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Synthesis, structural and magnetic characterization of a pyridyl(vinyl)benzoate based terbium complex.

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There is great interest in studying ligands containing carboxylate derivatives, pyridine and vinyl groups, which can act as spacer agents because they are versatile, have high metal-ligand interactions, are flexible, have the ability to incorporate specific functionalities, and specially with carboxylates, they can lead to distinct topologies of the crystal lattice, by the coordination of distinct modes, such as monodentate, bidentate or bridged coordination modes, depending on the metal ions used, whether they are first-series transition metals or trivalent lanthanide ions.[1-3] Thus, this work presents a coordination compound synthesized from the reaction between the potassium {3-[2-(4-pyridyl)vinyl]}benzoate salt (3,4-Kpvb) and the terbium(III) ion. The experimental procedure was carried out under magnetic stirring with the pre-ligand {3-[2-(4-pyridyl)vinyl]}benzoic acid (3,4-Hpvb), which was neutralized with potassium hydroxide, thus obtaining the salt (3,4-Kpvb).[4] The product obtained from the reaction between the 3,4-Kpvb salt and the terbium nitrate hexahydrate $Tb(NO_3)_3$▪$6H_2O$ under magnetic stirring for 1h was characterized by Fourier-transform Infrared Spectroscopy (FTIR), elemental analysis (CHN), thermogravimetric analysis (TGA) and magnetization measurements in continuous (DC) and alternating magnetic fields (AC). The FTIR showed no relevant differences on the C-H (trans vinyl), C=N, and symmetric COO^- stretches. However, for the asymmetric COO^- stretch, a shift from 1388 cm^{-1} in the 3,4-Kpvb, to 1405 cm^{-1} in the product indicates a coordination of the ligand to the terbium(III) ion via the carboxylate site. According to the TGA results there was a loss of $5H_2O$ at temperatures between 110°C and 200°C. The elemental analysis results for the molecular formula $C_{42}H_{30}TbN_3O_6 \cdot 5H_2O$ where: calculated: C 54.73%; H 4.37%; N 4.56%; found: C 50.46%; H 3.81% N 4.06%. In DC magnetization measurements at temperatures from 100 to 2 K, the molar susceptibility values slowly decreased with decreasing temperature, indicating weak antiferromagnetic interactions. For the AC magnetization measurements, an increase of the in-phase molar susceptibility values with decreasing temperature was observed, but no differences was observed for distinct AC frequencies. However, the out-of-phase molar susceptibility values showed that the increase of its values with decreasing temperature is higher for high frequencies, indicating magnetic anisotropy of the system, favoring a slow relaxation of the magnetization.

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