Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

catena-Poly[[bis(μ_2-4-aminobenzenesulfonato-κ^2O:O)disilver]-bis(μ_2-4,4′-bipyridine-κ^2N:N')]

Guang-Chuan Ou,* Min Zhang, Xian-You Yuan and Yong-Qiang Dai

Department of Biology and Chemistry, Hunan University of Science and Engineering, Yongzhou, Hunan 425100, People's Republic of China
Correspondence e-mail: ouguangchuan@yahoo.com.cn

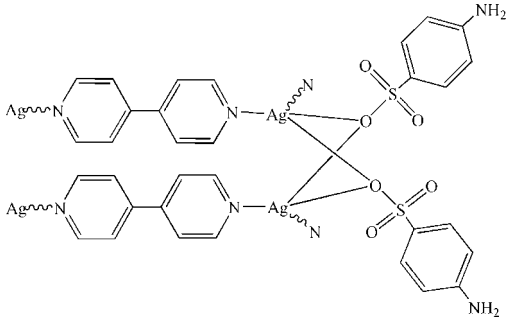
Received 30 September 2008; accepted 16 November 2008

Key indicators: single-crystal X-ray study; T = 173 K; mean σ(C–C) = 0.005 Å; R factor = 0.032; wR factor = 0.088; data-to-parameter ratio = 15.6.

In the title compound, $[Ag_2(C_6H_6NO_3S)_2(C_{10}H_8N_2)_2]_n$, the Ag^I atom is four-coordinated by two N atoms from two symmetry-related 4,4′-bipyridine (bipy) and two O atoms from two independent 4-aminobenzenesulfonate (ABS) ligands. The two inter-chain Ag^I atoms are bridged by two independent ABS ligands through weak Ag—O bonds and Ag···Ag attractions, forming a ladder-like chain coordination polymer $[Ag_2(ABS)_2(bipy)_2]_n$ parallel to [001], which is further linked to generate a two-dimensional structure *via* N—H···O hydrogen-bonding interactions.

Related literature

For general background, see: Liu, Kuroda-Sowa *et al.* (2005); Liu, Liu *et al.* (2005); Feng *et al.* (2003); Wei *et al.* (2004); Dong *et al.* (2005); Bi *et al.* (2003); Ding *et al.* (2005); Yang *et al.* (2004). For related structures, see: Sampanthar & Vittal (2000); Tong *et al.* (2000).



Experimental

Crystal data

$[Ag_2(C_6H_6NO_3S)_2(C_{10}H_8N_2)_2]$
M_r = 872.46
Monoclinic, $P2_1/n$
a = 9.2105 (19) Å
b = 15.774 (3) Å
c = 11.433 (2) Å
β = 108.004 (4)°
V = 1579.8 (6) Å^3
Z = 2
Mo $K\alpha$ radiation
μ = 1.43 mm^{-1}
T = 173 (2) K
0.42 × 0.13 × 0.12 mm

Data collection

Bruker SMART CCD area-detector diffractometer
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
T_{min} = 0.585, T_{max} = 0.847
7741 measured reflections
3375 independent reflections
2774 reflections with $I > 2\sigma(I)$
R_{int} = 0.023

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.032
$wR(F^2)$ = 0.088
S = 1.11
3375 reflections
217 parameters
H-atom parameters constrained
$\Delta\rho_{max}$ = 0.79 e Å^{-3}
$\Delta\rho_{min}$ = −0.69 e Å^{-3}

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

D—H···A	D—H	H···A	D···A	D—H···A
N3—H3B···O2^{i}	0.88	2.04	2.850 (5)	153
N3—H3C···O3^{ii}	0.88	2.25	2.905 (4)	131

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

Data collection: *SMART* (Bruker, 1997); cell refinement: *SAINT* (Bruker, 2003); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *DIAMOND* (Brandenburg, 2005); software used to prepare material for publication: *SHELXL97*.

The authors thank the Key Subject Construction Project of Hunan Province (grant No. 2006-180), the Scientific Research Project of the Hunan Provincial Finance Bureau and Education Department (grant No. 08C366), and the Foundation for University Key Teachers of the Education Department of Hunan Province for supporting this study.

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: PV2110).

References

Bi, W. H., Cao, R., Sun, D. F., Yuan, D. Q., Li, X. & Hong, M. C. (2003). *Inorg. Chem. Commun.* **6**, 1426–1428.
Brandenburg, K. (2005). *DIAMOND*. Crystal Impact, Bonn, Germany.
Bruker (1997). *SMART*. Bruker AXS Inc., Madison, Wisconsin, USA.
Bruker (2003). *SAINT*. Bruker AXS Inc., Madison, Wisconsin, USA.
Ding, B., Yi, L., Liu, Y., Cheng, P., Dong, Y. B. & Ma, J. P. (2005). *Inorg. Chem. Commun.* **8**, 38–40.
Dong, Y. B., Geng, Y., Ma, J. P. & Huang, R. Q. (2005). *Inorg. Chem.* **44**, 1693–1703.
Feng, L. Y., Wang, Y. H., Hu, C. W., Li, Y. G. & Wang, E. B. (2003). *J. Mol. Struct.* **650**, 115–122.
Liu, S. Q., Kuroda-Sowa, T., Konaka, H., Suenaga, Y., Maekawa, M., Mizutani, T., Ning, G. L. & Munakata, M. (2005). *Inorg. Chem.* **44**, 1031–1036.
Liu, Z., Liu, P., Chen, Y., Wang, J. & Huang, M. H. (2005). *New J. Chem.* **29**, 474–478.
Sampanthar, J. T. & Vittal, J. J. (2000). *Cryst. Eng.* **3**, 117–120.
Sheldrick, G. M. (1996). *SADABS*. University of Göttingen, Germany.
Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.
Tong, M. L., Chen, X. M. & Seik, W. N. (2000). *Inorg. Chem. Commun.* **3**, 436–438.
Wei, Q., Nieuwenhuyzen, M., Meunier, F., Hardacre, C. & James, S. L. (2004). *J. Chem. Soc. Dalton Trans.*, pp. 1807–1811.
Yang, J. H., Zheng, S. L., Yu, X. L. & Chen, X. M. (2004). *Cryst. Growth Des.* **4**, 831–836.

supplementary materials

Acta Cryst. (2008). E**64**, m1587 [**doi:10.1107/S160053680803804X**]

catena-Poly[[bis(μ_2-4-aminobenzenesulfonato-κ^2O:O)disilver]-bis(μ_2-4,4'-bipyridine-κ^2N:N')]

G.-C. Ou, M. Zhang, X.-Y. Yuan and Y.-Q. Dai

Comment

In the construction of inorganic–organic supramolecular complexes, the Ag^I is often a favorable candidate due to its flexible coordination modes and Ag–Ag attractions (Liu *et al.*, 2005; Dong *et al.*, 2005; Bi *et al.*, 2003; Ding *et al.*, 2005; Yang *et al.*, 2004). Bipy (4,4'-bipyridine) and ABS (4-aminobenzenesulfonic acid) are useful building blocks because they contain bifunctional groups, which can coordinate with metal ions in various coordination modes through the oxygen atoms of sulfonic group and the nitrogen atoms of pyridyl ring (Liu *et al.*, 2005; Feng *et al.*, 2003; Wei *et al.*, 2004). Therefore, we also extended these investigations to the use of the ligand ABS and obtained various framework structures. In this paper, we report the structure of the title compound, (I).

As illustrated in Fig. 1, each Ag^I atom in the title compound is four-coordinated by two nitrogen atoms from bipy (Ag1—N1 = 2.187 (3) Å, Ag1—N2 = 2.179 (3) Å) and two oxygen atoms from two independent ABS (Ag1—O1 = 2.572 (2) Å and Ag1—O1# = 2.654 (2) Å, # 1 - *x*, -*y*, 1 - *z*). These coordination modes are different from those found in structures similar to (I), wherein both oxygen atoms of acetic acid are linked to Ag atoms (Sampanthar & Vittal, 2000; Tong *et al.*, 2000). The two inter-chain Ag^I atoms are bridged by two independent ABS ligands through week Ag—O bonds and Ag–Ag attractions (Ag1–Ag1# = 3.903 Å, # 1 - *x*, -*y*, 1 - *z*), forming a one-dimensional ladder-like chain coordination polymer $[Ag_2(bipy)_2(ABS)_2]_n$ with periodical distance of 11.43 Å, which is further linked to generate a two-dimensional structure *via* hydrogen-bonding interactions with an average O–O distance of 2.877 Å (Fig. 2).

Experimental

To a mixture of bipy (0.032 g, 0.2 mmol), ABS (0.017 g, 0.1 mmol) and Ag_2O (0.028 g, 0.05 mmol) in CH_3OH (10 ml) was added ammonia water resulting in a clear solution. After heating at 323 K for 0.5 h, the solution was evaporated slowly in the dark. Five days later, slightly yellow crystals were formed from the solution.

Refinement

H atoms bound to C or N atoms were positioned geometrically and refined using the riding model, and with C—H = 0.95 Å and N—H = 0.88 Å, and with U(H) set to 1.2U_{eq}(C, N). A small degree of thermal disorder in O2 and O3 atoms could not be ruled out as reflected by large atomic displacement parameters of these atoms.

Figures

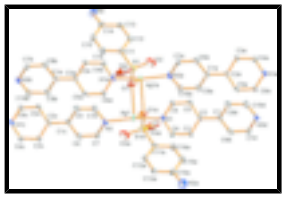


Fig. 1. The molecular structure of the title compound, showing displacement ellipsoids at the 30% probability level; H-atoms have been excluded for clarity. The symmetry codes for the generated atoms: a (1 - *x*, -*y*, 1 - *z*), b (1 - *x*, -*y*, 2 - *z*), c (*x*, *y*, 1 + *z*), d (*x*, *y*, -1 + *z*), e (1 - *x*, -*y*, -*z*).

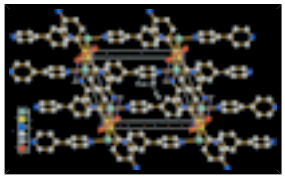


Fig. 2. A view of the packing of the title compound along *b* axis.

catena-Poly[[bis(μ$_2$-4-aminobenzenesulfonato-κ^{2}O:O)disilver]- bis(μ$_2$-4,4'-bipyridine-κ^{2}N:N')]

Crystal data

$[Ag_2(C_6H_6NO_3S)_2(C_{10}H_8N_2)_2]$	F_{000} = 872
M_r = 872.46	D_x = 1.834 Mg m^{-3}
Monoclinic, $P2_1/n$	Mo $K\alpha$ radiation λ = 0.71073 Å
Hall symbol: -P 2yn	Cell parameters from 2489 reflections
a = 9.2105 (19) Å	θ = 2.5–27.0º
b = 15.774 (3) Å	μ = 1.43 mm^{-1}
c = 11.433 (2) Å	*T* = 173 (2) K
β = 108.004 (4)º	Prism, light-yellow
V = 1579.8 (6) Å^3	0.42 × 0.13 × 0.12 mm
Z = 2	

Data collection

Bruker SMART CCD area-detector diffractometer	3375 independent reflections
Radiation source: fine-focus sealed tube	2774 reflections with $I > 2\sigma(I)$
Monochromator: graphite	R_{int} = 0.023
T = 173(2) K	θ_{max} = 27.0º
φ and ω scans	θ_{min} = 2.3º
Absorption correction: multi-scan (SADABS; Sheldrick, 1996)	*h* = −11→11
T_{min} = 0.585, T_{max} = 0.847	*k* = −17→20
7741 measured reflections	*l* = −13→14

Refinement

Refinement on F^2	Secondary atom site location: difference Fourier map

Least-squares matrix: full

$R[F^2 > 2\sigma(F^2)] = 0.032$

$wR(F^2) = 0.088$

$S = 1.11$

3375 reflections

217 parameters

Primary atom site location: structure-invariant direct methods

Hydrogen site location: inferred from neighbouring sites

H-atom parameters constrained

$w = 1/[\sigma^2(F_o^2) + (0.0458P)^2 + 0.7557P]$ where $P = (F_o^2 + 2F_c^2)/3$

$(\Delta/\sigma)_{max} = 0.001$

$\Delta\rho_{max} = 0.79$ e Å^{-3}

$\Delta\rho_{min} = -0.69$ e Å^{-3}

Extinction correction: none

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	0.72113 (3)	0.011584 (16)	0.56851 (2)	0.02788 (10)
S1	0.43413 (9)	0.19537 (5)	0.48987 (9)	0.0333 (2)
N1	0.7468 (3)	0.01972 (15)	0.3849 (2)	0.0216 (5)
N2	0.7473 (3)	0.01021 (16)	0.7646 (2)	0.0250 (6)
C2	0.7508 (3)	0.01617 (18)	0.1402 (3)	0.0203 (6)
C12	0.1224 (3)	0.19650 (18)	0.4380 (3)	0.0236 (6)
H12A	0.1175	0.1865	0.3549	0.028*
C14	−0.0062 (3)	0.2155 (2)	0.5922 (3)	0.0274 (7)
C1	0.7521 (3)	0.01415 (18)	0.0111 (3)	0.0211 (6)
O1	0.4856 (2)	0.10869 (15)	0.5186 (2)	0.0362 (6)
C11	0.2636 (3)	0.20524 (19)	0.5282 (3)	0.0228 (6)
C15	0.1367 (4)	0.2258 (2)	0.6808 (3)	0.0299 (7)
H15A	0.1427	0.2368	0.7638	0.036*
C10	0.6969 (4)	0.0780 (2)	0.8123 (3)	0.0282 (7)
H10A	0.6607	0.1256	0.7607	0.034*
C7	0.8025 (4)	−0.0552 (2)	0.8414 (3)	0.0273 (7)
H7A	0.8388	−0.1036	0.8097	0.033*
C16	0.2681 (4)	0.2204 (2)	0.6487 (3)	0.0288 (7)
H16A	0.3641	0.2270	0.7103	0.035*
C13	−0.0112 (3)	0.2024 (2)	0.4698 (3)	0.0258 (7)
H13A	−0.1072	0.1974	0.4078	0.031*
C3	0.8647 (3)	−0.02265 (19)	0.2346 (3)	0.0240 (6)

H3A	0.9463	−0.0514	0.2171	0.029*
C6	0.6367 (3)	0.0573 (2)	0.2940 (3)	0.0249 (6)
H6A	0.5563	0.0855	0.3141	0.030*
C5	0.6351 (3)	0.0569 (2)	0.1740 (3)	0.0258 (7)
H5A	0.5547	0.0846	0.1132	0.031*
C4	0.8586 (4)	−0.01927 (19)	0.3527 (3)	0.0261 (7)
H4A	0.9379	−0.0460	0.4155	0.031*
O2	0.3940 (4)	0.2091 (3)	0.3591 (3)	0.0931 (15)
N3	−0.1373 (3)	0.2149 (2)	0.6265 (3)	0.0483 (9)
H3B	−0.1314	0.2211	0.7043	0.058*
H3C	−0.2269	0.2084	0.5705	0.058*
O3	0.5398 (3)	0.25465 (19)	0.5646 (4)	0.0858 (13)
C8	0.8091 (4)	−0.0555 (2)	0.9632 (3)	0.0260 (7)
H8	0.8518	−0.1024	1.0143	0.031*
C9	0.6953 (4)	0.0818 (2)	0.9318 (3)	0.0277 (7)
H9	0.6555	0.1304	0.9604	0.033*

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Ag1	0.03363 (16)	0.03836 (16)	0.01360 (14)	0.00271 (10)	0.01013 (10)	0.00153 (10)
S1	0.0248 (4)	0.0333 (5)	0.0465 (5)	0.0039 (3)	0.0178 (4)	0.0092 (4)
N1	0.0276 (13)	0.0222 (13)	0.0164 (12)	−0.0020 (10)	0.0090 (10)	−0.0024 (10)
N2	0.0300 (14)	0.0297 (14)	0.0160 (13)	0.0008 (11)	0.0082 (11)	0.0003 (11)
C2	0.0287 (15)	0.0198 (14)	0.0139 (14)	−0.0011 (12)	0.0085 (12)	−0.0014 (11)
C12	0.0287 (16)	0.0210 (15)	0.0198 (15)	0.0019 (12)	0.0054 (13)	0.0011 (12)
C14	0.0216 (15)	0.0269 (16)	0.0351 (19)	0.0021 (12)	0.0109 (14)	−0.0026 (14)
C1	0.0267 (15)	0.0211 (14)	0.0153 (14)	−0.0017 (12)	0.0060 (12)	−0.0013 (11)
O1	0.0277 (12)	0.0297 (13)	0.0522 (16)	0.0044 (9)	0.0138 (11)	−0.0036 (11)
C11	0.0188 (14)	0.0234 (15)	0.0272 (16)	0.0013 (11)	0.0086 (12)	0.0005 (13)
C15	0.0338 (17)	0.0356 (18)	0.0223 (17)	−0.0021 (14)	0.0115 (14)	−0.0086 (14)
C10	0.0416 (18)	0.0236 (16)	0.0194 (16)	0.0030 (13)	0.0094 (14)	0.0033 (13)
C7	0.0338 (17)	0.0296 (17)	0.0196 (16)	0.0051 (13)	0.0099 (13)	−0.0007 (13)
C16	0.0258 (16)	0.0323 (18)	0.0235 (17)	−0.0009 (13)	0.0005 (13)	−0.0066 (13)
C13	0.0208 (15)	0.0274 (16)	0.0251 (16)	0.0004 (12)	0.0010 (13)	0.0013 (13)
C3	0.0248 (15)	0.0269 (16)	0.0198 (16)	0.0053 (12)	0.0062 (12)	−0.0004 (12)
C6	0.0266 (15)	0.0278 (16)	0.0200 (15)	0.0046 (12)	0.0071 (12)	−0.0025 (13)
C5	0.0257 (15)	0.0335 (18)	0.0175 (15)	0.0061 (13)	0.0054 (12)	0.0002 (13)
C4	0.0288 (16)	0.0270 (16)	0.0208 (16)	0.0046 (13)	0.0053 (13)	−0.0017 (13)
O2	0.064 (2)	0.163 (4)	0.070 (2)	0.054 (2)	0.0474 (19)	0.071 (3)
N3	0.0304 (16)	0.080 (2)	0.0402 (19)	0.0081 (16)	0.0189 (14)	−0.0024 (18)
O3	0.0339 (15)	0.0463 (18)	0.185 (4)	−0.0175 (14)	0.045 (2)	−0.046 (2)
C8	0.0345 (17)	0.0243 (16)	0.0193 (15)	0.0075 (13)	0.0085 (13)	0.0024 (13)
C9	0.0390 (18)	0.0246 (16)	0.0210 (16)	0.0068 (13)	0.0114 (13)	0.0010 (13)

Geometric parameters (Å, °)

Ag1—N2	2.179 (3)	C11—C16	1.387 (4)
Ag1—N1	2.187 (3)	C15—C16	1.372 (5)

Ag1—O1	2.571 (2)	C15—H15A	0.9500
S1—O3	1.428 (3)	C10—C9	1.372 (4)
S1—O2	1.441 (3)	C10—H10A	0.9500
S1—O1	1.451 (2)	C7—C8	1.375 (4)
S1—C11	1.763 (3)	C7—H7A	0.9500
N1—C4	1.345 (4)	C16—H16A	0.9500
N1—C6	1.345 (4)	C13—H13A	0.9500
N2—C10	1.347 (4)	C3—C4	1.370 (5)
N2—C7	1.348 (4)	C3—H3A	0.9500
C2—C3	1.393 (4)	C6—C5	1.368 (4)
C2—C5	1.398 (4)	C6—H6A	0.9500
C2—C1	1.480 (4)	C5—H5A	0.9500
C12—C13	1.390 (4)	C4—H4A	0.9500
C12—C11	1.394 (4)	N3—H3B	0.8800
C12—H12A	0.9500	N3—H3C	0.8800
C14—N3	1.380 (4)	C8—C1^{ii}	1.399 (4)
C14—C15	1.400 (4)	C8—H8	0.9500
C14—C13	1.401 (4)	C9—C1^{ii}	1.393 (4)
C1—C9^{i}	1.393 (4)	C9—H9	0.9500
C1—C8^{i}	1.399 (4)		
N2—Ag1—N1	167.73 (10)	N2—C10—C9	123.4 (3)
N2—Ag1—O1	92.98 (9)	N2—C10—H10A	118.3
N1—Ag1—O1	94.93 (9)	C9—C10—H10A	118.3
O3—S1—O2	115.6 (2)	N2—C7—C8	123.5 (3)
O3—S1—O1	111.53 (19)	N2—C7—H7A	118.2
O2—S1—O1	109.7 (2)	C8—C7—H7A	118.2
O3—S1—C11	106.77 (17)	C15—C16—C11	121.2 (3)
O2—S1—C11	106.38 (16)	C15—C16—H16A	119.4
O1—S1—C11	106.33 (14)	C11—C16—H16A	119.4
C4—N1—C6	116.7 (3)	C12—C13—C14	120.8 (3)
C4—N1—Ag1	123.7 (2)	C12—C13—H13A	119.6
C6—N1—Ag1	119.2 (2)	C14—C13—H13A	119.6
C10—N2—C7	116.8 (3)	C4—C3—C2	119.8 (3)
C10—N2—Ag1	117.8 (2)	C4—C3—H3A	120.1
C7—N2—Ag1	125.3 (2)	C2—C3—H3A	120.1
C3—C2—C5	116.4 (3)	N1—C6—C5	123.0 (3)
C3—C2—C1	121.8 (3)	N1—C6—H6A	118.5
C5—C2—C1	121.8 (3)	C5—C6—H6A	118.5
C13—C12—C11	119.9 (3)	C6—C5—C2	120.4 (3)
C13—C12—H12A	120.0	C6—C5—H5A	119.8
C11—C12—H12A	120.0	C2—C5—H5A	119.8
N3—C14—C15	120.3 (3)	N1—C4—C3	123.8 (3)
N3—C14—C13	121.4 (3)	N1—C4—H4A	118.1
C15—C14—C13	118.2 (3)	C3—C4—H4A	118.1
C9^{i}—C1—C8^{i}	117.2 (3)	C14—N3—H3B	120.0
C9^{i}—C1—C2	121.0 (3)	C14—N3—H3C	120.0
C8^{i}—C1—C2	121.8 (3)	H3B—N3—H3C	120.0

S1—O1—Ag1	143.69 (14)	C7—C8—C1^{ii}	119.3 (3)
C16—C11—C12	119.1 (3)	C7—C8—H8	120.4
C16—C11—S1	120.5 (2)	C1^{ii}—C8—H8	120.4
C12—C11—S1	120.4 (2)	C10—C9—C1^{ii}	119.8 (3)
C16—C15—C14	120.6 (3)	C10—C9—H9	120.1
C16—C15—H15A	119.7	C1^{ii}—C9—H9	120.1
C14—C15—H15A	119.7		
N2—Ag1—N1—C4	49.1 (6)	N3—C14—C15—C16	175.3 (3)
O1—Ag1—N1—C4	179.0 (2)	C13—C14—C15—C16	−2.2 (5)
N2—Ag1—N1—C6	−138.8 (4)	C7—N2—C10—C9	−2.1 (5)
O1—Ag1—N1—C6	−8.9 (2)	Ag1—N2—C10—C9	174.4 (3)
N1—Ag1—N2—C10	102.1 (5)	C10—N2—C7—C8	0.1 (5)
O1—Ag1—N2—C10	−28.0 (2)	Ag1—N2—C7—C8	−176.1 (2)
N1—Ag1—N2—C7	−81.8 (5)	C14—C15—C16—C11	0.6 (5)
O1—Ag1—N2—C7	148.2 (3)	C12—C11—C16—C15	0.8 (5)
C3—C2—C1—C9^{i}	−147.0 (3)	S1—C11—C16—C15	−178.2 (3)
C5—C2—C1—C9^{i}	33.1 (4)	C11—C12—C13—C14	−1.2 (5)
C3—C2—C1—C8^{i}	33.5 (4)	N3—C14—C13—C12	−174.9 (3)
C5—C2—C1—C8^{i}	−146.4 (3)	C15—C14—C13—C12	2.5 (5)
O3—S1—O1—Ag1	−41.8 (3)	C5—C2—C3—C4	0.0 (4)
O2—S1—O1—Ag1	87.6 (3)	C1—C2—C3—C4	−179.9 (3)
C11—S1—O1—Ag1	−157.8 (2)	C4—N1—C6—C5	0.1 (4)
N2—Ag1—O1—S1	102.2 (3)	Ag1—N1—C6—C5	−172.5 (2)
N1—Ag1—O1—S1	−68.4 (3)	N1—C6—C5—C2	0.1 (5)
C13—C12—C11—C16	−0.5 (5)	C3—C2—C5—C6	−0.2 (4)
C13—C12—C11—S1	178.4 (2)	C1—C2—C5—C6	179.7 (3)
O3—S1—C11—C16	−37.0 (3)	C6—N1—C4—C3	−0.3 (5)
O2—S1—C11—C16	−160.9 (3)	Ag1—N1—C4—C3	172.0 (2)
O1—S1—C11—C16	82.2 (3)	C2—C3—C4—N1	0.3 (5)
O3—S1—C11—C12	144.1 (3)	N2—C7—C8—C1^{ii}	1.9 (5)
O2—S1—C11—C12	20.2 (3)	N2—C10—C9—C1^{ii}	2.0 (5)
O1—S1—C11—C12	−96.7 (3)		

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

Hydrogen-bond geometry (Å, °)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
N3—H3B···O2^{iii}	0.88	2.04	2.850 (5)	153
N3—H3C···O3^{iv}	0.88	2.25	2.905 (4)	131

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

Fig. 1

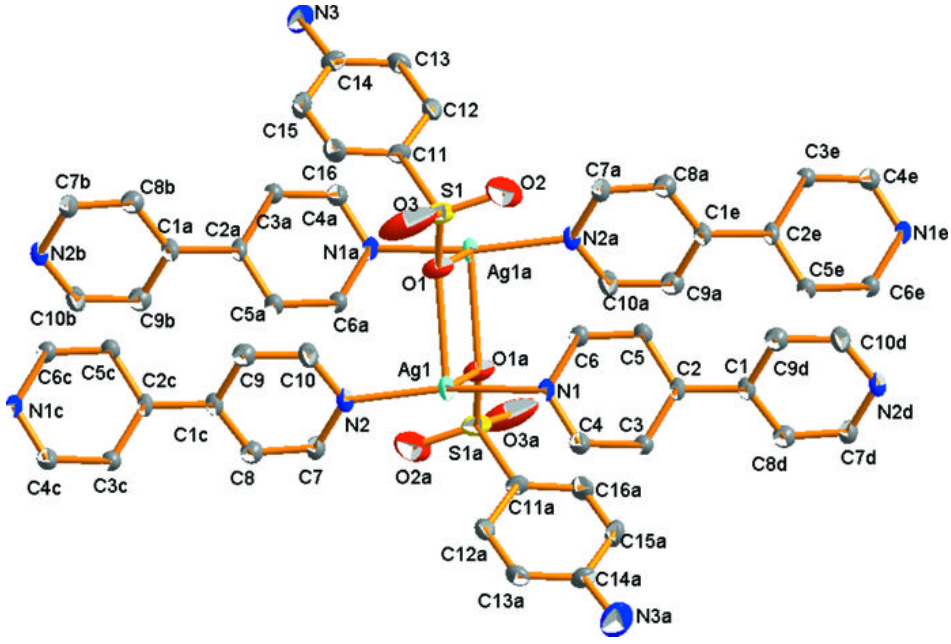

N3
C13
C14
C12
C15
C11
C16
S1
O2
O3
C7b
C8b
C1a
C2a
C3a
C4a
N2b
N1a
O1
Ag1a
C10b
C9b
C5a
C6a
C7a
C8a
C3e
C4e
C1e
C2e
N1e
N2a
C5e
C6e
C10a
C9a
C6c
C5c
C2c
C9
C10
Ag1
O1a
C6
C5
C2
C1
C10d
C9d
N1c
C1c
N2
N1
C4
C3
N2d
S1a
O3a
C4c
C3c
C8
C7
O2a
C8d
C7d
C11a
C16a
C12a
C15a
C14a
C13a
N3a

Fig. 2