

# Two Hydroxo Bridged Dinuclear Lanthanide Phen Complexes: [Ln<sub>2</sub>(phen)<sub>4</sub>(H<sub>2</sub>O)<sub>4</sub>(OH)<sub>2</sub>](phen)<sub>2</sub>(NO<sub>3</sub>)<sub>4</sub> with Ln = Tm, Yb

Dan-Yi Wei, Yue-Qing Zheng, and Jian-Li Lin

Municipal Key Laboratory of Inorganic Materials Chemistry, Institute for Solid State Chemistry, Ningbo University, Ningbo 315211 P. R. China

Reprint requests to Prof. Dr. Yue-Qing Zheng. Fax: Int. +574/87600747.

E-mail: zhengcm@nbu.edu.cn

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Two isostructural hydroxo bridged dinuclear lanthanide phen complexes of general composition [Ln<sub>2</sub>(phen)<sub>4</sub>(H<sub>2</sub>O)<sub>4</sub>(OH)<sub>2</sub>](phen)<sub>2</sub>(NO<sub>3</sub>)<sub>4</sub> with Ln = Tm (**1**), Yb (**2**) were prepared by reactions of the corresponding lanthanide nitrate and phenanthroline monohydrate in CH<sub>3</sub>OH/H<sub>2</sub>O at pH = 5.5. They crystallize in the triclinic space group  $P\bar{1}$  (no. 2) with the cell dimensions:  $a = 11.233(1)$ ,  $b = 11.456(1)$ ,  $c = 14.011(2)$  Å,  $\alpha = 93.91(1)^\circ$ ,  $\beta = 98.20(1)^\circ$ ,  $\gamma = 108.21(1)^\circ$ ,  $V = 1683.0(3)$  Å<sup>3</sup>,  $Z = 1$  for **1** and  $a = 11.236(1)$ ,  $b = 11.480(2)$ ,  $c = 13.986(2)$  Å,  $\alpha = 93.91(1)^\circ$ ,  $\beta = 98.17(1)^\circ$ ,  $\gamma = 108.33(1)^\circ$ ,  $V = 1682.9(3)$  Å<sup>3</sup>,  $Z = 1$  for **2**. The crystal structures are composed of the hydroxo bridged dinuclear [Ln<sub>2</sub>(phen)<sub>4</sub>(H<sub>2</sub>O)<sub>4</sub>(OH)<sub>4</sub>]<sup>4+</sup> complex cations, hydrogen bonded NO<sub>3</sub><sup>-</sup> anions and  $\pi$ - $\pi$  stacking (phen)<sub>2</sub> dimers. The lanthanide atoms are each surrounded by two phen ligands, two H<sub>2</sub>O molecules and two  $\mu$ -OH groups to complete a tetragonal antiprismatic LnN<sub>4</sub>O<sub>4</sub> coordination. Via two common  $\mu$ -OH groups, two neighboring tetragonal antiprisms are condensed to form a centrosymmetric dinuclear [Ln<sub>2</sub>(phen)<sub>4</sub>(H<sub>2</sub>O)<sub>4</sub>(OH)<sub>4</sub>]<sup>4+</sup> complex cation. The complex cations and (phen)<sub>2</sub> dimers are assembled via  $\pi$ - $\pi$  stacking interactions and hydrogen bondings into 2D layers parallel to (10 $\bar{1}$ ), between which the hydrogen bonded NO<sub>3</sub><sup>-</sup> anions are sandwiched. The Tm compound shows paramagnetic behavior with an experimental magnetic moment of 7.51  $\mu_B$  at room temperature. No magnetic ordering is evident down to 5 K. Over the temperature range 70 - 300 K, the Yb compound obeys the Curie-Weiss law with an experimental magnetic moment of 4.32  $\mu_B$  at room temperature and shows weak ferrimagnetic behavior at low temperature.