ratiometric thermometry in a Co–Yb–Co SMM,[2] and 3) visible luminescence thermometry adopting re-absorption effect in Ho–M SMMs (M = Co/Rh/Ir).[1]

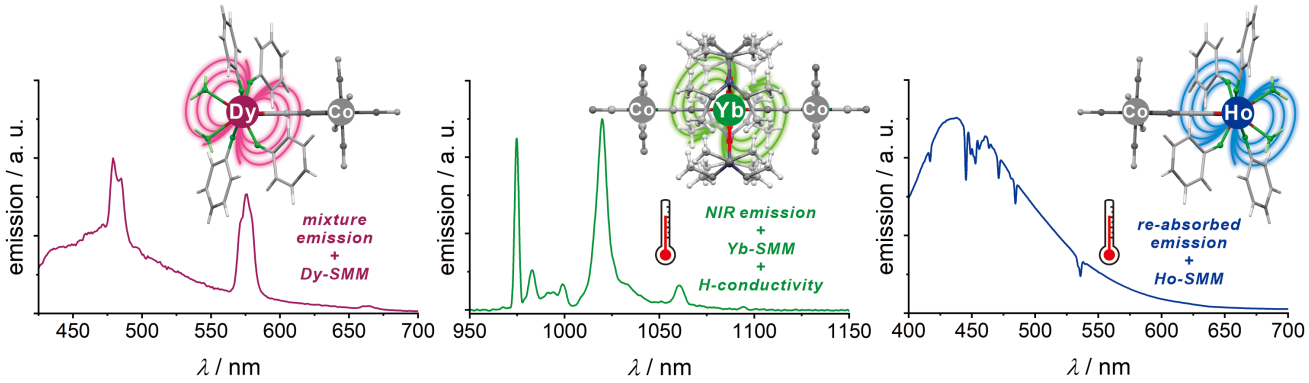

Fig. 1 Representative luminescent SMMs based on cyanido-bridged d–f complexes showing indicated functional features.

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[2] J. Wang, J. J. Zakrzewski, M. Heczko, M. Zychowicz, K. Nakagawa, K. Nakabayashi, B. Sieklucka, S. Chorazy and S. Ohkoshi ***J. Am. Chem. Soc.***, 2020, *142*, 3970–3979

[3] Y. Xin, J. Wang, M. Zychowicz, J. J. Zakrzewski, K. Nakabayashi, B. Sieklucka, S. Chorazy and S. Ohkoshi ***J. Am. Chem. Soc.***, 2019, *141*, 18211–18220.

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