

Synthesis and crystalline structure of a complex with phosphonate ligand and Eu(III) $[\text{Eu}(\text{idmp})_3] \cdot \text{H}_2\text{O}$

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The wide application of rare earths (RE) is due to the use of magnetic, optical or redox properties inherent to such elements¹. Therefore, materials with these ions have been explored intensively in the past three decades. Phosphonate group has three oxygen atoms capable of coordinating metal ions when they are in any state of protonation, resulting in many possible coordination modes with different arrangements in the structures. The majority of metal phosphonate compounds are not MOFs, although there are a number of instances where phosphonate-based MOFs have been prepared². In this work we report the synthesis and crystal structure of novel coordination compound named $[\text{Eu}(\text{idmp})_3] \cdot \text{H}_2\text{O}$, involving the ligand iminodi(methylphosphonic) acid (idmp) and Eu(III) ion. This compound was obtained by the reaction between aqueous solutions containing $\text{EuCl}_3 \cdot 6\text{H}_2\text{O}$ and idmp acid. The resulting solution was refluxed for 24 h at 95 °C. A white solid was separated and the mother solution was set aside. After a few days, transparent crystals suitable for single crystal X-ray diffraction analysis were collected by filtration. The IR spectrum of compound shows a band at 3456 cm^{-1} , assigned to OH stretching (ν_{OH}), confirming the presence of water molecules. The compound $[\text{Eu}(\text{idmp})_3] \cdot \text{H}_2\text{O}$ crystallizes in trigonal system presenting space group R-3c. Each Eu(III) center adopts an octahedral geometry and the coordination sphere consists of six oxygen atoms from six idmp ligands. In addition, there is a lattice water molecule, Figure 1. Idmp ligands act in bridging coordination mode connecting Eu(III) centers giving rise to a 1D polymeric arrangement along the crystallographic *c* axis as shown in Figure 2. The 1D chains are connected to each other through N-H...O and O-H...O hydrogen bonds, generating a tridimensional supramolecular arrangement.

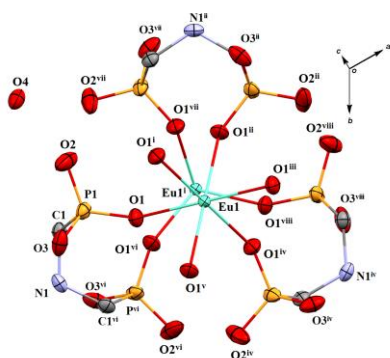


Figure 1: Coordination sphere of $[\text{Eu}(\text{idmp})_3] \cdot \text{H}_2\text{O}$.

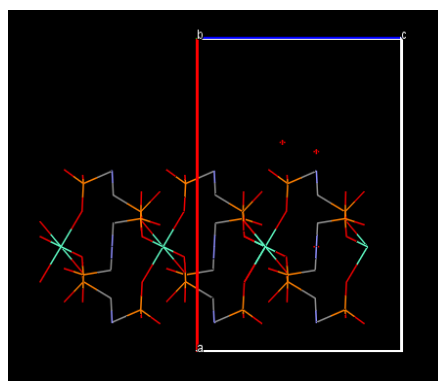


Figure 2: 1D polymeric arrangement of $[\text{Eu}(\text{idmp})_3] \cdot \text{H}_2\text{O}$.

¹DE SOUSA FILHO, P. C.; SERRA, O. A. Terras raras no Brasil: histórico, produção e perspectivas. **Quim. Nova**, v. 37, n. 4, p. 753-760, 2014.

² GAGNON, K. J.; PERRY, H. P.; CLEARFIELD, A. Conventional and Unconventional Metal–Organic Frameworks Based on Phosphonate Ligands: MOFs and UMOFs. **Chemical Reviews**, v. 112, n. 2, p. 1034-1054, 2012/02/08 2012.

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