

The Organic Chemistry of Palladium

The Organic Chemistry of Palladium, by Peter M. Maitlis. Vol. 1, *Metal Complexes*, 324 pp., £8.85. Vol. 2, *Catalytic Reactions*, 234 pp., £7.45. Academic Press, New York and London, 1971

The notion that a metallic element should have an 'organic chemistry' associated with it should come as no surprise to anyone who has graduated in chemistry in the past decade, or who has kept even half an eye on the recent chemical literature. Of the platinum group metals, none has a more extensive, interesting and useful 'organic chemistry' than palladium, and the recently published two-volume work by Professor Peter Maitlis is both welcome and timely.

Metal Complexes

The first of these two volumes is entitled 'Metal Complexes'. It comprises a thorough and up-to-date review of the great variety of complexes formed by palladium (usually in the +2 oxidation state) with unsaturated organic molecules, especially olefins, acetylenes and diolefins. The nature of the bond between the metal and the organic molecule is quite well understood, and one of the valuable results arising from the discovery of these compounds has been the extension of our understanding of valency theory and a realisation of the limitations of classical bonding symbolism. This point is especially relevant in the chapter on π -allylic complexes and in the shorter final chapter on cyclopentadienyl and benzene complexes.

Catalytic Reactions

The second volume, entitled 'Catalytic Reactions', will be of greater interest to synthetic organic chemists and to those seeking to employ the powerful techniques of homogeneous catalysis in the design of new processes of industrial significance. It is perhaps worth emphasising the pre-eminent position of palladium and its complexes in

this area. It appears to be a consequence of a fortunate concatenation of circumstances, in that palladium not only forms the right sort of complexes, but that they are sufficiently reactive to be effective intermediates in catalytic processes. This is, for example, not the case with platinum, where although similar complexes exist they are too stable to be reactive.

Professor Maitlis organises his material according to the type of bond which is formed or broken: thus there are chapters on the formation and cleavage of carbon-carbon bonds, carbon-oxygen bonds, carbon-hydrogen bonds and carbon-X bonds where X is halogen, nitrogen, sulphur or silicon. There is a final short chapter on heterogeneous reactions which has the value of comparing homogeneous and heterogeneous palladium catalysts.

It has been something of a disappointment to those who have worked long and hard in the fields of palladium complex chemistry and of homogeneous catalysis that so few large-scale industrial applications have yet emerged. It has not been for want of effort but those who place value upon the commercial relevance of their work may take heart; the difficulties which have inhibited industrial applications have been in the chemical engineering rather than in the chemistry of the systems. What is required now is more attention to the technology of homogeneous catalysis, so that what is known may be used fruitfully.

These two volumes are much to be welcomed and will long continue to be consulted by those who are interested in the interface between inorganic and organic chemistry.

G. C. B.