

Article

Silver(I) 2,2'-(1,2-Phenylenedisulfanediyl)diacetic Acid as a Molecular Building Block for a Silver(I)-Cadmium(II) Coordination Polymer

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Abstract: Starting from heterotopic multidentate ligand 2,2'-(1,2-phenylenedisulfanediyl)diacetic acid, (*Rs,Rs,Rs,Rs/Ss,Ss,Ss,Ss*)-[Ag{1,2-C₆H₄(SCH₂COOH)₂-κ²*S,S'*}]₂BF₄ (**1**) was prepared and further used as a building block for the synthesis of heterobimetallic Ag-Cd coordination polymer [Ag₂Cd₂{1,2-(OOCCH₂S)₂C₆H₄]₃(H₂O)₃·5H₂O]_n (**2**). Both complexes were characterized by X-ray structure analysis and conventional spectroscopic techniques.

Keywords: 2,2'-(1,2-phenylenedisulfanediyl)diacetic acid; silver(I) complex; mixed Ag-Cd coordination polymer

1. Introduction

Although the chemistry of coordination polymers has received much attention during the last decade, not only due to their interesting architectures [1] but also because of their potential applications in gas storage [2–4], nonlinear optics [5,6], or catalysis [7,8], and interesting magnetic [9,10] or luminescence [11] properties, the synthesis of such polymers with predictable geometries and structures is still a challenge [12,13]. Increasing attention has been paid in recent years to rational synthetic approaches for the assembly of target structures [14,15]. The key step of this approach is the design of molecular building blocks which can direct the formation of the desired architecture and functionality of the target compound.

Platinum(II) [16], manganese(II) [17–19], rhodium(II) [20], and copper(I) [21] complexes with bifunctional ligands were successfully used as “metalloligands” for rational construction of coordination polymers. Furthermore, heterobimetallic coordination polymers (e.g., Ln-Ba, Ln-Na, and Ln-Ca) that retain the luminescence properties of the mononuclear Ln complexes used as starting materials were obtained by a stepwise approach [22,23]. Nanoporous heterobimetallic Cd-Ag and heterotrimetallic Zn-Cd-Ag polymers were prepared from tris-chelate metalloligands (Cd, Zn) with 1,3-bis(4'-cyanophenyl)-1,3-propanedione as multifunctional chelate ligand and silver(I) salts [24]. Two one-dimensional heterotrimetallic Zn-Cd-Ag polymers with dicyanoargentate(I) bridges were obtained from a mixture of the metal salts and the nitronyl nitroxide radical ligand [25]; similarly, the mixed-ligand Ag-Cd heterometallic coordination polymer poly[bis(μ_3 -thiocyanato- κ^3N,S,S')(μ_2 -thiocyanato- κ^2N,S)(4'-*p*-tolyl-2,2':6',2''-terpyridine- κ^3N,N',N'')cadmium(II)silver(I)] was obtained from the corresponding metal salts and 4'-*p*-tolyl-2,2':6',2''-terpyridine [26].

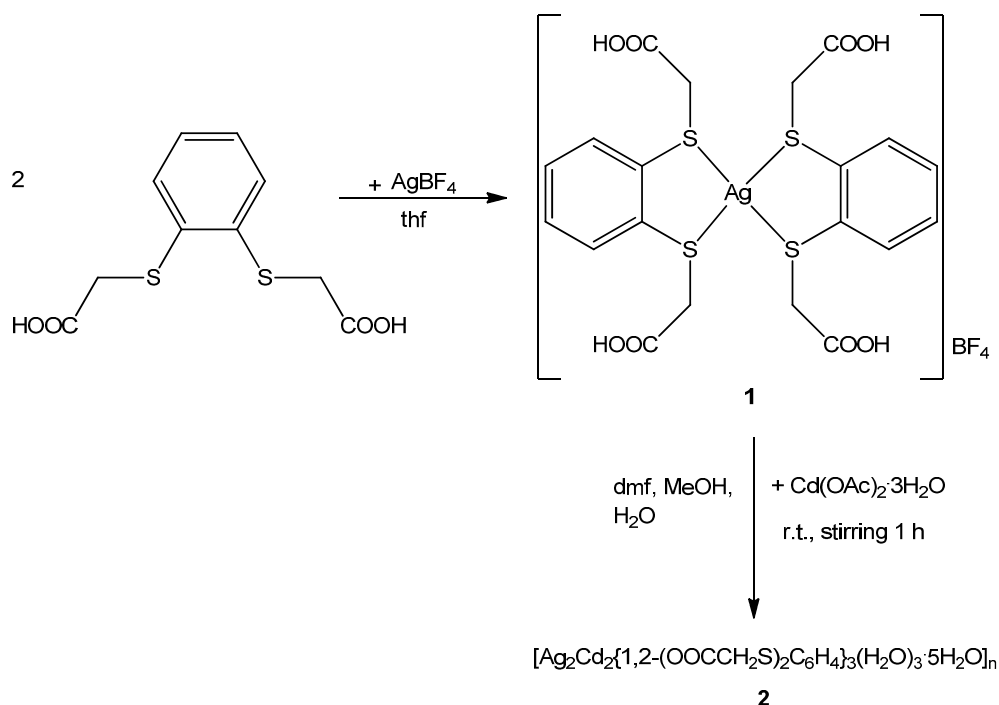
Here, we report the synthesis of a mononuclear silver(I) complex from heterotopic multidentate ligand 2,2'-(1,2-phenylenedisulfaneyl)diacetic acid, which was further used as a molecular building block for the synthesis of a Ag-Cd heterobimetallic coordination polymer.

2. Results and Discussion

2.1. Synthesis of **1** and **2**

With the goal of obtaining heterobimetallic coordination polymers through rational synthesis, the monomeric silver(I) complex of 2,2'-(1,2-phenylenedisulfaneyl)diacetic acid was prepared by heating the ligand with AgBF₄ (2:1) in tetrahydrofuran (thf) for five minutes. The ligand 2,2'-(1,2-phenylenedisulfaneyl)diacetic acid coordinates via both sulfur atoms in a chelating manner, leaving the carboxyl groups uncoordinated. Thus, it should be possible to employ complex **1** as a building block to construct extended networks. Accordingly, **1** reacts with Cd(OAc)₂·3H₂O (1:1) in dmf:H₂O:MeOH (1:2:2.5) at room temperature for one hour to give heterobimetallic Ag-Cd coordination polymer **2** (Scheme 1).

Complex **1** was characterized by ¹H, ¹¹B{¹H}, ¹⁹F{¹H}, ¹³C{¹H} NMR and IR spectroscopy and elemental analysis, and insoluble polymer **2** by IR spectroscopy and elemental analysis. Furthermore, single crystals suitable for X-ray crystallography could be obtained for both compounds.



Scheme 1. Synthesis of **1** and **2**.

2.2. Molecular Structures of **1** and **2**

Suitable crystals of **1** for X-ray structure analysis were obtained from thf at $-20\text{ }^\circ\text{C}$. Complex **1** crystallizes in the tetragonal space group $P\bar{4}n2$ with two molecules in the unit cell. In addition, eight thf molecules are also present in the unit cell. The structural motif of the $[\text{Ag}\{1,2\text{-C}_6\text{H}_4(\text{SCH}_2\text{COOH})_2\text{-}\kappa^2\text{S},\text{S}'\}_2]^+$ cation in monomeric complex **1** is a distorted AgS_4 tetrahedron with small $\text{S}(1)\text{-Ag}(1)\text{-S}(1')$ bite angles ($83.67(3)^\circ$) and large adjacent $\text{S}(1)\text{-Ag}(1)\text{-S}(1'')$ ($140.05(3)^\circ$) and $\text{S}(1)\text{-Ag}(1)\text{-S}(1''')$ ($110.10(3)^\circ$) bond angles. The metal center is located on a special position (three C_2 axes) with site symmetry (222) [27] (Figure 1, Table 1).

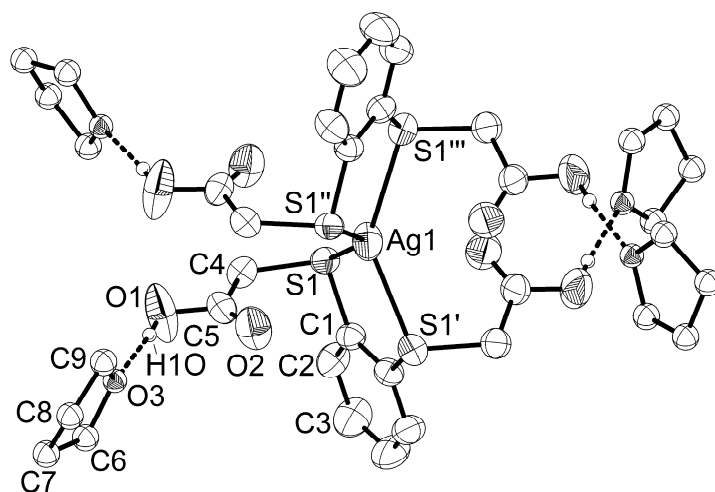


Figure 1. Molecular structure and atom labeling scheme for the silver complex cation in **1**. Each acetic acid proton (H10) is hydrogen-bonded to a thf molecule. The BF_4^- anion, CH protons, and noncoordinating thf molecules are omitted for clarity.

Table 1. Selected bond lengths (Å) and angles (°) in **1**.

Ag(1)–S(1)	2.5518(8)	S(1)–Ag(1)–S(1')	83.67(3)
S(1)–C(1)	1.778(3)	S(1)–Ag(1)–S(1'')	140.05(3)
S(1)–C(4)	1.805(3)	S(1)–Ag(1)–S(1''')	110.10(3)
F(1)–B(1)	1.343(3)	F(1)–B(1)–F(1')	109.8(1)
O(1)–C(5)	1.307(4)		
O(1)–H(1o)	0.82(5)		
O(2)–C(5)	1.182(4)		
O(3)–C(9)	1.394(7)		
O(3)–C(6)	1.427(8)		

A distorted tetrahedral coordination geometry of silver ions was also observed in the related homoleptic discrete silver(I) complex cations $[\text{Ag}\{1,2\text{-C}_2\text{H}_4(\text{SCH}_2\text{Ph})_2\text{-}\kappa^2\text{S,S}'\}_2]^+$ (Ag–S 2.590(1) to 2.604(1) Å, S–Ag–S bite angles 85.17(5) and 86.58(5)°) [28] and $[\text{Ag}\{1,2\text{-C}_2\text{H}_4(\text{SCH}_2\text{CH}_2\text{CH}_2\text{COOH})_2\text{-}\kappa^2\text{S,S}'\}_2]^+$ (Ag–S 2.55(2) to 2.60(2) Å, S–Ag–S bite angle 86(1)°) [29]. The Ag(1)–S(1) bond length in **1** (2.5518(8) Å) is in the range of reported values [21,22,30]. The five-membered AgS_2C_2 rings are almost planar (deviation of C(1) and C(1') from plane: 0.02 Å). The sulfur atoms are in a tetrahedral environment (three substituents and one lone pair of electrons) and are thus chiral. Due to the presence of three perpendicular C_2 axes at the silver center, all four sulfur atoms have the same configuration (either all *R* or all *S*).

The four carboxyl groups are noncoordinating, but each forms hydrogen bonds with one thf molecule (O(3)⋯H(1O) 1.80(5) Å, O(3)⋯O(1) 2.608(5) Å, O(3)⋯H(1O)–O(1) 174(5)°) (Figure 1). The BF_4^- anion is located on a fourfold inversion axis with ideal tetrahedral symmetry.

Colorless crystals of **2** were obtained at room temperature in three days from a solvent mixture of dmf, MeOH, and H_2O . Polymer **2** crystallizes in the monoclinic space group $P2_1$ with two formula units in the unit cell. Five water molecules are present in the asymmetric unit.

Polymer **2** contains three types of $\text{C}_6\text{H}_4(\text{SCH}_2\text{COO})_2^{2-}$ anions (Figure 2) which differ from each other in their coordination mode with the metal ions (Cd^{2+} is exclusively coordinated by oxygen, whereas Ag^+ is preferably coordinated by sulfur), as well as in the deviation of the SCH_2COO groups from the plane of the benzene ring. The silver ions are no longer coordinated in a chelating fashion by four sulfur atoms of two neutral ligands but by three sulfur atoms from three different $\text{C}_6\text{H}_4(\text{SCH}_2\text{COO})_2^{2-}$ dianions and by one carboxylate oxygen atom.

In type 1, the $\text{C}_6\text{H}_4(\text{SCH}_2\text{COO})_2^{2-}$ anion acts as a tetradentate ligand, bridging two silver and two cadmium ions. Each sulfur atom coordinates to a silver ion. One of the silver ions is also coordinated in a chelating fashion by one carboxylate oxygen atom, which also coordinates to a cadmium ion. The second cadmium ion is coordinated by an oxygen atom from the second carboxylate group. One SCH_2COO group is almost coplanar with the benzene ring, while the other is located out of the plane, and torsion angles $C_{\text{aryl}}\text{-S-C}_{\text{alkyl}}\text{-C}$ are 169.16(1)° and –85.94(1)°, respectively. The type 2, a hexadentate $\text{C}_6\text{H}_4(\text{SCH}_2\text{COO})_2^{2-}$ anion bridges two silver and four cadmium ions, each oxygen atom being involved in coordination with a different cadmium ion, while each sulfur atom coordinates to a silver ion. Like in type 1, only one SCH_2COO group is almost coplanar with the plane of the benzene ring, and the torsion angles $C_{\text{aryl}}\text{-S-C}_{\text{alkyl}}\text{-C}$ are 165.04(1)° and –68.38(1)°. In the third type of

coordination, type 3, the $C_6H_4(SCH_2COO)_2^{2-}$ anion acts as a pentadentate ligand bridging two silver and two cadmium ions. Each sulfur atom coordinates to a silver ion. One of the silver ions is also coordinated in a chelating fashion by one carboxylate oxygen atom, and the second oxygen atom of this carboxylate group coordinates to a cadmium ion. The second cadmium ion is coordinated by an oxygen atom from the second carboxylate group. Again, one SCH_2COO group is almost coplanar with the benzene ring, while the other is located out of the plane, and the torsion angles $C_{aryl}-S-C_{alkyl}-C$ are $-175.14(1)^\circ$ and $81.22(1)^\circ$, respectively.

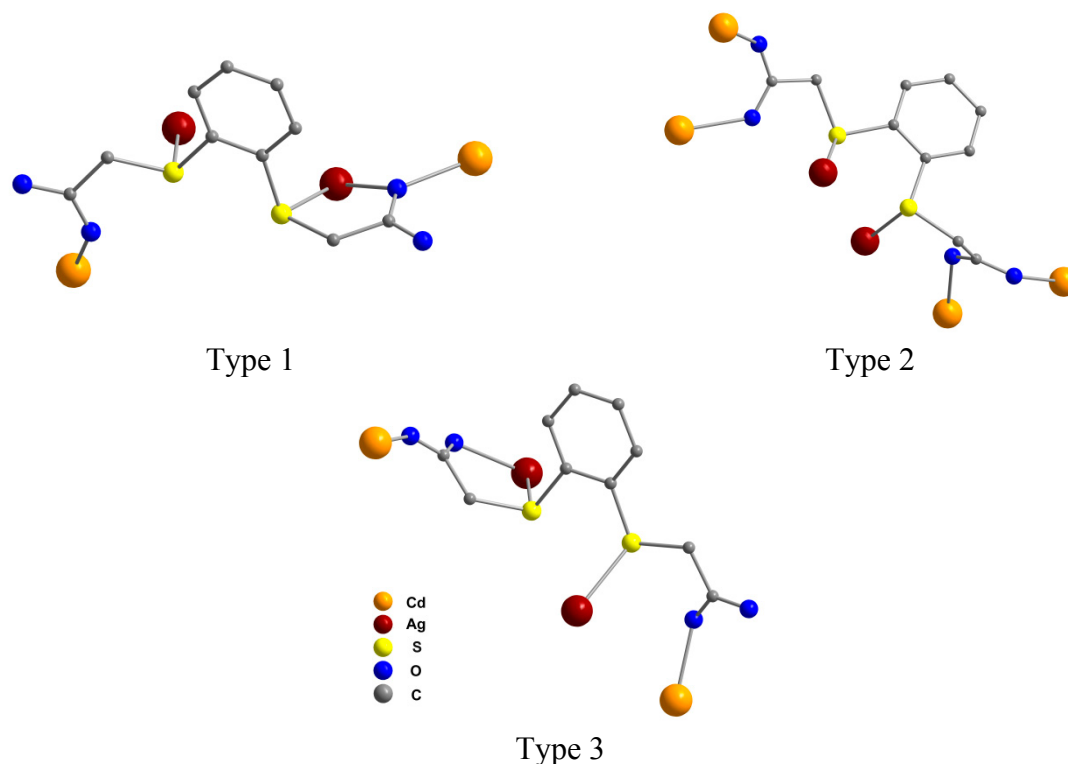


Figure 2. Observed coordination modes of $C_6H_4(SCH_2COO)_2^{2-}$ in polymer **2**: tetradentate ligand (type 1), hexadentate (type 2), or pentadentate (in type 3).

In **2**, two types of Cd^{2+} ions ($Cd(1)$ and $Cd(2)$) and two types of Ag^+ ions ($Ag(1)$ and $Ag(2)$) are present. The $Cd(1)$ ions are pentacoordinated in a square-pyramidal fashion by three carboxylate oxygen atoms from three different $C_6H_4(SCH_2COO)_2^{2-}$ anions and by two oxygen atoms from two coordinating water molecules. The $Cd(2)$ ions are hexacoordinated in a distorted octahedral fashion by four carboxylate oxygen atoms from four different $C_6H_4(SCH_2COO)_2^{2-}$ anions and two oxygen atoms from two coordinating water molecules. The $Cd(1)$ and $Cd(2)$ ions are bridged by one oxygen atom ($O(14)$) from a water molecule which coordinates to both metal ions (Figure 3, Table 2). The $Cd-O_{carboxylate}$ bond lengths range from 2.255(2) to 2.295(2) Å and are in agreement with those observed for similar compounds [31–33]. The $Cd-O_{water}$ bond lengths vary from 2.247(2) Å ($Cd(1)-O(13)$) and 2.268(3) Å ($Cd(2)-O(15)$) for the terminal water molecules to 2.301(2) Å ($Cd(1)-O(14)$) and 2.344(2) Å ($Cd(2)-O(14)$) for the bridging water molecule.

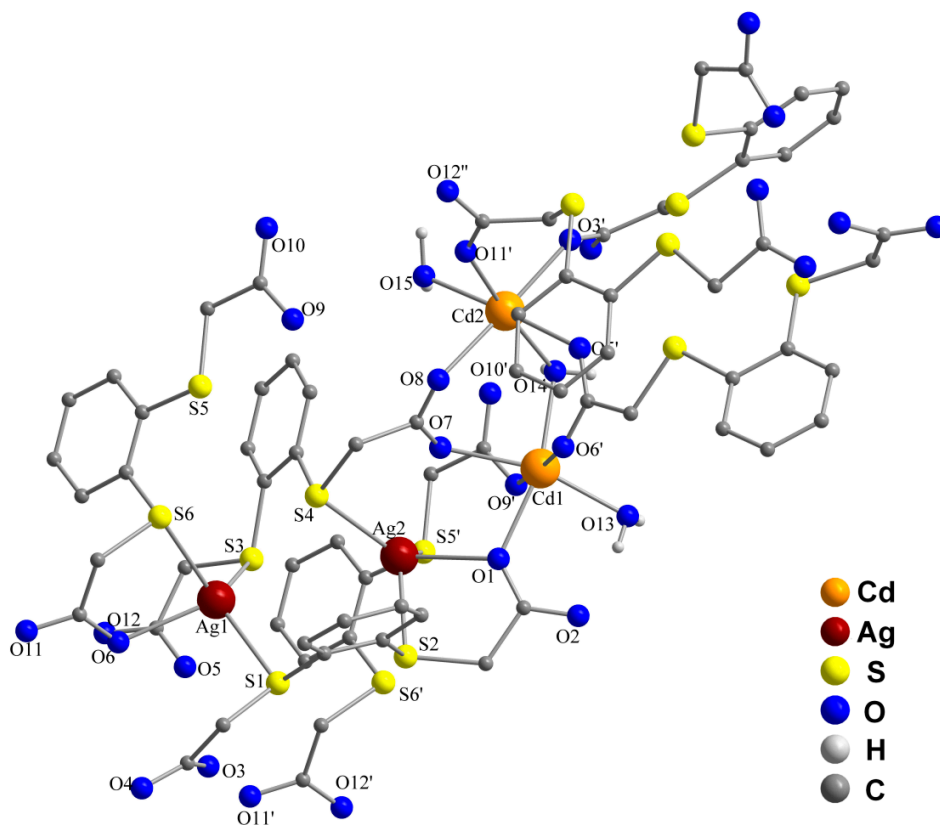


Figure 3. Coordination environments of the silver and cadmium ions and atom labeling in **2**. Hydrogen atoms other than O–H and the noncoordinating water molecules were omitted for clarity.

Table 2. Selected bond lengths (Å) and angles (°) in **2**.

Cd(1)–O(1)	2.282(2)	O(1)–Cd(1)–O(7)	76.97(7)
Cd(1)–O(6')	2.255(2)	O(6')–Cd(1)–O(13)	90.66(8)
Cd(1)–O(7)	2.295(2)	O(7)–Cd(1)–O(13)	162.48(8)
Cd(1)–O(9')	2.275(2)	O(7)–Cd(1)–O(9)	79.70(7)
Cd(1)–O(13)	2.247(2)	O(9)–Cd(1)–O(13)	91.32(8)
Cd(1)–O(14)	2.301(2)	O(13)–Cd(1)–O(14)	107.07(8)
Cd(2)–O(3')	2.263(2)	O(3')–Cd(2)–O(8)	176.54(8)
Cd(2)–O(5')	2.319(2)	O(3')–Cd(2)–O(11')	92.15(8)
Cd(2)–O(8)	2.289(2)	O(3')–Cd(2)–O(15)	97.57(1)
Cd(2)–O(11')	2.260(2)	O(5')–Cd(2)–O(8)	91.68(8)
Cd(2)–O(14)	2.344(2)	O(8)–Cd(2)–O(15)	82.73(1)
Cd(2)–O(15)	2.268(3)	O(11')–Cd(2)–O(14)	174.21(8)
Ag(1)–O(12)	2.434(2)	O(12)–Ag(1)–S(1)	97.80(5)
Ag(1)–S(1)	2.534(8)	O(12)–Ag(1)–S(3)	124.95(5)
Ag(1)–S(3)	2.571(7)	S(1)–Ag(1)–S(3)	116.24(2)
Ag(1)–S(6)	2.592(8)	S(1)–Ag(1)–S(6)	126.86(2)
Ag(2)–O(1)	2.482(2)	O(1)–Ag(2)–S(4)	118.42(6)
Ag(2)–S(2)	2.604(8)	O(1)–Ag(2)–S(2)	73.15(5)
Ag(2)–S(4)	2.548(7)	S(2)–Ag(2)–S(5')	120.37(2)
Ag(2)–S(5')	2.527(7)	S(4)–Ag(2)–S(2)	106.58(2)

Both silver ions Ag(1) and Ag(2) are tetracoordinated in a distorted trigonal-pyramidal fashion by two sulfur atoms from two different $C_6H_4(SCH_2COO)_2^{2-}$ and by one sulfur atom and one carboxylate oxygen atom from a third dicarboxylate anion. The ions Ag(1) and Ag(2) are bridged by two sulfur atoms of the same ligand molecule ($Ag(1)\cdots Ag(2)$ 4.350(1) Å). The Ag–S bond lengths (2.527(7) Å to 2.604(8) Å) are in the same range as those of the starting material **1** (2.552(8) Å). The Ag–O bonds (2.434(2) Å and 2.482(2) Å) are shorter than those observed in *catena*-[(μ_2 -benzene-1,3-dicarboxylato)-bis(μ_2 -3,3',5,5'-tetramethyl-4,4'-bipyrazole)disilver(I)] (2.615(2) Å and 2.672(2) Å) [34].

The structure extends to a two-dimensional network parallel to the *C* face (Figure 4). The water molecules of solvation interconnect the two-dimensional sheets via hydrogen bonding, giving rise to a three-dimensional supramolecular network (Figure 5a,b). The five noncoordinating water molecules are involved in hydrogen bonding between themselves ($H\cdots O$ 1.69 Å to 1.93 Å and $O\cdots O$ 2.649(5) Å to 2.870(5) Å), with the water molecules coordinated to the cadmium ions ($H(30O)\cdots O(17)$ 1.93 Å, $H(31O)\cdots O(18)$ 1.69 Å, $O(15)-H(30O)\cdots O(17)$ 2.894(5) Å, $O(15)-H(31O)\cdots O(18)$ 2.649(5) Å), and also with carboxylate hydrogen atoms which belong to different sheets ($H\cdots O$ 1.81 Å to 2.07 Å and $O\cdots O$ 2.752(5) Å to 3.018(4) Å).

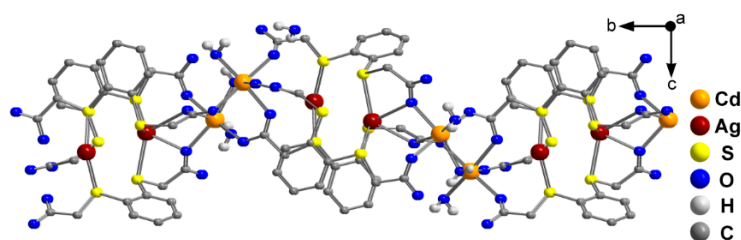


Figure 4. Two-dimensional layered structure of **2**, viewed along the *a* axis.

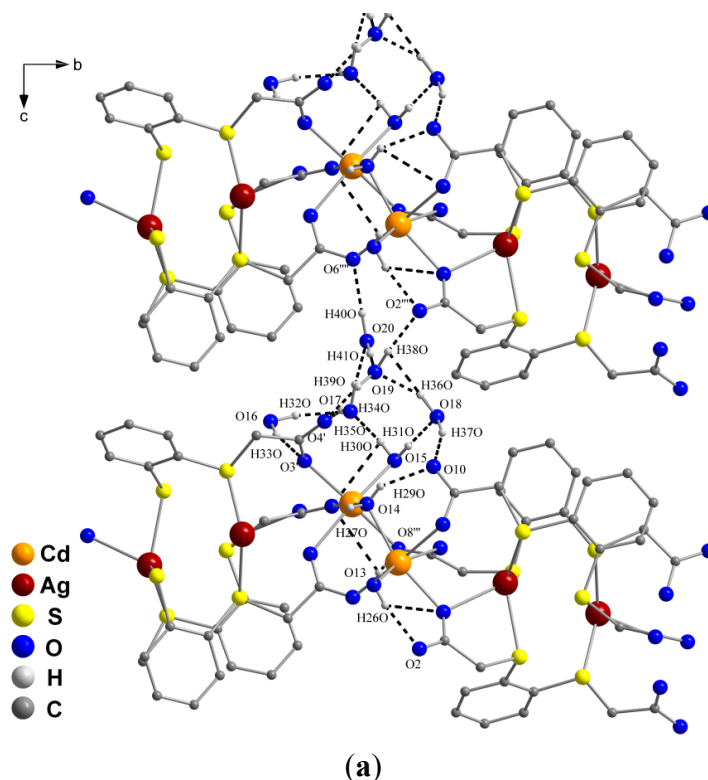


Figure 5. *Cont.*

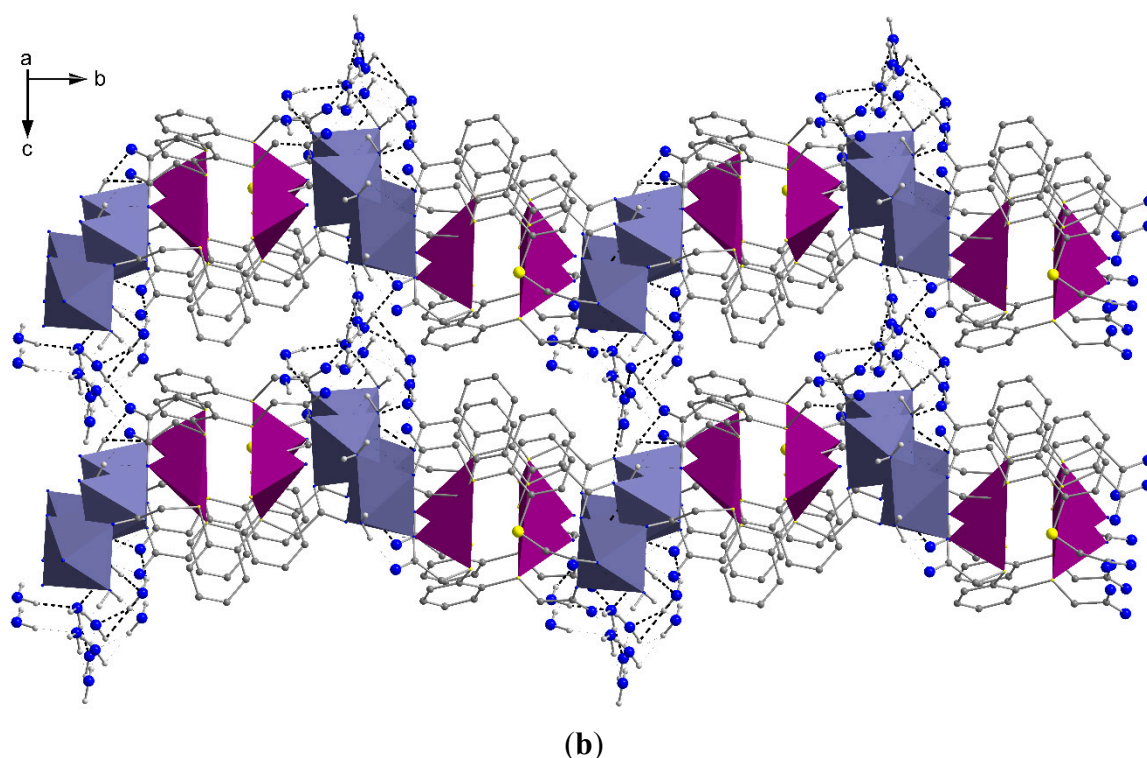


Figure 5. Three-dimensional hydrogen-bonded network of **2** (dashed lines) (a) with atom labeling and (b) with coordination polyhedra (blue-gray polyhedra denote the coordination environment of cadmium ions, and violet polyhedra the coordination environment of the silver ions).

3. Experimental Section

3.1. General Procedures

All manipulations for the synthesis of compound **1** were carried out in an inert atmosphere of dry nitrogen and in the absence of light; the synthesis of **2** was performed in air. 2,2'-(1,2-Phenylenedisulfanediy)diacetic acid [35,36] was prepared according to literature methods; AgBF_4 and $\text{Cd}(\text{OAc})_2 \cdot 3\text{H}_2\text{O}$ were commercially available. The thf was dried over sodium/benzophenone, distilled under an atmosphere of dry argon, and stored over potassium mirror. CD_3OD for NMR spectroscopy was kept in an inert atmosphere of dry argon over molecular sieves. The NMR spectra were recorded on a Bruker Avance DRX-400 spectrometer. Chemical shifts are quoted in ppm relative to tetramethylsilane. Elemental analysis was performed with a Vario EL-Heraeus microanalyzer. IR spectra were recorded with a Perkin-Elmer System 2000 in the range $4000\text{--}400\text{ cm}^{-1}$ in KBr pellets.

3.2. Synthesis of $(R_S,R_S,R_S,R_S/S_S,S_S,S_S,S_S)\text{-[Ag}\{1,2\text{-C}_6\text{H}_4(\text{SCH}_2\text{COOH})_2\text{-}\kappa^2\text{S,S'}\}_2\text{]BF}_4$ (**1**)

A solution of AgBF_4 (0.21 g, 1.08 mmol) in thf (20 mL) was added dropwise over a period of 5 min to a solution of 2,2'-(1,2-phenylenedisulfanediy)diacetic acid (0.63 g, 2.44 mmol) in thf (15 mL). The reaction mixture was heated to reflux for 5 min. The solvent volume was reduced in vacuum to yield a white precipitate. Recrystallization from thf under a nitrogen atmosphere at $-20\text{ }^\circ\text{C}$ gave **1** (0.41 g, 38%) as air-stable colorless crystals. M.p. $73\text{ }^\circ\text{C}$. Elemental Anal. Calc. for $\text{C}_{20}\text{H}_{20}\text{AgBF}_4\text{O}_8\text{S}_4 \cdot 4\text{thf}$: C

43.25; H 5.24. Found: C 39.66; H 4.74%. The lower values indicate loss of thf (calculated for $C_{20}H_{20}AgBF_4O_8S_4 \cdot 2thf$: C 39.31; H 4.24) as was also observed by 1H -NMR spectroscopy. 1H -NMR (CD_3OD): δ = 1.86 (m, 8H, CH_2 in thf), 3.72 (m, 8H, CH_2 in thf), 3.96 (s, 8H, SCH_2), 7.44 (d, 4H, CH), 7.77 (d, 4H, CH). $^{13}C\{^1H\}$ NMR (CD_3OD): δ = 25.1 (s, CH_2 in thf), 38.8 (s, SCH_2), 67.5 (s, CH_2 in thf), 129.5 (s, CH), 133.0 (s, CH), 134.4 (s, SC), 170.7 (s, COOH). IR (KBr, cm^{-1}): $\tilde{\nu}$ = 3440 (s, $\nu(O-H)$), 2951 (s), 1705 (s, $\nu(C=O)$), 1568 (w), 1431 (m), 1386 (m), 1318 (s), 1043 (s, $\nu(B-F)$), 902 (m), 810 (m), 755 (s), 668 (m).

3.3. Synthesis of $[Ag_2Cd_2\{1,2-(OOCCH_2S)_2C_6H_4\}_3(H_2O)_3 \cdot 5H_2O]_n$ (**2**)

A solution of complex **1** (0.20 g, 0.28 mmol) and $Cd(OAc)_2 \cdot 3H_2O$ (0.075 g, 0.26 mmol) in a mixture of dmf (4 mL), MeOH (10 mL), and H_2O (8 mL) was stirred at room temperature for one hour. The reaction mixture was filtered and the resulting solution was kept unsealed in air. Colorless crystals of **2** (0.12 g, 44%) were formed in three days. The crystals were isolated by filtration and washed twice with H_2O (10 mL). Elemental Anal. Calc. for $C_{30}H_{30}Ag_2Cd_2O_{15}S_6 \cdot 5H_2O$: C: 26.62; H: 2.98. Found: C: 25.68; H: 2.50%. IR (KBr, cm^{-1}): $\tilde{\nu}$ = 3451 (s, $\nu(O-H)$), 2930 (w, $\nu(CH)$), 2364 (w), 2057 (w), 1620 (m), 1477 (w), 1384 (m, $\nu(C-O)$), 1224 (w), 1042 (w), 900 (w), 813 (m), 754 (m), 691 (w), 638 (m), 561 (m), 523 (m).

3.4. X-ray Structure Determination

Data for **1** were collected on a Siemens CCD diffractometer (SMART) [37] in ϕ -scan mode using $MoK\alpha$ radiation ($\lambda = 0.71073 \text{ \AA}$). Data reduction was performed with SAINT [38], including the program SADABS [39] for empirical absorption correction. Data for **2** were collected on a CCD Gemini diffractometer (Agilent Technologies) in ω -scan mode using $MoK\alpha$ radiation ($\lambda = 0.71073 \text{ \AA}$). Data reduction was performed with CrysAlis Pro including analytical numeric absorption correction using a multifaceted crystal model based on expressions derived by Clark and Reid [40]. All structures were solved by direct methods [41,42] and the refinement of all atoms was performed with SHELXL-97 [31]. With the exception of thf molecules, all hydrogen atoms for **1** were located in difference Fourier maps calculated at the final stage of structure refinement. For **2**, all H atoms except those of the water molecules $H_2O(13)$ and $H_2O(14)$ were calculated on idealized positions. Structure figures were generated with ORTEP [43] and DIAMOND-3 [44]. CCDC 877467 (**1**) and 877468 (**2**) contain the supplementary crystallographic data for this paper [45]. A summary of the data collection, structure solution, and refinement details for compounds **1** and **2** is given in Table 3.

Table 3. Data collection, structure solution, and refinement details for compounds **1** and **2**.

	1	2
Empirical formula	$C_{20}H_{20}AgBF_4O_8S_4 \cdot 4thf$	$C_{30}H_{30}Ag_2Cd_2O_{15}S_6 \cdot 5H_2O$
$M/g \cdot mol^{-1}$	999.70	1353.52
T/K	213(2)	130(2)
Crystal system	tetragonal	monoclinic
Space group	$P\bar{4}n2$	$P2_1$
$a/\text{\AA}$	12.0071(6)	7.6790(1)

Table 3. Cont.

	1	2
$b/\text{\AA}$	12.0071(6)	24.2111(3)
$c/\text{\AA}$	15.219(1)	11.7500(2)
$\alpha/^\circ$	90	90
$\beta/^\circ$	90	102.175(1)
$\gamma/^\circ$	90	90
$V/\text{\AA}^3$	2194.1(2)	2135.39(5)
Z	2	2
$D_{\text{calcd}}/\text{Mg}\cdot\text{m}^{-3}$	1.513	2.105
μ/mm^{-1}	0.723	2.256
$F(000)$	1032	1332
Reflections collected	11088	48203
Independent reflections	2238 [R(int) = 0.0209]	12977 [R(int) = 0.0290]
Restraints/parameters	0/152	8/557
Goodness of fit on F^2	1.061	0.985
Final R indices [$I > 2\sigma(I)$]	$R1 = 0.0310$ $wR2 = 0.0756$	$R1 = 0.0227$ $wR2 = 0.0519$
R indices (all data)	$R1 = 0.0379$ $wR2 = 0.086$	$R1 = 0.0255$ $wR2 = 0.0524$
Largest diff. peak and hole/ $e\cdot\text{\AA}^{-3}$	0.241 and -0.186	2.186 and -0.759
Absolute structure parameter	$-0.01(4)$	$-0.02(1)$

4. Conclusions

The reaction of 2,2'-(1,2-phenylenedisulfaneyl)diacetic acid with AgBF_4 produced mononuclear silver(I) complex **1**, which was further used as a building block for the synthesis of two-dimensional heterobimetallic Ag-Cd coordination polymer **2**. In the discrete silver(I) complex cation in **1**, the four COOH groups are not coordinated to the metal center but are involved in hydrogen bonding with one thf molecule each. In **2**, the water molecules of solvation interconnect the two-dimensional sheets via hydrogen bonding, giving rise to a three-dimensional supramolecular network.

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Author Contributions

CB prepared compound **1** and analyzed the data; IGG prepared compound **2**, analyzed the data and prepared the first draft of the manuscript; PL performed X-ray crystallography and analyzed the data; LSD analyzed the data and prepared the manuscript; EHH designed research, analyzed the data and prepared the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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