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Photoluminescent crystalline magnetic materials based on trivalent lanthanide ions and polycyanidometallates

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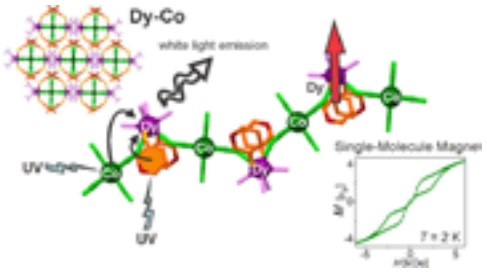
Photo- and electroluminescence induced in solid-state materials arouse a remarkable interest due to a number of applications in light-emitting devices, optical communication, tunable laser systems, low-energy scintillation, energy conversion, chemical sensing, and bioimaging. Thus, there is a strong need to design and prepare new functional materials exhibiting efficient light-emitting functionalities, including white-light emission, near-infrared phosphorescence, multi-colored switchable emission, or up-conversion luminescence. Another exciting idea is to synthesize multifunctional luminescent materials that combine strong photoluminescence with other physical properties. In this regard, the conjunction of magnetic and emission phenomena are particularly attractive due to the expected cooperative effects, and the possibility of tuning light emission by a magnetic field. We present two main strategies toward bifunctional photoluminescent and magnetic materials, both realized within the family of heterobimetallic coordination polymers built of polycyanidometallates, $[MV(CN)_8]^{3-}$(M=Mo, W) and $[M^{III}(CN)_6]^{3-}$ (M=Cr, Co), which serve as metalloligands to complexes of trivalent lanthanide ions with selected organic molecules. In the first approach, we present the synthetic route toward emissive molecule-based ferromagnets based on bimetallic octacyanido-bridged Tb-W and Tb-Mo, and hexacyanido-bridged Nd-Cr assemblies. They combine a long-range ferromagnetic ordering with the visible or near-infrared emission, depending on the applied lanthanide (3+) ions. Our second approach explores a strong magnetic anisotropy of Dy^3 complexes leading to the effect of slow magnetic relaxation, which is named a single-molecule magnet (SMM) behavior. We embedded the Dy^3 SMMs into bimetallic cyanido-bridged Dy-Co coordination networks producing the magneto-luminescent materials combining significant magnetic anisotropy with white light emission, or multi-colored visible emission tunable by the excitation light.



Biography

Szymon Chorazy is an Assistant Professor in Inorganic Molecular Materials Group at the Jagiellonian University in Krakow, Poland, and Collaborative Researcher in Solid State Physical Chemistry Group at The University of Tokyo, Japan. He has received his PhD from Jagiellonian University under the supervision of Professor Barbara Sieklucka and Professor Shinichi Ohkoshi from the University of Tokyo. He joined as a Project Assistant Professor in the Department of Chemistry, School of Science, University of Tokyo. Later, he joined Professor Barbara Sieklucka's Group working as an Assistant Professor. His research interests cover the design, preparation and physico-chemical characterization of novel functional magnetic materials revealing various optical, magneto-optical, and phase transition properties.

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