1,2,4-Triazolyl-4-acetate: a ditopic ligand combining soft and hard donor sites in homometallic (Ag^{I}) and heterometallic (Ag^{I}/U^{VI}) coordination polymers

Autorzy

Ganna A. Senchyk

Andrey B. Lysenko

Harald Krautscheid

Eduard B. Rusanov

Mirosław Karbowiak

Konstiantyn V. Domasevitch

Rok wydania

2022

Czasopismo

CrystEngComm

Numer woluminu

24

Strony

2241-2250

DOI

10.1039/d1ce01549d

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

1,2,4-Triazol-4-yl-acetic acid (*trGly-H*) has been used as a heterobifunctional ligand for preparing homometallic (Ag^{I}) and heterometallic (Ag^{I}/U^{VI}) coordination polymers under hydrothermal conditions. Four coordination compounds, $[Ag_4(trGly)_4]\cdot 2H_2O$ (**1**), $[Ag_4(trGly)_2(trGly\text{-}H)_2](NO_3)_2\cdot 2H_2O$ (**2**), $[(UO_2)\{Ag_4(trGly)_4(NO_3)_2(H_2O)\}]\cdot 4H_2O$ (**3**) and $[(UO_2)_2\{Ag_6(trGly)_{10}\}]\cdot 7H_2O$ (**4**), have been synthesized and structurally characterized. Compounds **1** and **2** are similar and consist of tetranuclear $[Ag_4(tr)_4(COO)_2]$ secondary building units (SBUs) supported by four [–N–N–] triazole bridges in the $\{Ag_4\}$-cluster plane and two carboxylate functions in the axial positions, which link the rhomboid units together into a thick layer. Addition of uranyl ions in the reaction system leads to compounds **3** and **4**, where *tr*- and $–COO^{–}$-functional groups are differentiated by their coordination role: *tr* binds Ag^{+} ions, while $–COO^{–}$ interacts with UO_2^{2+}. The crystal structure of **3** includes tetranuclear $[Ag_4(tr)_4(NO_3)_2]$ units linked by four [–N–N–] triazoles and two nitrate anions above and below the cluster core. In **3**, uranium in a pentagonal bipyramidal $\{UO_7\}$ arrangement forms “cation–cation” interactions with Ag^{I} centers (the Ag⋯OUO distance is short, 2.600 Å). The 3D framework of compound **4** is constructed from hexanuclear $[Ag_6(tr)_{10}]$ SBUs in a form of hexagonal twisted prisms that are further stacked into a column motif through argentophilic (Ag⋯Ag) interactions of 3.06 Å. To explore the $AgNO_3/trGly\text{-}H/UO_2(NO_3)_2\cdot 6H_2O$ system, the composition space diagram approach was employed. The defined crystallization fields of the compounds show that complex **3** is the dominant product, while **4** appears only in a high ligand concentration range. The thermal behavior and solid-state photoluminescence properties of the compounds have been investigated.