Isolation and Characterization of a Ferromagnetic Gadolinium(III) Citrate Chain

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Novel lanthanide citrate chains have been hydrothermally synthesized from Ln_2O_3 (Ln = Gd, Nd) and citric acid at pH = 2 and 120 °C. Their structure, crystal packing, network topology, hydrogen bonds, metal ligand interactions, TG and DTA measurements and magnetic susceptibility properties are examined. Two new isostructural compounds described detail: are in $[Ln(Hcit)(H_2O)_2.H_2O]n$ (Ln: Gd (1), Nd (2), Hcit = $C(OH)(COO-)(CH_2COO-)_2$. They are monoclinic, $P2_1/n$, and crystallize as linear polymers. The multidentate citrate anion coordinates through six out of its seven oxygen atoms, five of them acting as simple donors and the remaining one in a bridging mode. Two aqua molecules complete a LnO₉ coordination environment. Each citrate links to 3 lanthanide metal centers leading to the formation of "ladder like" chains parallel to [100] where the steps are defined by the Ln-O-Ln bridges (Ln...Ln: 4.321(4)/4.389(2)Å, for Gd/Nd respectively), connected to each other by longer citrate-based "linkers" (Ln...Ln: 6.145(4)/6.230(2)Å).

The inter-linkage of chains is achieved through H-bonding to which the three water molecules provide five donor hydrogens.

Magnetic susceptibility measurements in (1) show that ferromagnetic interactions are operative between the Gd(III) centers below 10 K.

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