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Letters to the Editor

Synthesis and structure of the first dinuclear gold complex with the Au—Au bond containing no bridging ligands*

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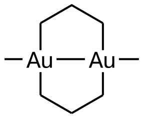
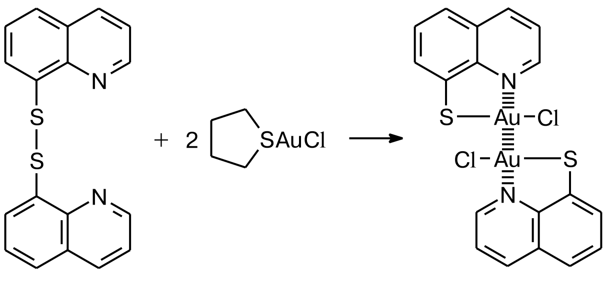
Analysis of the published data demonstrated that the oxidation state +2 is very rare for gold. It was established that gold(II) compounds are formed as intermediates in redox reactions involving complexes of gold in stable oxidation states, *viz.*, gold(I) and gold(III). Divalent gold compounds synthesized earlier are unstable,[1] except for compounds in which two Au atoms are not only involved in the Au—Au bond but are also linked *via* a pair of bridging ligands (for example, diphosphine ligands).



We prepared a stable divalent gold compound. The reaction of tetrahydrothiophenegold chloride[2] with di(8-quinolyl) disulfide in a mixture of chloroform and dichloromethane afforded bis(quinolin-8-ylthio)digold dichloride (**1**) as an air-stable dark-brown crystalline compound. Complex **1** melts with decomposition at 230 °C and is very poorly soluble in all organic solvents. The latter fact did not allow us to study **1** by NMR spectroscopy.

Found (%): C, 27.50; H, 1.56; Au, 50.16; Cl, 9.04. $C_9H_6AuClNS$. Calculated (%): C, 27.53; H, 1.54; Au, 50.17; Cl, 9.03.

The ESR study demonstrated that the reaction product is diamagnetic.



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According to the results of X-ray diffraction study, complex **1** has a dinuclear structure. In the crystal, molecules **1** occupy special positions on twofold symmetry axes (molecular symmetry of the complex is C_2). The Au atoms have a planar-square coordination formed by the Au—Cl bonds as well as by the Au—S and Au—N bonds of the mercaptoquinoline ligand. The Au—N bond is in a

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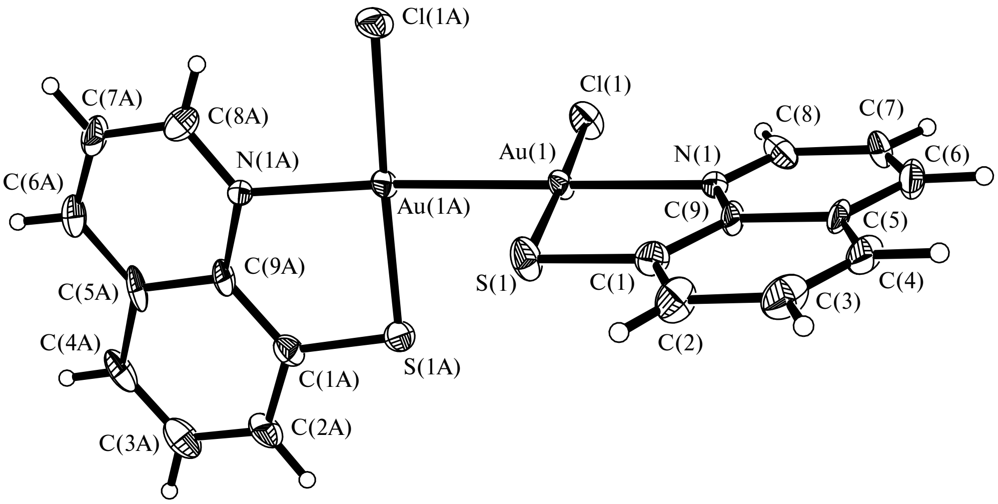

Fig. 1. Structure of complex **1**.

trans position with respect to the Au—Au bond (Fig. 1). Therefore, although complex **1** contains formally divalent gold, the coordination environment of each metal atom in this complex is typical of $\mathrm{Au^{III}}$.

X-ray diffraction study was carried out on a Bruker SMART CCD diffractometer. The crystals of $[\mathrm{C_9H_6AuClNS}]_2$ are monoclinic, space group $C2/c$, a = 13.8678(4) Å, b = 10.3657(4) Å, c = 13.4957(5) Å, α = 90.000(2)°, β = 96.259(1)°, γ = 90.000(2)°, V = 1928.4(1) $\mathrm{Å^3}$, ρ = 2.705 g $\mathrm{cm^{-3}}$, Z = 4, T = 153.0(2) K, R_1 = 0.0445, wR_2 = 0.1064.

The pairs of the Au(1)—Cl(1) and Au(1a)—Cl(1a), Au(1)—S(1) and Au(1a)—S(1a), Au(1)—N(1) and Au(1a)—N(1a) bonds have equal lengths (2.328(2), 2.265(2), and 2.186(8) Å, respectively), which is consistent with the published data[3] on gold compounds in different oxidation states.

The Au—Au bond lengths in $\mathrm{Au^{II}}$ complexes vary in the range of 2.52—2.69 Å. The Au—Au bond length in the complex under consideration (2.5355(5) Å) is close to the lower limit of this range. Apparently, this short Au—Au bond additionally stabilizes the complex. The structure of the complex under consideration is the only example of complexes with formally divalent gold without bridging ligands.

Based on the geometry of the complex, the hybridization of the gold atoms can be represented as $\mathrm{sp}_x\mathrm{d}_{x^2-y^2}$.

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