NecIIC-116
Title: Synthesis and X-ray study of a new oxo-bridged heterotrinuclear compound ...
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NecIIC-117
Title: Synthesis and Crystalllography of a new oxo-bridge complex Cr,Mn with p-chloro benzoate ligand
Author/Authors: Mohammad Yazdanbakhsh, Iman Khooravi

NecIIC-120
Title: Synthesis and characterization analysis of new oxo-bridged, trimer of mixed-metal complexes with ...
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Title: Synthesis, characterization and IR investigation of novel oxo-centered, trinuclear of transition metal ...
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Synthesis, characterization and IR investigation of novel oxo-centered, trinuclear of transition metal complexes with 2-propanoic acid

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Oxo-centered trinuclear carboxylates are a well-established class of complexes, referred to as "basic carboxylates" of the general formula [M(μ₂-\(\text{OH}\))\(\text{RCOO}_2\)]\(_2\)\(\text{L}^-\) (M = metal; L = terminal ligand) (for example: pyridine derivative, THF, water, etc.; R = CH₃, Ph, CF₃, H, ...). Complexes of this structure contain a triangular arrangement of metal ions bridged by a central μ₂-oxo atom. Each carboxylate anion spans two metal centers at the periphery of the [M(μ₂-\(\text{OH}\)])\(\text{L}^-\) core, while the neutral monodentate ligands occupy the remaining coordination sites on each metal center, and as a result the coordination around the metal centers is approximately octahedral [5].

In this work, [Cr₂FeO\(\text{C}_8\text{H}_8\text{O}_4\)\(\text{H}_2\text{O}\)]\(\text{NO}_3\)·3\(\text{H}_2\text{O}\) (1) has been synthesized by reaction of metal nitrate with the sodium propionate in aqueous solution, and then [Cr₂FeO\(\text{C}_8\text{H}_8\text{O}_4\)\(\text{H}_2\text{O}\)]\(\text{NO}_3\)·2\(\text{H}_2\text{O}\) (2) have been prepared through substitution of water molecules in (1) with methanol. The isolated complexes were characterized by elemental analysis, infrared and electronic spectroscopy. The observed frequencies \(v_{\text{CO}}\) and \(v_{\text{COO}}\) for the carboxylate ligands support the presence of landscape coordinated carboxylates in complexes. For the identification of the metal oxygen bonds of \(\text{M}_2\text{O}\) groups, IR spectra in the range of 800–400 cm\(^{-1}\) were used [4]. The visible spectra of pseudo-octahedral Cr(III) complexes are expected to display two dominant d-d bands, corresponding to the spin-allowed \(A_g \rightarrow T_{2g}\) and \(A_g \rightarrow E_g\) transitions. The reflectance spectra of complexes show moderate broad bands in the UV region that shows π → π\(^*\) double bond in 2-propanoic ligand.

References: