Supramolecular coordination chemistry of aromatic polyoxalamide ligands: A metallosupramolecular approach toward functional magnetic materials

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Résumé en anglais	The impressive potential of the metallosupramolecular approach in designing new functional magnetic materials constitutes a great scientific challenge for the chemical research community that requires an interdisciplinary collaboration. New fundamental concepts and future applications in nanoscience and nanotechnology will emerge from the study of magnetism as a supramolecular function in metallosupramolecular chemistry. Our recent work on the rich supramolecular coordination chemistry of a novel family of aromatic polyoxalamide (APOXA) ligands with first-row transition metal ions has allowed us to move one step further in the rational design of metallosupramolecular assemblies of increasing structural and magnetic complexity. Thus, we have taken advantage of the new developments of metallosupramolecular chemistry and, in particular, the molecular-programmed self-assembly methods that exploit the coordination preferences of paramagnetic metal ions and suitable designed polytopic ligands. The resulting self-assembled di- and trinuclear metallacyclic complexes with APOXA ligands, either metallacyclophanes or metallacryptands, are indeed ideal model systems for the study of the electron exchange mechanism between paramagnetic metal centers through extended π-conjugated aromatic bridges. So, the influence of different factors such as the topology and conformation of the bridging ligand or the electronic configuration and magnetic anisotropy of the metal ion have been investigated in a systematic way. These oligonuclear metallacyclic complexes can be important in the development of a new class of molecular magnetic devices, such as molecular magnetic wires (MMWs) and switches (MMSs), which are major goals in the field of molecular electronics and spintronics. On the other hand, because of their metal binding capacity through the outer carbonyl-oxygen atoms of the oxamato groups, they can further be used as ligands, referred to as metal–organic ligands (MOLs), toward either coordinatively unsaturated metal complexes or fully solvated metal ions. This well-known “complex-as-ligand” approach affords a wide variety of high-nuclearity metal–organic clusters (MOCs) and high-dimensionality metal–organic polymers (MOPs). The judicious choice of the oligonuclear MOL, ranging from mono- to di- and trinuclear species, has allowed us to control the overall structure and magnetic properties of the final oxamato-bridged multidimensional (*nD*, *n* = 0–3) MOCs and MOPs. The intercrossing between short- (nanoscopic) and long-range (macroscopic) magnetic behavior has been investigated in this unique family of oxamato-bridged metallosupramolecular magnetic materials expanding the examples of low-dimensional, single-molecule (SMMs) and single-chain (SCMs) magnets and high-dimensional, open-framework magnets (OFMs), which are brand-new targets in the field of molecular magnetism and materials science.
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