Platinum Metals Carbene Complexes

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This volume contains the proceedings of a NATO Advanced Research Workshop on Transition-Metal Carbene Complexes held at Wildbad Kreuth, West Germany in September 1988. The 43 papers contained in this useful publication were contributed by leading scientists in the field. In eight of the chapters the complexes of the platinum group metals are the major topic, and a number of other authors make peripheral references to platinum group metal complexes. The preponderance of papers dealing with early transition metals is a reflection both that the methodology developed for carbene synthesis by Professor E. O. Fischer and others is more readily applicable to these metals, and also that in catalytic applications which invoke carbene complexes the use of early transition metals has predominated.

The conversion of carbynes to carbenes at heteronuclear dimetal centres was addressed by F. G. A. Stone, of the University of Bristol. Bimetallic bridging carbynes were generated by the addition of organometallics, including complexes of platinum, rhodium and iridium, to tungsten carbynes. The protonation of the mixed metal carbyne was shown to generate a heterobimetallic bridging carbene complex, and platinum-tungsten systems appear particularly useful in these transformations.

The preparation of stable, methylene complexes of iridium, osmium and ruthenium was described by W. R. Roper of the University of Auckland. In the main, these were carried out by the reaction of diazomethane with nitrosyl phosphine complexes. The resultant complexes were characterised by crystallographic and spectroscopic means. For d^8 complexes it was shown that the addition of electrophiles occurred readily across the metal-carbon bond of the carbene, whereas the d^6 complexes were inert to electrophiles and unco-ordinated nucleophiles, such as triphenylphosphine and pyridine.

New routes towards highly substituted cyclopentanoids via the metal-mediated cyclisation of alkynes and carbenes were reported by J. M. O'Connor, L. Pu, J. A. Johnson and R. Uhrhammer, of the University of California at San Diego. Stable iridium complexes containing both metallacycle and carbene ligands were isolated, and on extended thermal decomposition these gave a mixture of products. A rhodium metallacycle [$RhCl(PPh_3)_2(C_{24}O_2H_{24})$] reacted with butynediol to give a substituted anthraquinone rather than the desired five membered ring.

The synthesis of electron-rich alkenes containing nitrogen functionalities attached to the alkenic bond was discussed by J. A. Chamizo and M. F. Lappert of the University of Sussex. Carbene complexes could be isolated when these were reacted with palladium and rhodium complexes. A further related contribution by M. F. Lappert, P. B. Hitchcock and H. A. Jasim of the University of Sussex, and B. Cetinkaya of Inönü University, Turkey concerned the synthesis of a range of rhodium carbene complexes and one iridium compound. For these electron-rich carbenes, one carbene ligand was readily displaced from [$RhCl(carbene)_3$] by carbon monoxide or oxygen.

The synthesis of cyclic and acyclic carbene complexes of palladium(II) and platinum(II) derived from the reaction of aziridine, thiirane and oxirane at co-ordinated isocyanide ligands was reported by R. Bertani, M. Mozzon, L. Zanotto and R. A. Michelin. Preliminary investigations of related polymer supported carbene complexes were reported by B. Corain, R. A. Michelin, M. Mozzon and M. Zecca, also of the University of Padua, Italy.

This volume provides a good guide to the preparation of metal carbene complexes, and will prove useful to those entering this area of research. M.J.H.R.