Cubic and Rhombohedral Heterobimetallic Networks Constructed from Uranium, Transition Metals, and Phosphonoacetate

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A series of heterobimetallic uranium/transition metal carboxyphosphonates have been synthesized and characterized to reveal high-symmetry structures with large voids. The structures of the Mn(II), Co(II), and Cd(II) variants of $[M_2(UO_2)_6(PO_3CH_2CO_2)_3O_3(OH)(H_2O)_2]\cdot 16H_2O$ are isotypic and adopt the high-symmetry cubic space group $Im\bar{3}$. The subunits of this structure forms a large cavity of 16 Å in diameter that is filled with co-crystallized water molecules. The second high-symmetry cadmium compound, $[Cd(UO_2)_2(PO_3CH_2CO_2)_2(H_2O)_{4.33}]\cdot 2H_2O$, crystallizes in the rhombohedral space group, $R\bar{3}$. In this structure, there are flower-filled shaped channels that extend in the same direction. These compounds demonstrate new features to the family of carboxylphosphonates, which are high symmetry structures can be synthesized, structures with large voids can also be achieved, and for the first time in the cubic compound, the phosphonate oxygen atoms are being used to bind the transition metals.