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NOTE

Molecular Magnet Based on a Thiocyanato-Bridged Heterobimetallic Complex: Synthesis and Magnetic Properties

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One new self-assembled heterobimetallic complex with the composition CuL-$Co(SCN)_4$ (L = 5,5,7,12,12,14-hexamethyl-1,4,8,11-tetraazacyclotetradeca-4,11-diene) has been prepared and characterized by IR spectra and elemental analysis. The molecular magnetic properties of the complex were characterized by magnetic susceptibility and presents a antiferromagnetic interaction between the tetraaza macrocycle Cu(II) ions and $Co(SCN)_4^{2-}$ through the thiocyanato-bridged in the complex.

Key Words: Heterobimetallic complex, Tetraza macrocycle, Self-assemble, Synthesis, Magnetic property.

Because of their unique properties, hetero-polynuclear metal complexes are studied extensively[1-4]. Metal heteronuclear compounds have been used in many disciplines of modern science and provided a broad development space for overlapping and penetration each other between chemistry, physics and biology[5-8].

Here a new self-assembled thiocyanato-bridged heterobimetallic complex: CuL-$Co(SCN)_4$ (L = 5,5,7,12,12,14-hexamethyl-1,4,8,11-tetraazacyclotetradeca-4,11-diene) has been prepared and characterized by IR spectra and elemental analysis. The molecular magnetic properties of the complex were characterized by magnetic susceptibility.

All the reagents were of AR grade and used without further purification. $CuL(ClO_4)_2$ was synthesized according to the literature[9]. IR spectra were recorded on a Nexus-870 spectrophotometer. Elemental analysis were performed on a Elementar Vario ELZ(III) analyzer. Variable temperature magnetic data (5-300 K) were gathered with Quantum Design MPMS XL5 Squid magnetometer.

Synthesis of the CuL-$Co(SCN)_4$: The mixture of 25 mL H_2O solution of 40 mmol KSCN and 10 mmol $CoCl_2$ was added to 25 mL acetonitrile solution of 10 mmol $CuL(ClO_4)_2$, then refluxed for 1 h and left at room temperature. The shallow blue powder solids were procured respectively. Yield 39 %. IR spectrum (KBr, ν_{max}, cm^{-1}): 2924 (-CH_2), 2062 (-SCN), 1668(-C=N), 1103 (-C-N). Elemental analysis (%): Calcd. (found); C, 37.82 (37.80), H, 5.08 (5.03); N, 17.64 (17.62). The magnetic susceptibility data on the complex were collected over the temperature range 5~300 K at 100 Oe.

Magnetic properties: Fig. 1 shows the plots of χ_m *versus* T and χ_m^{-1} *versus* T for CuL-$Co(SCN)_4$. When the temperature was decreased from 300 to 5 K, the χ_m values increased gradually from 0.017 to 0.54 cm^3/mol. This indicates that the χ_m of CuL-$Co(SCN)_4$ is accord with the Curie-Weiss law in wide temperature range. When the temperature was decreased from 28 to 5 K, the χ_m values increased rapidly from 0.09 to 0.54 cm^3/mol. This shows that there are intramolecular weak antiferromagnetic coupling. From 5.0 to 300K , the magnetic data can be fitted to the Curie-Weiss law with C = 2.998 emu k/mol and θ = -1.23 K, The small negative value of Weiss temperature

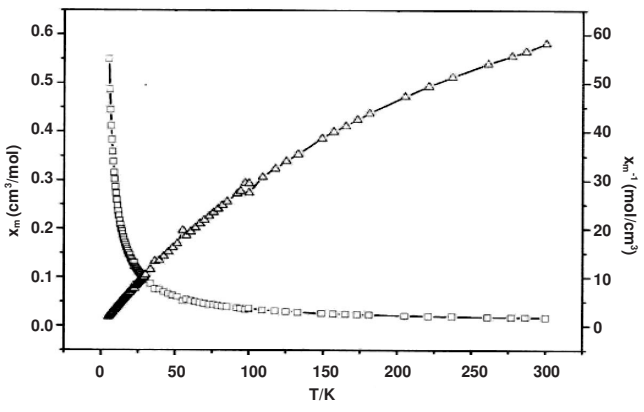

Fig. 1. χ_m-T and $1/\chi_m$-T curves of CuL-$Co(SCN)_4$

also indicates that there is a weak antiferromagnetic exchange coupling between the tetraaza macrocycle Cu(II) ions and $Co(SCN)_4^{2-}$ by the thiocyanato-bridged in the complex[10].

In summary, a heterobimetallic complex: CuL-$Co(SCN)_4$ was obtained and characterized by IR spectra and elemental analysis. The molecular magnetic susceptibility characterization presents that there are a weak antiferromagnetic interactions between the tetraaza macrocycle Cu(II) ions and $Co(SCN)_4^{2-}$ through the SCN^- bridged in the complex.

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