Sutton, L. E. (1965). *Tables of Interatomic Distances and Configurations in Molecules and Ions*, Supplement. London: The Chemical Society.
Tian, Y.-P., Duan, C.-Y., Zhao, C.-Y., You, X.-Z., Mak, T. C. W. & Zhang, Z.-Y. (1997). *Inorg. Chem.* **36**, 1247–1252.
Togni, A. & Rihs, G. (1993). *Organometallics*, **12**, 3368–3376.
Williams, D. J. (1984). *Angew. Chem. Int. Ed. Engl.* **23**, 690–695.

Acta Cryst. (1999). C**55**, 2060–2061

[N,N'-Bis(salicylidene)ethylenediaminato-N,N',O,O']platinum(II)

WOLFGANG SAWODNY,[a] ULF THEWALT,[b] EDITH POTTHOFF[a] AND REINHARD OHL[a]

[a]*Abteilung Anorganische Chemie I, Universität Ulm, Albert-Einstein-Allee 11, D-89069 Ulm, Germany, and* [b]*Sektion für Röntgen- und Elektronenbeugung, Universität Ulm, Albert-Einstein-Allee 11, D-89069 Ulm, Germany. E-mail: ulf.thewalt@chemie.uni-ulm.de*

Abstract

The title compound, [Pt($C_{16}H_{14}N_2O_2$)], is nearly planar. There is pairing of two molecules with a Pt···Pt distance of 3.277 (1) Å indicating weak interaction. The pairs form puckered layers in the (010) planes.

Comment

A great number of structures of Schiff base complexes of divalent first row transition metal ions are well known. They exhibit either planar (Akhtar & Drew, 1982) or tetrahedral (Fox *et al.*, 1964) coordination around the central atom. Also, widening of the coordination sphere by additional metal–metal (Shkol'nikova *et al.*, 1970) or metal–base (Hall *et al.*, 1968) interactions can occur. No complete structural data of heavier transition metals, especially of group ten metals, are known so far. Only the point group and unit-cell dimensions of the Pd–salen complex have been reported (Shkol'nikova *et al.*, 1963), though this complex exhibits interesting catalytic properties (Henrici-Olivé & Olivé, 1974). The structure of Pt–salen described here is the first one reported for this type of complex.

Pt-salen
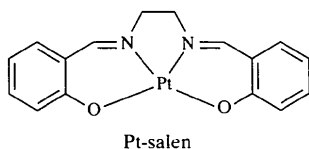
The whole molecule is nearly planar with a hardly perceptible arch-like deviation from the long axis (Fig. 1). The tetrahedral distortion around the Pt ion is very small, as indicated by the deviations of the ligating atoms from the best plane defined by them: O1 0.015 (2), O2 −0.015 (2), N1 −0.016 (2) and N2 0.016 (2) Å. The Pt atom deviates by 0.007 (2) Å and the maximum deviation from the plane is shown by C15 [0.373 (9) Å], giving the PtN₂(CH₂)₂ ring an envelope form.
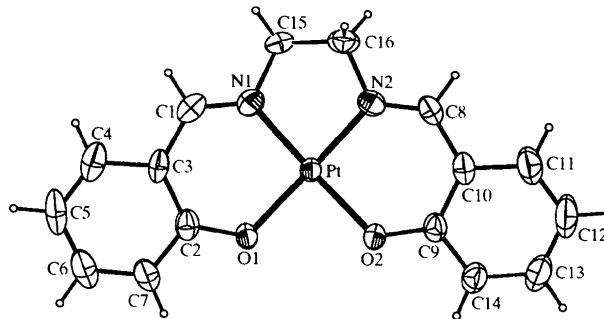
Fig. 1. The molecular structure of Pt–salen showing 50% probability displacement ellipsoids. H atoms have been omitted for clarity.

The arrangement of the molecules within the crystal lattice (Fig. 2) is in pairs with a rotation of 180° and a Pt···Pt distance of 3.277 (1) Å indicating metal–metal interaction as in the analogous Ni–salen complex (3.21 Å; Gaetani Manfredotti & Guastini, 1983). These pairs form puckered layers with an alternate tilt angle of ±24.4 (3)° from the (010) plane. The analogy of the lattice constants of Pd–salen to Pt–salen suggests a similarity of the structures with only slightly different geometrical data.
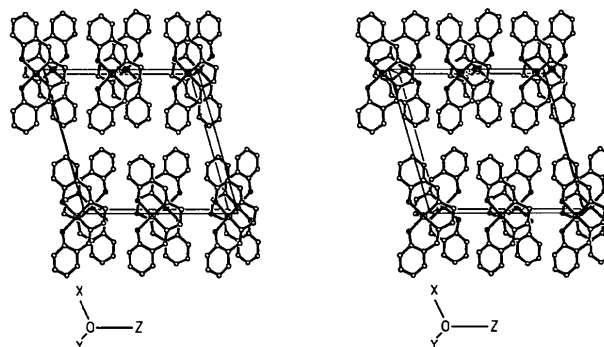
Fig. 2. Stereoscopic view of the crystal structure of Pt–salen down the *y* axis.

Experimental

Pt–salen was prepared by stirring a mixture of Pt(en)Cl₂ (0.5 g) and the Tl salt of salicylaldehyde (1 g) in absolute *N,N'*-dimethylformamide (70 ml) for 20 d at 333 K. Vine-red

crystals of Pt–salen crystallize from the solution together with TlCl and can be separated mechanically because of the colour. The product can be recrystallized from chloroform. Elemental analysis (%): C 41.21 (41.65), H 3.06 (3.06), N 6.07 (6.07), Pt 42.04 (42.28) (theoretical values in brackets).

Crystal data

[Pt(C$_{16}$H$_{14}$N$_2$O$_2$)]	Mo $K\alpha$ radiation
M_r = 461.39	λ = 0.71069 Å
Monoclinic	Cell parameters from 16
$P2_1/c$	reflections
a = 13.788 (2) Å	θ = 15.1–18.4°
b = 7.3827 (12) Å	μ = 10.182 mm^{-1}
c = 14.0672 (17) Å	T = 293 (2) K
β = 105.66 (2)°	Fragment cut from a larger
V = 1378.8 (4) Å^3	crystal
Z = 4	0.38 × 0.24 × 0.15 mm
D_x = 2.223 Mg m^{-3}	Red
D_m not measured	

Data collection

Stoe-modified Philips PW1100 diffractometer	2195 reflections with $I > 2\sigma(I)$
ω-2θ scans	R_{int} = 0.032
Absorption correction:	θ_{max} = 24.99°
ψ scan (*X-RED*; Stoe & Cie, 1994a)	h = $-16 \rightarrow 16$
	k = $0 \rightarrow 8$
T_{min} = 0.048, T_{max} = 0.217	l = $-16 \rightarrow 16$
4850 measured reflections	3 standard reflections
2425 independent reflections	frequency: 60 min
	intensity decay: 3%

Refinement

Refinement on F^2	$\Delta\rho_{max}$ = 1.570 e Å^{-3}
$R[F^2 > 2\sigma(F^2)]$ = 0.027	(0.89 Å from Pt)
$wR(F^2)$ = 0.068	$\Delta\rho_{min}$ = -2.026 e Å^{-3}
S = 1.051	(0.93 Å from Pt)
2425 reflections	Extinction correction:
191 parameters	*SHELXL97* (Sheldrick,
H atoms constrained	1997a)
$w = 1/[\sigma^2(F_o^2) + (0.0415P)^2]$	Extinction coefficient:
where $P = (F_o^2 + 2F_c^2)/3$	0.0071 (3)
$(\Delta/\sigma)_{max}$ < 0.001	Scattering factors from *International Tables for Crystallography* (Vol. C)

Table 1. *Selected geometric parameters (Å, °)*

Pt—N1	1.938 (5)	C8—N2	1.276 (8)
Pt—N2	1.950 (5)	C9—O2	1.310 (7)
Pt—O2	2.002 (4)	C15—C16	1.468 (9)
Pt—O1	2.006 (4)	C15—N1	1.497 (7)
C1—N1	1.288 (9)	C16—N2	1.483 (7)
C2—O1	1.305 (7)		
N1—Pt—N2	84.2 (2)	N1—Pt—O1	94.5 (2)
N2—Pt—O2	94.27 (19)	O2—Pt—O1	87.02 (15)

Data collection: *STADI4* (Stoe & Cie, 1994b). Cell refinement: *STADI4*. Data reduction: *X-RED* (Stoe & Cie, 1994a). Program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997b). Program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997a). Molecular graphics: *PLATON* (Spek, 1998) and *OR-TEP*III (Johnson & Burnett, 1996). Software used to prepare material for publication: *SHELXL97*.

References

Akhtar, F. & Drew, M. G. B. (1982). *Acta Cryst.* B38, 1149–1154.

Fox, M. R., Orioli, P. L., Lingafelter, E. C. & Sacconi, L. (1964). *Acta Cryst.* 17, 1159–1166.

Gaetani Manfredotti, A. & Guastini, C. (1983). *Acta Cryst.* C39, 863–865.

Hall, D., Sheat, S. V. & Waters, T. N. (1968). *J. Chem. Soc. A*, pp. 460–463.

Henrici-Olivé, G. & Olivé, S. (1974). *Angew. Chem.* 86, 561–562.

Johnson, C. K. & Burnett, M. N. (1996). *ORTEPIII*. Report ORNL-6895. Oak Ridge National Laboratory, Tennessee, USA.

Sheldrick, G. M. (1997a). *SHELXL97. Program for the Refinement of Crystal Structures*. University of Göttingen, Germany.

Sheldrick, G. M. (1997b). *SHELXS97. Program for the Solution of Crystal Structures*. University of Göttingen, Germany.

Shkol'nikova, L. M., Shugam, E. A. & Makarevich, L. G. (1963). *J. Struct. Chem.* 4, 854–855.

Shkol'nikova, L. M., Yumal, E. M., Shugam, E. A. & Voblikova, V. A. (1970). *J. Struct. Chem.* 11, 819–823.

Spek, A. L. (1998). *PLATON. Program for Calculations on X-ray Data*. University of Utrecht, The Netherlands.

Stoe & Cie (1994a). *X-RED. Data Reduction Program*. Version 1.04. Stoe & Cie, Darmstadt, Germany.

Stoe & Cie (1994b). *STADI4. Diffractometer Control Program*. Version 1.04. Stoe & Cie, Darmstadt, Germany.

Bis[μ-(hydrogen benzene-1,2-dicarboxylato)-*O*:*O*′]bis[bis(1,10-phenanthroline-*N*,*N*′)cobalt(II)] bis(hydrogen benzene-1,2-dicarboxylate) dihydrate

Dejan Poleti,[a] Ljiljana Karanović,[b] Goran A. Bogdanović[c]† and Anne Spasojević-de Biré[c]

[a]*Department of General and Inorganic Chemistry, Faculty of Technology and Metallurgy, PO Box 494, 11001 Belgrade, Yugoslavia, [b]Laboratory of Crystallography, Faculty of Mining and Geology, Djušina 7, 11000 Belgrade, Yugoslavia, and [c]École Centrale Paris, Laboratoire de Physico-Chimie Moléculaire et Minérale, URA 1907 du CNRS, Grande Voie des Vignes, 92295 Châtenay-Malabry CEDEX, France*

Abstract

The structure of the title compound, [Co$_2$(C$_8$H$_5$O$_4$)$_2$-(C$_{12}$H$_8$N$_2$)$_4$](C$_8$H$_5$O$_4$)$_2$·2H$_2$O, consists of centrosym-

† Current address: Laboratory of Theoretical Physics and Condensed Matter Physics, Institute of Nuclear Sciences 'Vinča', 11001 Belgrade, PO Box 522, Yugoslavia.