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Synthesis and Characterization of Novel 2D Organic-Inorganic Hybrid Cobalt and Nickel Vanadates.

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Two new isomorphous 2D organic-inorganic hybrid metal vanadates with general formula $[M_2(\text{Im})_8\text{V}_4\text{O}_{12}]$, (M = Ni, Co, and Im = imidazole) have been hydrothermally synthesized. The crystal structure of both compounds consists of $\{\text{V}_4\text{O}_{12}\}^{4-}$ clusters covalently attached to four $\{\text{M}(\text{Im})_4\}^{2+}$ moieties via bridging oxo groups. Each M(II) displays distorted octahedral geometry, defined by one nitrogen atom from each of four equatorially coordinated imidazole ligands, and one oxygen atom from each of two $\{\text{V}_4\text{O}_{12}\}^{4-}$ subunits in the axial positions. Alternatively, the structure consists of distorted MN_4O_2 octahedra and distorted VO_4 tetrahedra. Two cyclic constructs define the oxide layer, four VO_4 tetrahedra edge connect to form small rings, and four MN_4O_2 octahedra and eight VO_4 tetrahedra connect to form large $\{\text{M}_4\text{V}_8\text{O}_{12}\}$ rings which fuse to produce the two-dimensional connectivity. The supramolecular hydrogen bonding (N–H $\cdots\pi$, C–H $\cdots\text{O}$, and N–H $\cdots\text{O}$) plays a significant role in the formation and stability of the structure, binding adjacent oxide layers together to generate the three-dimensional structure. Further characterization of the compounds by EDX, FTIR, TGA, elemental analyses, and magnetic susceptibility is also reported.