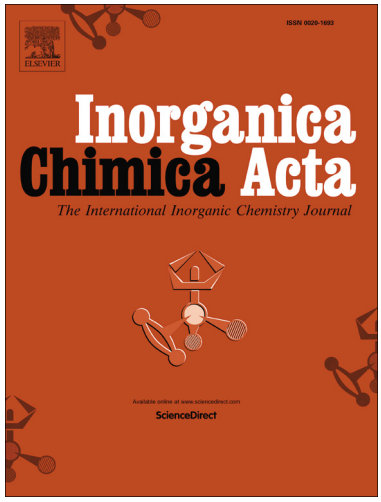

Research paper

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Series of polyoxometalates-based metal-organic frameworks exhibiting high photocatalytic activities for the degradation of methylene blue

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Abstract

A series of metal-organic frameworks built from Keggin and Wells–Dawson polyoxometalates were obtained at different pH values under hydrothermal conditions, namely, $[H_2bimb]_{1.5}[Co(bimb)_{1.5}(H_2O)(BW_{12}O_{40})\cdot 4H_2O$ (**1**), $[H_2bimb]_{1.5}[Ni(bimb)_{1.5}(H_2O)(BW_{12}O_{40})]\cdot 4H_2O$ (**2**), $K[H_2bimb][Cu(bimb)(BW_{12}O_{40})]\cdot 2H_2O$ (**3**) and $H_2[Ni(bimb)_2(bimbp)_{0.5}(H_2O)_2][P_2W_{18}O_{62}]_{0.5}\cdot 3H_2O$ (**4**) (bimb = 1,4-bis(1-imidazoly)benzene, bimbp = 4,4'-bis(imidazolyl) biphenyl). All of the compounds have been structurally characterized by elemental analysis, IR, TG, XRD and single-crystal X-ray diffraction. Compounds **1** and **2** exhibit an interesting network, in which each BW_{12} anion as double-dentate inorganic ligand link two adjacent Co/Ni-bimb chains to form a wave-type two-dimensional (2-D) plane. Compound **3** displays a 3D structure constructed from Cu^{II}–BW_{12} sheets and bimb organic ligand with 1D channels. Compound **4** displays a one-dimensional (1D) polypendant chain with P_2W_{18} anions as templates. It is noteworthy that the bimb ligand was in situ transformed into bimbp ligand during the synthesis of **4**, and both bimb and bimbp ligands take part in the construction of the structure of **4**. Photocatalytic investigation indicates that compounds **1-3** are highly active for the degradation of methylene blue under UV irradiation. In addition, electrochemical properties and electrocatalytic activities of compounds **1-3** have been investigated in detail.

Keywords: Metal–organic framework; Polyoxometalates; Photocatalysis; Electrochemistry; In-situ ligand transformation

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