

## ORIGINAL PAPER

# Synthesis in water-free DMF, characterization, electrical, and gas sensing properties of bis[2-(2-aminoethylamino)ethanol]copper(II) dibromide

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2-(2-Aminoethylamino)ethanol (L) reacts with cupric bromide in dimethylformamide to give a mononuclear complex of Cu(II) [L<sub>2</sub>Cu]Br<sub>2</sub>, with six-coordinate distorted octahedral geometry, in which two molecules of tridentate (*N,N,O*) ligand are involved. The structure was confirmed by spectroscopic methods, elemental and thermogravimetric analyses, and magnetic measurements. Optimization of possible configurations indicated the formation of the trans structure of the complex. Experimental results indicate that the investigated complex, bis[2-(2-aminoethylamino)ethanol]copper(II) bromide, behaves as a semiconductor in the studied temperature range of 298–388 K. Gas sensing properties of the film for the volatile organic compounds (VOCs): acetone, tetrachloromethane, chloroform, ethanol, and methanol, were also investigated as a function of vapor concentration and temperature in dark. The film showed maximum sensitivity to tetrachloromethane and ethanol vapors at room temperature. Responses of the film to the tested gases are reversible. © 2013 Institute of Chemistry, Slovak Academy of Sciences

**Keywords:** 2-(2-aminoethylamino)ethanol, copper(II) bromide, six coordinated Cu(II) complex, semiconductor, gas sensing

## Introduction

2-(2-Aminoethylamino)ethanol being an ambidentate ligand gives metal complexes with different coordination modes. The ligand has three donor sites (*N,N,O*-tridentate) but it can act as a bidentate or terdentate ligand (Breckenridge, 1948; Das Sarma & Bailar, 1969) depending on the kind of metal and anion in the complex. Cu(II) bromide and chloride complexes of the ligand in 95 vol. % ethanol were prepared and reported by Breckenridge (1948). This complex has a bidentate ligand and no spectral/magnetic data or other types of characterizations were presented in the report. A survey of the reports showed that the contribution of bromide anions to coordination is questionable. Copper has four coordination sites which belong to two mole bidentate ligand (*N,N*) and

bromide anions are located outside the coordination sphere. However, in this work, copper has six coordination sites which belong to two mole terdentate ligand (*N,N,O*) and bromide anions are located outside the coordination sphere. The band of the ligand assigned to free  $\nu_{OH}$  at ca 3380 cm<sup>-1</sup> disappears due to coordination. The bromo complex shows no band in the IR region assignable to free  $\nu_{OH}$ . Thus, the complex contains a terdentate ligand, as it is demonstrated by the absence of the band assigned to free  $\nu_{OH}$ , rather than a bidentate ligand as suggested by Breckenridge (1948) and later by Miller and Theriot (1976). However, in the presence of different anions, several papers suggested both five- and six-coordinate geometries of the Cu(II) complexes of the ligand. X-ray data of the complexes indicate that the coordination number of Cu(II) is affected by the kind

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