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# Crystal structure of *catena*-poly[bis[$\mu_3$-2-(2-nitrophenyl)acetato-$\kappa^3O:O:O'$]-disilver(I)]

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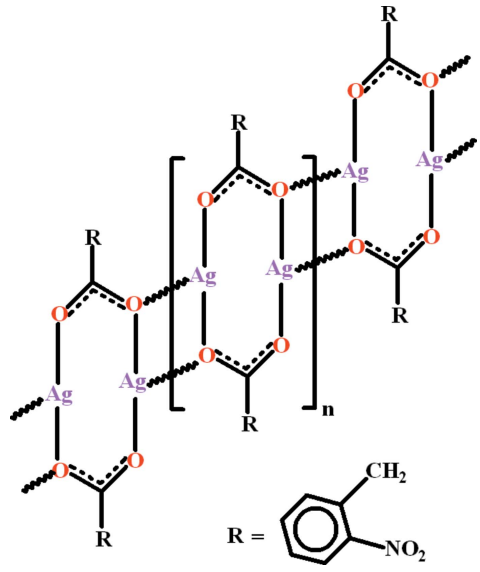
The title compound, $[Ag_2(C_8H_6NO_4)_2]_n$, is a silver complex of 2-(2-nitrophenyl)acetic acid. The molecules are not conventional crystallographic inversion dimers but consist of two independent ligands and two $Ag^I$ ions, each with a distorted T-shaped coordination environment. The dihedral angles between acetate groups and the benzene rings are 51.1 (2) and 57.9 (2)°. The nitro groups are oriented at dihedral angles of 23.6 (5) and 32.3 (3)° with respect to the parent benzene rings. The dimers form polymeric chains along the *a*-axis direction. The Ag···Ag separation within a dimer is 2.8200 (5) and between symmetry-related dimers is 3.6182 (5) Å. The polymeric chains are interlinked by C—H···O hydrogen-bond interactions.

**Keywords:** crystal structure; silver(I) complex; 2-(2-nitrophenyl)acetic acid; hydrogen bonding.

**CCDC reference**: 1060272

## 1. Related literature

For related structures see: Danish *et al.* (2011*a*,*b*, 2015*a*,*b*); Li *et al.* (2011)




## 2. Experimental

### 2.1. Crystal data

$[Ag_2(C_8H_6NO_4)_2]$
$M_r$ = 576.02
Monoclinic, $P2_1/c$
$a$ = 5.5249 (3) Å
$b$ = 15.8838 (10) Å
$c$ = 20.0257 (11) Å
$\beta$ = 96.853 (3)°
$V$ = 1744.83 (17) Å$^3$
$Z$ = 4
Mo $K\alpha$ radiation
$\mu$ = 2.30 mm$^{-1}$
$T$ = 296 K
0.37 × 0.22 × 0.18 mm

### 2.2. Data collection

Bruker Kappa APEXII CCD diffractometer
Absorption correction: multi-scan (*SADABS*; Bruker, 2005)
$T_{min}$ = 0.485, $T_{max}$ = 0.682
14170 measured reflections
3781 independent reflections
3113 reflections with $I > 2\sigma(I)$
$R_{int}$ = 0.027

### 2.3. Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.033
$wR(F^2)$ = 0.066
$S$ = 1.10
3781 reflections
253 parameters
H-atom parameters constrained
$\Delta\rho_{max}$ = 0.47 e Å$^{-3}$
$\Delta\rho_{min}$ = −0.55 e Å$^{-3}$

**Table 1**
Hydrogen-bond geometry (Å, °).

| $D$—H···$A$ | $D$—H | H···$A$ | $D$···$A$ | $D$—H···$A$ |
|---|---|---|---|---|
| C2—H2$B$···O4$^{i}$ | 0.97 | 2.53 | 3.312 (6) | 138 |
| C10—H10$B$···O8$^{ii}$ | 0.97 | 2.35 | 3.205 (6) | 146 |
| C6—H6···O8$^{iii}$ | 0.93 | 2.48 | 3.322 (6) | 151 |
| C15—H15···O7$^{iv}$ | 0.93 | 2.59 | 3.268 (6) | 130 |

Symmetry codes: (i) $x-1, y, z$; (ii) $x+1, y, z$; (iii) $x, -y+\frac{1}{2}, z-\frac{1}{2}$; (iv) $-x+2, y-\frac{1}{2}, -z+\frac{1}{2}$.

Data collection: *APEX2* (Bruker, 2007); cell refinement: *SAINT* (Bruker, 2007); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL2014* (Sheldrick, 2015); molecular graphics:

*ORTEP-3 for Windows* (Farrugia, 2012) and *PLATON* (Spek, 2009); software used to prepare material for publication: *WinGX* (Farrugia, 2012) and *PLATON*.

## Acknowledgements

The authors acknowledge the provision of funds for the purchase of a diffractometer and encouragement by Dr Muhammad Akram Chaudhary, Vice Chancellor, University of Sargodha, Pakistan.

Supporting information for this paper is available from the IUCr electronic archives (Reference: FK2086).

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# supporting information

*Acta Cryst.* (2015). E**71**, m118–m119 [https://doi.org/10.1107/S2056989015007616]

## Crystal structure of *catena*-poly[bis[$\mu_3$-2-(2-nitrophenyl)acetato-$\kappa^3O$:$O$:$O'$]disilver(I)]

**Muhammad Danish, Muhammad Nawaz Tahir, Sana Iftikhar and Nazir Ahmad**

### S1. Structural commentary

We have reported the crystal structure of *catena*- poly[[trimethyltin(IV)]-$\mu$-2-(2-nitrophenyl)acetato-$\kappa^2O$:$O'$] (Danish *et al.*, 2015*a*) and tetra-aqua-bis-[2-(2-nitrophenyl)acetato-$\kappa O$]cobalt(II) (Danish *et al.*, 2015*b*). The title silver complex (I), (Fig. 1) is in continuation of synthesizing various metal complexes with this legand and other studies of these complexes. We have also reported the crystal structures of *catena*-poly[bis-($\mu$3–2-methylbenzoato)disilver(I)] (Danish *et al.*, 2011*a*) and *catena*-poly[bis-($\mu$3–2-methyl-3,5-dinitrobenzoato)disilver (I)] (Danish *et al.*, 2011*b*) which are related to (I). Similarly, the crystal structures of bis(*N*,*N*-dimethylpyridin-4-amine)-((4-hydroxyphenyl) acetato)-silver dihydrate (Li *et al.*, 2011), is related to the title compound.

In (I), the two ligands of (2-nitrophenyl)acetatic acid have been coordinated to to two silver ions making a dimer. The structural behaviour of both ligands is different. In one ligand the acetato moiety *A* (O1/C1/C2/O2) and benzene ring *B* (C3–C8) are planar with r.m.s. deviation of 0.0041 and 0.0091 Å, respectively. The dihedral angle between *A*/*B* is 57.87 (17)°. The nitro group is oriented at a dihedtal angle of 23.6 (5)° with the parent benzene ring. In the second ligand the acetato moiety *C* (O5/C9/C10/O6) and benzene ring *D* (C11—C16) are also planar with r. m. s. deviation of 0.0046 and 0.0147 Å, respectively. The dihedral angle between *C*/*D* is 51.13 (16)°. The adjacent nitro group makes dihedral angle of 32.3 (3)° with *D*. The central eight membered ring (Ag1/O1/C1/O2/Ag2/O5/C9/O6) is not exactly planar. The dimers are interlinked from opposite ends due to Ag—O bonds in the form of one dimensional polymers extending along the *a*-axis. One of the H-atoms of each methlenic group makes H-bonding with adjacent nitro group of parental ligand in the one-dimensional chain. The polymers are interlinked due to C—H···O interactions, where C-atoms are of benzene rings and O-atoms are of nitro groups, therfore, stabilizing the molecules in the form of three dimensional polymeric network ultimately.

### S2. Synthesis and crystallization

The sodium salt of (2-nitrophenyl)acetic acid was prepared in water with one molar ratio of (2-nitrophenyl)acetic acid and Na($HCO_3$). In this solution one mole of silver nitrate $AgNO_3$ (1.08 g) dissolved in water was added and stirred for 5 minutes. Curd white precipitate formed was dissolved by adding few drops of liquid ammonia and kept for crystallization in dark. Needle like colourless crystals were obtained after two weeks.

Yield: 45% Melting Point: 395 K (Decomposes)

### S3. Refinement

Crystal data, data collection and structure refinement details are summarized in Table 1. The H-atoms were positioned geometrically (C–H = 0.93–0.97 Å) and refined riding on the carbon atoms with isotropic displacement parameters $U_{iso}(H) = 1.2U_{eq}(C)$.

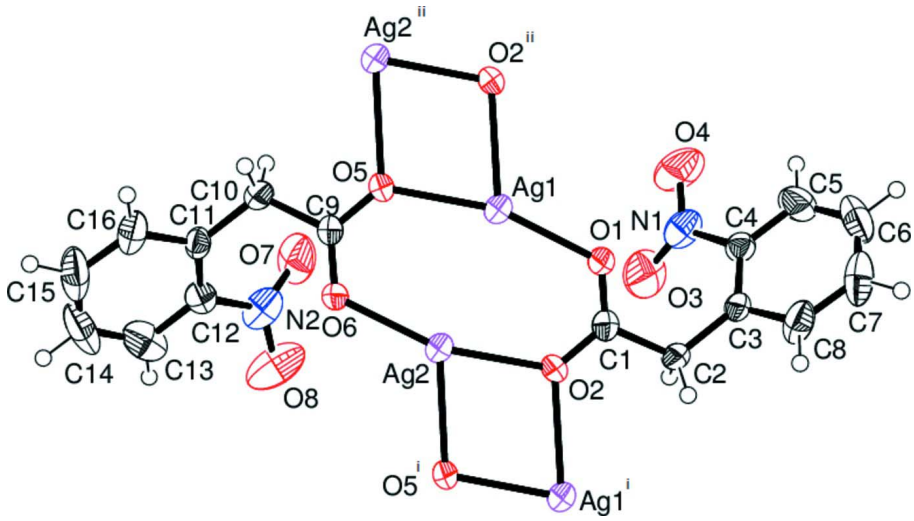


**Figure 1**

Molecular structure of the title compound. Anisotropic displacement ellipsoids are drawn at the 50% probability level. H-atoms are shown by small circles of arbitrary radii.

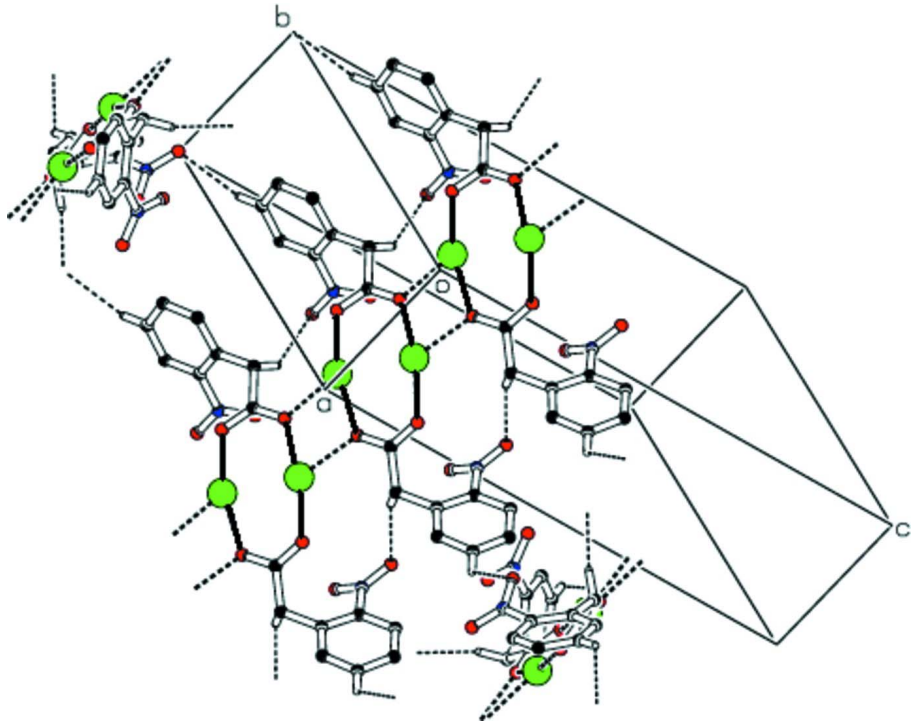


**Figure 2**

Crystal packing which shows that molecules form polymeric network due to interlinkage of dimers. The dimers are interlinked due to H-bondings. The H-atoms not involved in H-bondings are omitted for clarity.

**catena-Poly[bis[$\mu_3$-2-(2-nitrophenyl)acetato-$\kappa^3O:O:O'$]disilver(I)]**

*Crystal data*

$[Ag_2(C_8H_6NO_4)_2]$
$M_r = 576.02$
Monoclinic, $P2_1/c$
$a = 5.5249$ (3) Å
$b = 15.8838$ (10) Å
$c = 20.0257$ (11) Å
$\beta = 96.853$ (3)°
$V = 1744.83$ (17) Å$^3$
$Z = 4$
$F(000) = 1120$
$D_x = 2.193$ Mg m$^{-3}$
Mo $K\alpha$ radiation, $\lambda = 0.71073$ Å
Cell parameters from 3113 reflections
$\theta = 1.6$–$27.0°$
$\mu = 2.30$ mm$^{-1}$
$T = 296$ K
Needle, colorless
0.37 × 0.22 × 0.18 mm

*Data collection*

Bruker Kappa APEXII CCD diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
Detector resolution: 7.80 pixels mm$^{-1}$
$\omega$ scans
Absorption correction: multi-scan (*SADABS*; Bruker, 2005)
$T_{min} = 0.485$, $T_{max} = 0.682$
14170 measured reflections
3781 independent reflections
3113 reflections with $I > 2\sigma(I)$
$R_{int} = 0.027$
$\theta_{max} = 27.0°$, $\theta_{min} = 1.6°$
$h = -7 \rightarrow 7$
$k = -20 \rightarrow 20$
$l = -25 \rightarrow 25$

*Refinement*

Refinement on $F^2$
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)] = 0.033$
$wR(F^2) = 0.066$
$S = 1.10$
3781 reflections
253 parameters
0 restraints
Primary atom site location: structure-invariant direct methods
Secondary atom site location: difference Fourier map
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0165P)^2 + 3.0884P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.47$ e Å$^{-3}$
$\Delta\rho_{min} = -0.55$ e Å$^{-3}$

*Special details*

**Geometry**. All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

**Refinement**. Refinement of $F^2$ against ALL reflections. The weighted $R$-factor $wR$ and goodness of fit $S$ are based on $F^2$, conventional $R$-factors $R$ are based on $F$, with $F$ set to zero for negative $F^2$. The threshold expression of $F^2 > \sigma(F^2)$ is used only for calculating $R$-factors(gt) *etc*. and is not relevant to the choice of reflections for refinement. $R$-factors based on $F^2$ are statistically about twice as large as those based on $F$, and $R$-factors based on ALL data will be even larger.

*Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å$^2$)*

| | $x$ | $y$ | $z$ | $U_{iso}$*/$U_{eq}$ |
|---|---|---|---|---|
| Ag1 | 0.94971 (5) | 0.08333 (2) | 0.04106 (2) | 0.04649 (10) |
| Ag2 | 0.55095 (5) | −0.00701 (2) | 0.08051 (2) | 0.04710 (10) |
| O1 | 0.6850 (4) | 0.17796 (16) | 0.00365 (15) | 0.0446 (7) |
| O2 | 0.3776 (5) | 0.11268 (17) | 0.04293 (16) | 0.0507 (8) |

| | | | | |
|---|---|---|---|---|
| O3 | 0.6222 (7) | 0.3128 (3) | 0.10446 (17) | 0.0813 (12) |
| O4 | 0.9451 (7) | 0.3737 (3) | 0.0785 (2) | 0.0857 (12) |
| O5 | 1.1302 (5) | −0.02471 (16) | 0.09716 (15) | 0.0455 (7) |
| O6 | 0.8165 (4) | −0.09755 (16) | 0.12586 (14) | 0.0422 (7) |
| O7 | 1.0110 (7) | −0.0492 (2) | 0.2652 (2) | 0.0769 (11) |
| O8 | 0.6646 (7) | −0.0985 (3) | 0.28321 (19) | 0.0891 (13) |
| N1 | 0.7356 (7) | 0.3501 (2) | 0.06550 (19) | 0.0519 (9) |
| N2 | 0.8701 (7) | −0.1072 (3) | 0.26878 (18) | 0.0534 (10) |
| C1 | 0.4719 (7) | 0.1752 (2) | 0.0172 (2) | 0.0376 (9) |
| C2 | 0.3050 (7) | 0.2495 (2) | 0.0012 (2) | 0.0439 (10) |
| H2A | 0.1657 | 0.2306 | −0.0292 | 0.053* |
| H2B | 0.2445 | 0.2672 | 0.0426 | 0.053* |
| C3 | 0.4109 (6) | 0.3250 (2) | −0.02943 (19) | 0.0321 (8) |
| C4 | 0.6114 (7) | 0.3702 (2) | −0.00200 (19) | 0.0344 (8) |
| C5 | 0.7012 (8) | 0.4370 (3) | −0.0343 (3) | 0.0583 (12) |
| H5 | 0.8407 | 0.4645 | −0.0149 | 0.070* |
| C6 | 0.5883 (11) | 0.4634 (3) | −0.0944 (3) | 0.0666 (14) |
| H6 | 0.6486 | 0.5095 | −0.1158 | 0.080* |
| C7 | 0.3877 (11) | 0.4226 (3) | −0.1231 (2) | 0.0654 (14) |
| H7 | 0.3080 | 0.4410 | −0.1640 | 0.079* |
| C8 | 0.3015 (8) | 0.3533 (3) | −0.0914 (2) | 0.0531 (11) |
| H8 | 0.1660 | 0.3248 | −0.1122 | 0.064* |
| C9 | 1.0388 (6) | −0.0834 (2) | 0.12825 (19) | 0.0338 (8) |
| C10 | 1.2235 (7) | −0.1397 (3) | 0.1690 (2) | 0.0448 (10) |
| H10A | 1.3176 | −0.1683 | 0.1379 | 0.054* |
| H10B | 1.3352 | −0.1038 | 0.1972 | 0.054* |
| C11 | 1.1271 (7) | −0.2051 (2) | 0.21313 (18) | 0.0333 (8) |
| C12 | 0.9564 (7) | −0.1916 (2) | 0.25696 (18) | 0.0366 (8) |
| C13 | 0.8654 (9) | −0.2561 (3) | 0.2933 (2) | 0.0609 (13) |
| H13 | 0.7455 | −0.2457 | 0.3211 | 0.073* |
| C14 | 0.9568 (12) | −0.3357 (3) | 0.2873 (3) | 0.0778 (18) |
| H14 | 0.8973 | −0.3801 | 0.3108 | 0.093* |
| C15 | 1.1325 (11) | −0.3498 (3) | 0.2474 (3) | 0.0747 (17) |
| H15 | 1.1997 | −0.4033 | 0.2453 | 0.090* |
| C16 | 1.2119 (8) | −0.2866 (3) | 0.2102 (2) | 0.0518 (11) |
| H16 | 1.3281 | −0.2985 | 0.1815 | 0.062* |

*Atomic displacement parameters (Å²)*

| | $U^{11}$ | $U^{22}$ | $U^{33}$ | $U^{12}$ | $U^{13}$ | $U^{23}$ |
|---|---|---|---|---|---|---|
| Ag1 | 0.02941 (16) | 0.04213 (18) | 0.0682 (2) | 0.00658 (13) | 0.00686 (14) | 0.02080 (15) |
| Ag2 | 0.02920 (16) | 0.04436 (18) | 0.0678 (2) | 0.00628 (13) | 0.00618 (14) | 0.02365 (16) |
| O1 | 0.0297 (14) | 0.0374 (15) | 0.069 (2) | 0.0081 (11) | 0.0160 (13) | 0.0225 (13) |
| O2 | 0.0301 (14) | 0.0367 (15) | 0.086 (2) | −0.0014 (11) | 0.0084 (14) | 0.0291 (15) |
| O3 | 0.090 (3) | 0.112 (3) | 0.041 (2) | 0.009 (2) | 0.0057 (19) | 0.018 (2) |
| O4 | 0.054 (2) | 0.101 (3) | 0.093 (3) | −0.003 (2) | −0.031 (2) | −0.015 (2) |
| O5 | 0.0312 (14) | 0.0391 (15) | 0.0670 (19) | 0.0026 (11) | 0.0095 (13) | 0.0276 (13) |
| O6 | 0.0265 (14) | 0.0419 (15) | 0.0569 (18) | −0.0024 (11) | −0.0010 (12) | 0.0243 (13) |

| | | | | | | |
|---|---|---|---|---|---|---|
| O7 | 0.093 (3) | 0.0350 (18) | 0.096 (3) | 0.0016 (18) | −0.016 (2) | −0.0170 (18) |
| O8 | 0.065 (2) | 0.135 (4) | 0.065 (2) | 0.032 (2) | −0.0004 (19) | −0.044 (2) |
| N1 | 0.050 (2) | 0.053 (2) | 0.049 (2) | 0.0084 (18) | −0.0069 (19) | −0.0121 (18) |
| N2 | 0.056 (2) | 0.059 (2) | 0.042 (2) | 0.0120 (19) | −0.0094 (18) | −0.0205 (18) |
| C1 | 0.035 (2) | 0.0286 (19) | 0.049 (2) | 0.0023 (15) | 0.0027 (17) | 0.0075 (16) |
| C2 | 0.0245 (19) | 0.032 (2) | 0.075 (3) | 0.0038 (15) | 0.0060 (19) | 0.0145 (19) |
| C3 | 0.0283 (18) | 0.0251 (17) | 0.043 (2) | 0.0057 (14) | 0.0039 (16) | 0.0032 (15) |
| C4 | 0.0321 (19) | 0.0316 (19) | 0.039 (2) | 0.0009 (15) | 0.0023 (16) | −0.0012 (15) |
| C5 | 0.054 (3) | 0.042 (2) | 0.081 (4) | −0.013 (2) | 0.012 (3) | 0.004 (2) |
| C6 | 0.096 (4) | 0.039 (3) | 0.070 (4) | 0.002 (3) | 0.033 (3) | 0.018 (2) |
| C7 | 0.102 (4) | 0.053 (3) | 0.040 (3) | 0.024 (3) | 0.002 (3) | 0.013 (2) |
| C8 | 0.058 (3) | 0.041 (2) | 0.053 (3) | 0.008 (2) | −0.019 (2) | 0.001 (2) |
| C9 | 0.0315 (19) | 0.0311 (19) | 0.038 (2) | 0.0021 (15) | 0.0025 (16) | 0.0100 (16) |
| C10 | 0.029 (2) | 0.051 (2) | 0.055 (3) | 0.0056 (17) | 0.0051 (18) | 0.022 (2) |
| C11 | 0.035 (2) | 0.0276 (18) | 0.035 (2) | 0.0015 (14) | −0.0060 (16) | 0.0048 (15) |
| C12 | 0.040 (2) | 0.038 (2) | 0.030 (2) | −0.0071 (16) | −0.0068 (16) | −0.0018 (15) |
| C13 | 0.071 (3) | 0.081 (4) | 0.029 (2) | −0.024 (3) | 0.000 (2) | 0.005 (2) |
| C14 | 0.111 (5) | 0.052 (3) | 0.063 (4) | −0.038 (3) | −0.021 (3) | 0.027 (3) |
| C15 | 0.103 (5) | 0.029 (2) | 0.083 (4) | −0.002 (3) | −0.027 (3) | 0.011 (2) |
| C16 | 0.061 (3) | 0.037 (2) | 0.054 (3) | 0.013 (2) | −0.009 (2) | 0.002 (2) |

*Geometric parameters (Å, º)*

| | | | |
|---|---|---|---|
| Ag1—O1 | 2.167 (2) | C3—C4 | 1.379 (5) |
| Ag1—O5 | 2.221 (2) | C3—C8 | 1.388 (5) |
| Ag1—O2$^{i}$ | 2.405 (3) | C4—C5 | 1.365 (5) |
| Ag1—Ag2 | 2.8200 (4) | C5—C6 | 1.354 (7) |
| Ag1—Ag1$^{ii}$ | 3.1998 (7) | C5—H5 | 0.9300 |
| Ag2—O6 | 2.174 (2) | C6—C7 | 1.351 (7) |
| Ag2—O2 | 2.219 (3) | C6—H6 | 0.9300 |
| Ag2—O5$^{iii}$ | 2.404 (2) | C7—C8 | 1.384 (7) |
| Ag2—Ag2$^{iv}$ | 3.2140 (7) | C7—H7 | 0.9300 |
| O1—C1 | 1.241 (4) | C8—H8 | 0.9300 |
| O2—C1 | 1.259 (4) | C9—C10 | 1.518 (5) |
| O2—Ag1$^{iii}$ | 2.405 (3) | C10—C11 | 1.503 (5) |
| O3—N1 | 1.211 (5) | C10—H10A | 0.9700 |
| O4—N1 | 1.215 (5) | C10—H10B | 0.9700 |
| O5—C9 | 1.260 (4) | C11—C12 | 1.380 (5) |
| O5—Ag2$^{i}$ | 2.404 (2) | C11—C16 | 1.380 (5) |
| O6—C9 | 1.244 (4) | C12—C13 | 1.386 (6) |
| O7—N2 | 1.214 (5) | C13—C14 | 1.373 (8) |
| O8—N2 | 1.212 (5) | C13—H13 | 0.9300 |
| N1—C4 | 1.476 (5) | C14—C15 | 1.348 (8) |
| N2—C12 | 1.451 (5) | C14—H14 | 0.9300 |
| C1—C2 | 1.509 (5) | C15—C16 | 1.354 (7) |
| C2—C3 | 1.498 (5) | C15—H15 | 0.9300 |
| C2—H2A | 0.9700 | C16—H16 | 0.9300 |
| C2—H2B | 0.9700 | | |

| | | | |
|---|---|---|---|
| O1—Ag1—O5 | 162.60 (9) | C4—C3—C2 | 126.1 (3) |
| O1—Ag1—O2$^{i}$ | 119.49 (9) | C8—C3—C2 | 118.4 (4) |
| O5—Ag1—O2$^{i}$ | 76.16 (9) | C5—C4—C3 | 122.4 (4) |
| O1—Ag1—Ag2 | 86.12 (7) | C5—C4—N1 | 116.5 (4) |
| O5—Ag1—Ag2 | 77.51 (6) | C3—C4—N1 | 121.0 (3) |
| O2$^{i}$—Ag1—Ag2 | 153.31 (6) | C6—C5—C4 | 120.4 (4) |
| O1—Ag1—Ag1$^{ii}$ | 123.20 (8) | C6—C5—H5 | 119.8 |
| O5—Ag1—Ag1$^{ii}$ | 61.69 (8) | C4—C5—H5 | 119.8 |
| O2$^{i}$—Ag1—Ag1$^{ii}$ | 86.43 (8) | C7—C6—C5 | 119.8 (4) |
| Ag2—Ag1—Ag1$^{ii}$ | 84.972 (15) | C7—C6—H6 | 120.1 |
| O6—Ag2—O2 | 161.91 (10) | C5—C6—H6 | 120.1 |
| O6—Ag2—O5$^{iii}$ | 118.69 (9) | C6—C7—C8 | 119.7 (4) |
| O2—Ag2—O5$^{iii}$ | 76.23 (9) | C6—C7—H7 | 120.2 |
| O6—Ag2—Ag1 | 86.72 (6) | C8—C7—H7 | 120.2 |
| O2—Ag2—Ag1 | 77.83 (6) | C7—C8—C3 | 122.1 (4) |
| O5$^{iii}$—Ag2—Ag1 | 154.04 (6) | C7—C8—H8 | 119.0 |
| O6—Ag2—Ag2$^{iv}$ | 119.58 (8) | C3—C8—H8 | 119.0 |
| O2—Ag2—Ag2$^{iv}$ | 65.40 (9) | O6—C9—O5 | 124.5 (3) |
| O5$^{iii}$—Ag2—Ag2$^{iv}$ | 95.20 (7) | O6—C9—C10 | 120.8 (3) |
| Ag1—Ag2—Ag2$^{iv}$ | 74.507 (13) | O5—C9—C10 | 114.7 (3) |
| C1—O1—Ag1 | 121.2 (2) | C11—C10—C9 | 117.4 (3) |
| C1—O2—Ag2 | 129.1 (2) | C11—C10—H10A | 107.9 |
| C1—O2—Ag1$^{iii}$ | 126.9 (2) | C9—C10—H10A | 107.9 |
| Ag2—O2—Ag1$^{iii}$ | 102.88 (10) | C11—C10—H10B | 107.9 |
| C9—O5—Ag1 | 129.8 (2) | C9—C10—H10B | 108.0 |
| C9—O5—Ag2$^{i}$ | 127.3 (2) | H10A—C10—H10B | 107.2 |
| Ag1—O5—Ag2$^{i}$ | 102.86 (9) | C12—C11—C16 | 115.8 (4) |
| C9—O6—Ag2 | 120.7 (2) | C12—C11—C10 | 125.7 (3) |
| O3—N1—O4 | 124.4 (4) | C16—C11—C10 | 118.5 (4) |
| O3—N1—C4 | 118.4 (4) | C11—C12—C13 | 122.5 (4) |
| O4—N1—C4 | 117.1 (4) | C11—C12—N2 | 120.7 (4) |
| O8—N2—O7 | 123.6 (4) | C13—C12—N2 | 116.7 (4) |
| O8—N2—C12 | 118.7 (4) | C14—C13—C12 | 118.3 (5) |
| O7—N2—C12 | 117.7 (4) | C14—C13—H13 | 120.8 |
| O1—C1—O2 | 124.6 (3) | C12—C13—H13 | 120.8 |
| O1—C1—C2 | 119.8 (3) | C15—C14—C13 | 120.2 (5) |
| O2—C1—C2 | 115.6 (3) | C15—C14—H14 | 119.9 |
| C3—C2—C1 | 117.0 (3) | C13—C14—H14 | 119.9 |
| C3—C2—H2A | 108.0 | C14—C15—C16 | 120.4 (5) |
| C1—C2—H2A | 108.0 | C14—C15—H15 | 119.8 |
| C3—C2—H2B | 108.0 | C16—C15—H15 | 119.8 |
| C1—C2—H2B | 108.0 | C15—C16—C11 | 122.5 (5) |
| H2A—C2—H2B | 107.3 | C15—C16—H16 | 118.7 |
| C4—C3—C8 | 115.5 (3) | C11—C16—H16 | 118.7 |

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| Ag1—O1—C1—O2 | −12.5 (6) | Ag2—O6—C9—O5 | −11.1 (5) |
| Ag1—O1—C1—C2 | 169.0 (3) | Ag2—O6—C9—C10 | 170.6 (3) |

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| Ag2—O2—C1—O1 | 5.5 (6) | Ag1—O5—C9—O6 | 9.8 (6) |
| Ag1$^{iii}$—O2—C1—O1 | −160.2 (3) | Ag2$^{i}$—O5—C9—O6 | −167.2 (3) |
| Ag2—O2—C1—C2 | −175.9 (3) | Ag1—O5—C9—C10 | −171.8 (3) |
| Ag1$^{iii}$—O2—C1—C2 | 18.3 (5) | Ag2$^{i}$—O5—C9—C10 | 11.2 (5) |
| O1—C1—C2—C3 | −1.4 (6) | O6—C9—C10—C11 | −8.0 (6) |
| O2—C1—C2—C3 | −180.0 (4) | O5—C9—C10—C11 | 173.6 (4) |
| C1—C2—C3—C4 | −57.6 (6) | C9—C10—C11—C12 | −47.7 (6) |
| C1—C2—C3—C8 | 122.1 (4) | C9—C10—C11—C16 | 131.7 (4) |
| C8—C3—C4—C5 | −1.7 (6) | C16—C11—C12—C13 | −3.2 (6) |
| C2—C3—C4—C5 | 177.9 (4) | C10—C11—C12—C13 | 176.2 (4) |
| C8—C3—C4—N1 | 176.2 (3) | C16—C11—C12—N2 | 174.5 (3) |
| C2—C3—C4—N1 | −4.1 (6) | C10—C11—C12—N2 | −6.1 (6) |
| O3—N1—C4—C5 | 155.5 (4) | O8—N2—C12—C11 | 150.3 (4) |
| O4—N1—C4—C5 | −23.1 (5) | O7—N2—C12—C11 | −31.5 (5) |
| O3—N1—C4—C3 | −22.5 (6) | O8—N2—C12—C13 | −31.9 (5) |
| O4—N1—C4—C3 | 158.8 (4) | O7—N2—C12—C13 | 146.4 (4) |
| C3—C4—C5—C6 | 2.5 (7) | C11—C12—C13—C14 | 2.7 (6) |
| N1—C4—C5—C6 | −175.5 (4) | N2—C12—C13—C14 | −175.1 (4) |
| C4—C5—C6—C7 | −1.0 (8) | C12—C13—C14—C15 | 0.7 (7) |
| C5—C6—C7—C8 | −1.0 (8) | C13—C14—C15—C16 | −3.4 (8) |
| C6—C7—C8—C3 | 1.8 (7) | C14—C15—C16—C11 | 2.8 (8) |
| C4—C3—C8—C7 | −0.4 (6) | C12—C11—C16—C15 | 0.4 (6) |
| C2—C3—C8—C7 | 179.9 (4) | C10—C11—C16—C15 | −179.0 (4) |

Symmetry codes: (i) *x*+1, *y*, *z*; (ii) −*x*+2, −*y*, −*z*; (iii) *x*−1, *y*, *z*; (iv) −*x*+1, −*y*, −*z*.

*Hydrogen-bond geometry (Å, º)*

| *D*—H···*A* | *D*—H | H···*A* | *D*···*A* | *D*—H···*A* |
|---|---|---|---|---|
| C2—H2*B*···O4$^{iii}$ | 0.97 | 2.53 | 3.312 (6) | 138 |
| C10—H10*B*···O8$^{i}$ | 0.97 | 2.35 | 3.205 (6) | 146 |
| C6—H6···O8$^{v}$ | 0.93 | 2.48 | 3.322 (6) | 151 |
| C15—H15···O7$^{vi}$ | 0.93 | 2.59 | 3.268 (6) | 130 |

Symmetry codes: (i) *x*+1, *y*, *z*; (iii) *x*−1, *y*, *z*; (v) *x*, −*y*+1/2, *z*−1/2; (vi) −*x*+2, *y*−1/2, −*z*+1/2.