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Rare-earth-containing magnetic liquid crystals

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Abstract

Rare-earth-containing metallomesogens with 4-alkoxy-N-alkyl-2-hydroxybenzaldimine ligands are reported. The stoichiometry of the complexes is $[\text{Ln}(\text{LH})_3(\text{NO}_3)_3]$, where Ln is the trivalent rare-earth ion (Y, La, and Pr to Lu, except Pm) and LH is the Schiff base. The Schiff base ligands are in the zwitterionic form and coordinate through the phenolic oxygen only. The three nitrate groups coordinate in a bidentate fashion. The X-ray single-crystal structures of the nonmesogenic homologous complexes $[\text{Ln}(\text{LH})_3(\text{NO}_3)_3]$, where Ln = Nd(III), Tb(III), and Dy(III) and LH = $\text{CH}_3\text{OC}_6\text{H}_3(2\text{-OH})\text{CH}=\text{NC}_4\text{H}_9$, are described. Although the Schiff base ligands do not exhibit a mesophase, the metal complexes do (SmA phase). The mesogenic rare-earth complexes were studied by NMR, IR, EPR, magnetic susceptibility measurements, X-ray diffraction, and molecular modeling. The metal complexes in the mesophase have a very large magnetic anisotropy, so that these magnetic liquid crystals can easily be aligned by an external magnetic field.

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