

Structure and Properties of Coordination Polymers Containing Hydrogen-Bonding Capable and Conformationally Flexible Dipyridyl Ligands: An Introductory Undergraduate Research Program at Lyman Briggs College at Michigan State University
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Lyman Briggs College (LBC) is a residential community at Michigan State University for the study of science and its impact on society. The undergraduate-only LaDuca group consisting of LBC students and external REU students has been investigating the synthesis, structure, and properties of coordination polymers containing hydrogen-bonding capable and conformationally flexible dipyridylamide ligands. Hydrothermal reaction of divalent metal nitrates, pyromellitic acid (pymH_4), and either 1,6-hexanediaminebis(nicotinamide) (hbn) or 1,6-hexanediaminebis(isonicotinamide) (hbin) afforded crystalline coordination polymers whose dimensionality depends synergistically on the dipyridylamide nitrogen donor disposition and metal coordination environment. These new phases were structurally characterized via single-crystal X-ray diffraction. $[\text{Cd}(\text{pymH}_2)(\text{hbn})(\text{H}_2\text{O})_2]_n$ (**1**) and $[\text{Co}(\text{pymH}_2)(\text{hbn})(\text{H}_2\text{O})_2]_n$ (**2**) display isostructural (4,4) grid topologies with $[\text{M}(\text{pymH}_2)(\text{H}_2\text{O})_2]_n$ chains pillared by hbn ligands. $\{[\text{Cu}_2(\text{pym})(\text{hbn})(\text{H}_2\text{O})_2] \cdot 2\text{H}_2\text{O}\}_n$ (**3**) manifests a 3D 3,4-connected network with a rare $(8^3)_2(8^6)$ topology (pictured) built from the hbn pillaring of $[\text{Cu}_2(\text{pym})(\text{H}_2\text{O})]_n$ layer motifs. $\{[\text{Zn}_2(\text{pym})(\text{hbin})_2(\text{H}_2\text{O})] \cdot \text{H}_2\text{O}\}_n$ (**4**) shows a 1D ribbon motif based on $[\text{Zn}_2(\text{OCCCCO})_2]$ 14-membered circuits. $\{[\text{Ni}_2(\text{pym})(\text{hbin})(\text{H}_2\text{O})_4] \cdot 3\text{H}_2\text{O}\}_n$ (**5**) exhibits 3,4-connected layer motifs. Luminescent behavior in **1** and **3** is ascribed to intra-ligand molecular orbital transitions. These phases were also surveyed for the ability to detect nitrobenzene in ethanol suspension.

