

Bis[μ -bis(diphenylphosphino)methane- $\kappa^2P:P'$]bis[(4-toluenesulfonato- κO)-silver(I)] monohydrate

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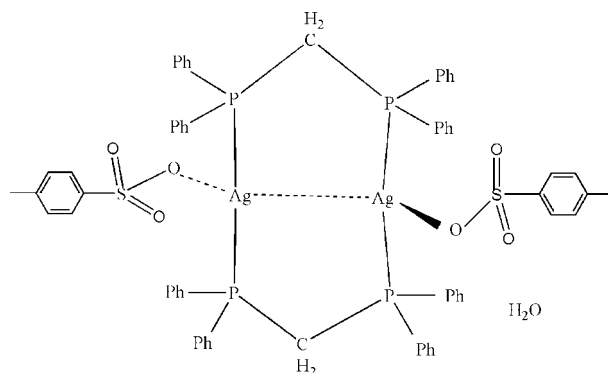
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Key indicators: single-crystal X-ray study; $T = 293$ K; mean $\sigma(C-C) = 0.007$ Å; H-atom completeness 97%; disorder in solvent or counterion; R factor = 0.041; wR factor = 0.131; data-to-parameter ratio = 18.6.

The title complex, $[Ag_2(C_7H_7O_3S)_2(C_{25}H_{22}P_2)_2] \cdot H_2O$, was obtained by the reaction of silver toluenesulfonate with diphenylphosphinomethane (dppm) in acetonitrile. There are two unique half-molecules of the complex in the asymmetric unit, together with one water molecule, which is disordered over two positions with site occupancy factors of 0.6 and 0.4. In each centrosymmetric neutral dimeric molecule, two Ag atoms are bridged by a pair of dppm ligands to give an eight-membered $Ag_2P_4C_2$ ring with a distorted $AgOP_2$ trigonal-planar environment. The Ag–Ag distances of 2.9215 (9) and 3.027 (1) Å indicate a direct bonding interaction.

Related literature

For similar structures, see: Chen *et al.* (2004); Effendy *et al.* (2005); Fournier, Decken & Harvey (2004); Fournier, Lebrun *et al.* (2004); Hong *et al.* (1997); Youm *et al.* (2000).



Experimental

Crystal data

$[Ag_2(C_7H_7O_3S)_2(C_{25}H_{22}P_2)_2] \cdot H_2O$
 $M_r = 1344.86$
 Triclinic, $P\bar{1}$
 $a = 11.239$ (2) Å
 $b = 11.802$ (2) Å
 $c = 23.363$ (5) Å
 $\alpha = 103.86$ (3)°
 $\beta = 93.79$ (3)°
 $\gamma = 91.95$ (3)°
 $V = 2998.1$ (10) Å³
 $Z = 2$
 Mo $K\alpha$ radiation
 $\mu = 0.88$ mm⁻¹
 $T = 293$ (2) K
 $0.36 \times 0.31 \times 0.28$ mm

Data collection

Rigaku Weissenberg IP diffractometer
 Absorption correction: none
 27870 measured reflections
 13424 independent reflections
 11383 reflections with $I > 2\sigma(I)$
 $R_{int} = 0.029$

Refinement

$R[F^2 > 2\sigma(F^2)] = 0.042$
 $wR(F^2) = 0.131$
 $S = 1.05$
 13424 reflections
 721 parameters
 H-atom parameters constrained
 $\Delta\rho_{max} = 0.71$ e Å⁻³
 $\Delta\rho_{min} = -1.86$ e Å⁻³

Table 1

Selected geometric parameters (Å, °).

Ag1–P2	2.4067 (11)	Ag2–P4	2.4033 (11)
Ag1–P1	2.4255 (11)	Ag2–P3	2.4181 (12)
Ag1–O6	2.491 (3)	Ag2–O3	2.500 (3)
P2–Ag1–P1	164.99 (3)	P4–Ag2–P3	158.11 (3)
P2–Ag1–O6	112.29 (10)	P4–Ag2–O3	111.55 (9)
P1–Ag1–O6	82.57 (10)	P3–Ag2–O3	90.29 (9)

Data collection: *CrystalClear* (Rigaku, 2000); cell refinement: *CrystalClear*; data reduction: *CrystalClear*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *SHELXTL/PC* (Sheldrick, 1993); software used to prepare material for publication: *SHELXL97*.

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: CF2162).

References

- Chen, Y.-D., Qin, Y.-H., Zhang, L.-Y., Shi, L.-X. & Chen, Z.-N. (2004). *Inorg. Chem.* **43**, 1197–1205.
 Effendy, Nicola, C. D., Nitiatmodjo, M., Pettinari, C., Skelton, B. W. & White, A. H. (2005). *Inorg. Chim. Acta*, **358**, 735–747.
 Fournier, E., Decken, A. & Harvey, P. D. (2004). *Eur. J. Inorg. Chem.* pp. 4420–4429.
 Fournier, E., Lebrun, F., Drouin, M., Decken, A. & Harvey, P. D. (2004). *Inorg. Chem.* **43**, 3127–3135.
 Hong, M., Wu, D., Liu, H., Mak, T. C. W., Zhou, Z., Wu, D. & Li, S. (1997). *Polyhedron*, **16**, 1957–1962.
 Rigaku (2000). *CrystalClear*. Rigaku/MSO, The Woodlands, Texas, USA.
 Sheldrick, G. M. (1993). *SHELXTL/PC*. Siemens Analytical X-ray Instruments Inc., Madison, Wisconsin, USA.
 Sheldrick, G. M. (1997). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.
 Youm, K.-T., Kim, Y., Do, Y. & Jun, M.-J. (2000). *Inorg. Chim. Acta*, **310**, 203–209.

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