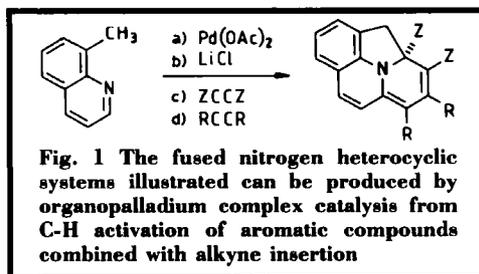


Organopalladium Chemistry Project Sponsored by European Commission

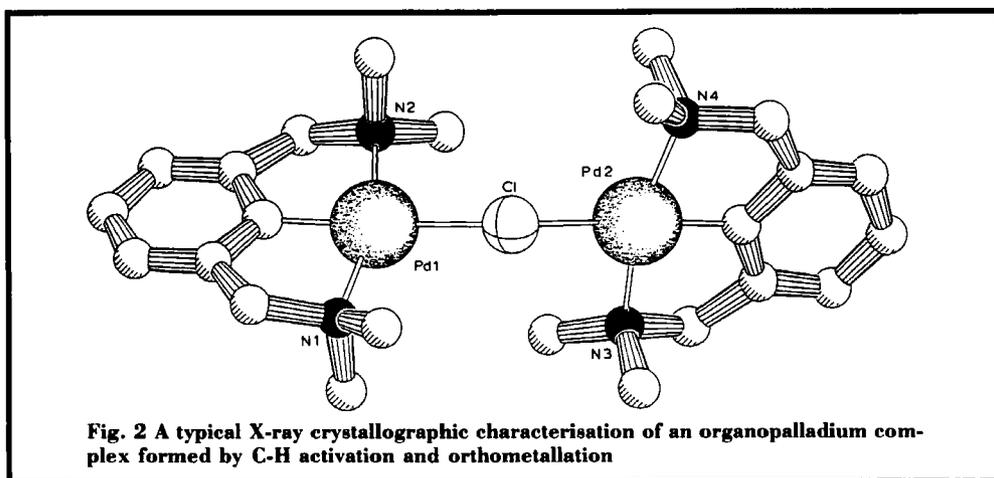
In its latest round of funding under the Science Plan, the European Commission has agreed to support a programme of research in four university laboratories covering diverse aspects of the chemistry of palladium complexes applied to organic synthesis. At Strasbourg, the group led by Dr. Michel Pfeffer is engaged in studying the preparation of novel types of cyclic compound, including a range of nitrogen heterocycles of different ring size, through reactions which involve intramolecular C-H activation of functional aromatic compounds. These processes are combined with alkyne insertion to provide a battery of fused ring systems, as shown in Figure 1. Dr. Alain Dedieu is also at Strasbourg and works on the theoretical basis for organometallic catalytic reactions. Previous studies have been concerned with the classic catalytic reactions such as hydrogenation and hydroformylation, but within the framework of the present grant he will attempt to illuminate the course of relevant C-C bond forming reactions. Specific aspects of organopalladium catalysis, particularly cross-coupling and other related reactions which hold promise in asymmetric synthesis, will be the



concern of Dr. John M. Brown at Oxford. The collaboration will involve regular meetings of the participants, as well as the exchange of research workers among the various laboratories.

The project is co-ordinated by Professor Gerard van Koten of Utrecht. His interests, like those of Pfeffer, are in cyclopalladated compounds but using the directed metallation procedures to provide functionalisation of aromatic compounds. This is of particular interest for oxidation chemistry and could lead to simple routes from arenes to the corresponding phenols.

Thus, all the participants have a common ground in organopalladium chemistry but plan



to develop their research in diverse ways. A further basis for collaboration is provided by the sharing of equipment and expertise among the centres. The Utrecht group, for example, has long-standing experience in X-ray crystallographic characterisation of reactive organometallic compounds, see Figure 2. In catalytic cross-coupling reactions, the structure of the nucleophilic component may play a crucial part in determining the reaction selectivity. X-ray characterisation will underpin the work in the other laboratories. Similarly, the Oxford group has a lot of experience in applying NMR techniques to the mechanistic analysis of homogeneous catalysis.

European Commission projects of this type serve a further useful purpose. They encourage a high level of exchange between the different laboratories both for the academic supervisors and for their students and associates. It is specified in the grant conditions that co-workers, supported by the project, must be members of one European Commission country but working in another. This stipulation serves a dual purpose. Not only will it help to bring about the broadening of the European research base in chemistry, but it will also lead to the training of students and postdoctorals who will be well-equipped to live and work in post-1992 Europe.

Complete Oxidation of Organics

Catalysis Volume 8, Specialist Periodical Reports

EDITED BY G. C. BOND AND G. WEBB, The Royal Society of Chemistry, 1989, 203 pages, ISBN 0-85186-594-1, £70.00, U.S.\$134.00

As may well be expected, any book on catalysis is almost certain to contain many references to the uses of the platinum metals and this is especially true if, as in the present case, one whole chapter is devoted to the complete catalytic oxidation of volatile organic molecules. Altogether the present volume contains five chapters of approximately equal length, including one devoted to catalysis by solid acids and bases, two on theoretical studies of the structure of the catalytic site in zeolites and on oxide/metal surfaces, and a fifth on the use of EXAFS in the study of catalysts.

The chapter on EXAFS starts with a brief but useful description of the underlying theory and type of equipment used for making measurements. Information can be obtained which is extremely pertinent to two main problems: the specific detailed environment of a given atom, for example the ligand donor set of a given metal centre, or secondly, the morphology and atomic packing of small metal particles. Intermediate between these would be the structure and integrity of small metal cluster compounds such as are sometimes used in catalyst preparation. Details are given of work in all these areas. Particularly relevant to the platinum metals is the work described on the structures of osmium and rhodium carbonyl cluster compounds and, together with similar ruthenium complexes, their fate when impregnated on typical silica or alumina catalyst

supports. The cationic exchange of metals onto zeolites can also be followed, as can the development of metal and metal alloy particles during reduction.

The chapter on complete oxidation of organics is less informative and therefore less satisfactory. Again there is an introductory section but this is both too long and too elementary for a Specialist Report. This chapter is more a review of catalytic combustion rather than a review of recent literature. Of the 125 references quoted more than 20 predate the 1970s and less than 50 appeared in the 1980s. For the enthusiast there is a Table extending for some twenty pages which lists, apparently in random order, a selection of systems which have been reported in terms of conditions and catalyst used, and the nature of the reactant. Less than one page of text is devoted to a discussion of applications.

Major problem areas identified with this type of oxidation include the possibility of producing more toxic products by partial combustion; for example, dioxins from incomplete combustion of chlorinated compounds and also the poisoning of the catalyst by sulphur or chlorine, and fouling of the catalyst by other components which can give rise to an inorganic ash. Problems also arise when trying to predict conditions for the combustion of mixtures since both synergistic and antagonistic interactions can occur.

J.W.J.