

Synthesis, Crystal, and Molecular Structure of the Novel Infinite Chain Mixed Metal Carbene Complex $[\text{Pd}(\mu\text{-Cl})_2\text{Pt}\{\text{C}(\text{PPh}_2)_2\}]_n$ derived from Co-ordinated Bis(diphenylphosphino)methane (dppm)

Saud I. Al-Resayes, Peter B. Hitchcock, and John F. Nixon*

School of Chemistry and Molecular Sciences, University of Sussex, Brighton BN1 90J, Sussex, U.K.

The title infinite chain carbene complex is reported.

Bis(diphenylphosphino)methane (dppm) and bis(dimethylphosphino)methane (dmpm) are widely used as ligands in stabilising dinuclear transition metal complexes.¹ Recent reports by McLennan and Puddephatt² of a novel mixed oxidation state $\text{Pt}^0\text{-Pt}^{\text{II}}$ complex containing bis(diethylphosphino)methane (depn) and phosphorus-carbon bond cleavage of dppm at a di-iron centre by Orpen, Knox, and co-workers³ prompts us to describe the synthesis of the novel bimetallic carbene complex derived from dppm which contains Pd^0 and Pt^{II} .

The light brown complex (1), can be obtained in low yield among other products from the reaction between Bu^tCP and $[\text{PdPtCl}_2(\mu\text{-dppm})_2]$ but is better synthesised in good yield by treatment of $[\text{PdCl}_2(\text{PhCN})_2]$ with $[\text{Pt}(\text{Ph}_2\text{PCHPh}_2)_2]$ at room temperature in benzene.

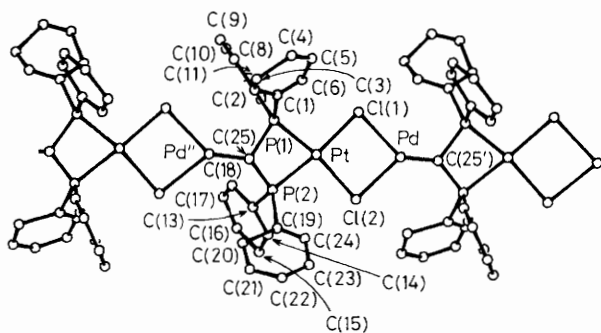


Figure 1. Structure of $[\text{Pd}(\mu\text{-Cl})_2\text{Pt}\{\text{C}(\text{PPh}_2)_2\}]_n$. (1).

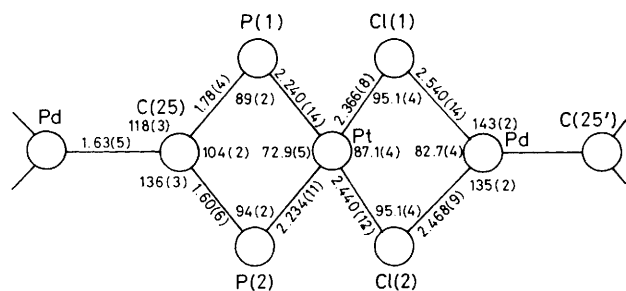


Figure 2. Important bond lengths (Å) and angles (°) in the inner co-ordination sphere of (1).

A single crystal *X*-ray diffraction study† on (1) reveals an infinite chain structure (Figure 1) of alternating Pd and Pt units. The asymmetric unit of the crystal contains one $[-\text{PdCl}_2\text{Pt}\{\{(\text{PPh}_2)_2\text{C}\}-\}]$ fragment with subsequent units in the infinite chain related by the diagonal glide on which the Pd, Pt, and carbene carbon atoms lie. The co-ordination units about the Pd and Pt atoms are coplanar as are the adjacent units of the chain.

† *Crystal Data*: $\text{C}_{25}\text{H}_{20}\text{Cl}_2\text{P}_2\text{PdPt}$, $M = 754.8$, rhombohedral, space group $R\bar{3}c$, $a = 21.200(4)$, $c = 31.258(5)$ Å, $U = 12166.4$ Å³, $Z = 18$, $D_c = 1.85$ g cm⁻³. The structure was solved by heavy atom methods and refined to $R = 0.085$. 7188 Reflections were measured with Mo- K_α radiation on an Enraf-Nonius CAD 4 diffractometer and 1630 with $|F^2| > \sigma|F^2|$ were used in the refinement. Atomic co-ordinates, bond lengths and angles, and thermal parameters have been deposited at the Cambridge Crystallographic Data Centre. See Notice to Authors, Issue No. 1, 1986.

The Pd and Pt atoms in the infinite chain can be regarded as being three co-ordinate Pd⁰ and four co-ordinate Pt^{II} and Figure 2 shows the important bond lengths and angles in the inner co-ordination sphere of both metals. The palladium environment is very unusual and although the Pd-C(sp²) carbene bond length [1.63(5) Å] is less well determined than the others, it is shorter than that in the Pd^{II} carbene complex *cis*-[PdCl₂{C(Me₂NC)₂}(PBuⁿ₃)] [1.961(3) Å]⁴ or related Pt^{II} carbene complexes where the Pt-C(sp²) bond distances average 2.024 Å.⁵⁻⁸

We thank the S.E.R.C. and the Saudi Arabian Government for financial support for the work and Messrs Johnson-Matthey for the loan of some precious metal salts.

Received, 30th June 1986; Com. 899

References

- 1 R. J. Puddephatt, *Chem. Soc. Rev.*, 1983, **12**, 99 and references therein.
- 2 A. J. McLennan and R. J. Puddephatt, *J. Chem. Soc., Chem. Commun.*, 1986, 422.
- 3 N. M. Doherty, G. Hogarth, S. A. R. Knox, K. A. MacPherson, F. Melchior, and A. G. Orpen, *J. Chem. Soc., Chem. Commun.*, 1986, 540.
- 4 R. D. Wilson, Y. Kamitori, H. Ogoishi, Z.-I. Yoshida, and J. A. Ibers, *J. Organomet. Chem.*, 1973, **57**, 213.
- 5 L. Manojlovic-Muir and K. W. Muir, *J. Chem. Soc., Dalton Trans.*, 1974, 2427.
- 6 W. M. Butler and J. N. Enemark, *Inorg. Chem.*, 1973, **12**, 540.
- 7 E. M. Badley, J. Chatt, R. L. Richards, and G. A. Sim, *J. Chem. Soc., Chem. Commun.*, 1969, 1322.
- 8 W. M. Butler, J. H. Enemark, J. Parks, and A. L. Balch, *Inorg. Chem.*, 1973, **12**, 451.