

processes were used to prevent environment pollution and support valuable material recovery. The main purpose of this study was to determine the crystal phases of the metal plating sludge at different temperatures to obtain the optimum thermal treatment conditions. Sample was heated at 105, 125, 200, 400, 625, 850 and 1000°C; and X-ray diffraction (XRD) examination of the powder samples was carried out using a Philips Panalytical X'pert Pro Diffractometer. The instrument was operated at 45 kV with a filament current of 40 mA and Cu K α radiation. Scanning operation covered a wide range of 2θ from 5 to 70° with a scanning speed 0.0025°/s at 0.02° steps. Crystal phase identification results of thermal treated sludge samples at different temperatures concluded that sulfate complexes with metals (Zn, Cr, Cu) transformed to oxide phases such as calcium iron phosphate (Ca₉Fe(PO₄)₇), zincochromite (ZnCr₂O₄) and tenorite (CuO) with Powder Diffraction File (PDF) cards: 00-045-0338, 01-073-1962 and 00-003-0884, respectively.

Keywords: waste treatment, crystal phases, metal oxides

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Two binuclear molecular magnet: K₂Fe₂(C₂O₄)Cl₆(H₂O)₂ and K₆Fe₆(C₂O₄)₃Cl₁₄(H₂O)₁₀

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Two oxalate-bridged binuclear iron(III) compounds K₂Fe₂(C₂O₄)Cl₆(H₂O)₂ (I) and K₆Fe₆(C₂O₄)₃Cl₁₄(H₂O)₁₀ (II) were synthesised. Their crystal structures were determined by single crystal X-ray diffraction. Both of them are composed of oxalate-bridged binuclear iron (III) anions with K⁺ as cation and Cl⁻ coordinated to iron on equator plane with oxalate group. The coordination ligands perpendicular to equator plane is different on I and II: In I, one H₂O and one Cl⁻ coordinated to Fe³⁺ at same time. But there are two kinds of binuclear anions with different coordination environments in (II): in one anion, H₂O occupy four axial positions, in another anion, one of them is replaced by Cl⁻. There are extensive hydrogen bonds in the crystal I and II. In I, it is only layered [4⁴,6²] lattice in the ac plane; in II, the hydrogen bond form a NaCl-type framework in the crystal. The cation exist in the hole between layer of II and vacant in the NaCl lattice. Their magnetic properties were measured. Both of them show anti-ferromagnetic interaction as dimer modes with J = -5.18cm⁻¹ in I and J = -1.50cm⁻¹ in II. The difference on magnetic property was determined by coordination environments and hydrogen bonds. Both of them are potential ionic conductor.

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Keywords: iron compounds, oxalate-bridged, magnetic property

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Structure diversity and reversible anion exchange properties of metal complexes with tripodal ligand

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We focus our attention on crystal engineering and properties of metal-organic frameworks with flexible multidentate organic ligands, such as 1,3,5-tris(imidazol-1-ylmethyl)benzene (tib), 1,3,5-tris(imidazol-1-ylmethyl)-2,4,6-trimethylbenzene (titmb). Systematic study of reactions of tib and titmb with varied metal salts was carried out, and coordination architectures with zero-, one-, two- and three-dimensional structures were obtained and their properties were investigated. For example, six cadmium(II) coordination polymers, [Cd(tib)₂](BF₄)₂ (**1**), [Cd(tib)₂](NO₃)₂·2C₂H₅OH (**2**), [Cd(tib)(OAc)₂]₄·5H₂O (**3**) (OAc = acetate anion), [Cd(tib)(μ₂-Cl)Cl]·CH₃OH (**4**), [Cd(tib)₂(H₂O)₂]Cl₂·4H₂O (**5**) and [Cd(tib)₂][Cd₂I₆] (**6**), were obtained by reactions of tib with the corresponding metal salts, respectively. Their structures were determined by X-ray crystallography. **1** and **6** have infinite 2D cationic double layered structures with different shapes. **2** possesses a 3D framework structure with two different kinds of channels. The structure of **3** is a two-fold interpenetrated 3D framework. **4** and **5**, synthesized by the same reactants in the same solvent, have different 2D network structures due to the different synthetic methods. The distinct structures of the complexes (e.g. **1**, **2** and **6**) indicate that the counteranions have significant influence on the structures of coordination polymers. **4** and **5** provide nice example that synthetic methods can affect the structures of the frameworks in this system. In addition, the results also attest that the flexible ligand tib can adopt different conformations and coordination modes to form complexes with varied structures. Furthermore, the reversible anion exchange properties of **1** and **2** were studied.

Keywords: crystal engineering, metal-organic complexes, supramolecular assembly

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Lanthanoid, transition metal and heterobimetallic complexes with polynitrile and derivative ligands

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Anionic polynitrile ligands such as dicyanonitrosomethanide (dcnm) have been shown to readily undergo transition metal promoted nucleophilic addition, providing a convenient pathway to simultaneous *in situ* ligand and complex synthesis. These derivative ligands have targeted coordination modes allowing the formation of 3d/4f heterobimetallic species. Solvothermal synthesis allows for the formation of networks, not accessible through bench top methods, which display ferromagnetic coupling.¹ Lanthanoid complexes of dcnm display a unique η² nitroso bonding,² the symmetry of which can be affected by co-ligands, such as crown ethers and 1,10-phenanthroline, by introducing steric crowding into systems. This bonding mode is also observed in the water addition product, carbamoylcyanonitrosomethanide (ccnm), where extensive intermolecular hydrogen bonding influences the degree of asymmetry in the nitroso bonding. As the ccnm ligand retains its anionic character the requirement of a counter cation allows for tuneable solubility properties and has been shown to dramatically effect of the topology of resulting networks, despite the absence of any obvious