

Preface

The world-wide community of workers in the field of catalysis owe a great debt of gratitude to Charles Kemball and Dennis Dowden for their work as Senior Reporters for the first four volumes of this Specialist Periodical Report. They have set a standard of wisdom in selecting subjects of current interest from a large and ever-growing field which we, their successors, will find hard to emulate. We have tried to follow in their path by calling for up-dating reviews in the most popular and rapid-growing areas, while, in the case of at least two articles in this volume, also venturing into previously untrodden ways.

Richard Joyner continues the tradition established by Sam Thomson of a biennial review of catalysis by single-crystal surfaces. Although still far removed from practically-useful catalysts, the gap has narrowed considerably with the ability to model small particles by stepped surfaces and to study reaction behaviour at high pressure in the same apparatus used to apply the armoury of surface physics techniques. The results obtained are bound to interest those whose concern is with the intimate details of reaction mechanisms.

The synthesis and reactions of hydrocarbons are areas of continuing attention. Vladimir Ponec has written a timely summary of the state of our understanding of the Fischer–Tropsch synthesis, with emphasis on the manner in which CO adsorbs and enters into chain growth. We hope to have a companion article on methanation in a later volume. Zoltan Paál and Pal Tétényi have undertaken a herculean task in up-dating earlier reviews by Ronnie Moss and by one of us on hydrocarbon transformations on metallic catalysts: the wealth of mechanistic detail and the great commercial importance of these reactions ensure a continuing high level of interest. We are approaching the point of being able to specify with some accuracy the geometric and electronic requirements for active sites to effect particular molecular rearrangements.

There has been no previous review in this Report of the catalytic chemistry associated with the treatment of vehicle exhaust to minimise harmful emissions. Because again of the great commercial importance, much study has been devoted to the decomposition of NO and its reduction by CO, H₂, and NH₃. We are very pleased that Brian Harrison and his colleagues at the Johnson Matthey Research Centre have produced a comprehensive picture of the work in this field. The molecular simplicity of reactants and products does not ensure a corresponding simplicity of kinetics and mechanism, and the detection of more complex species such as NCO⁻ in the course of the NO + CO reaction is an example of the unexpected turns which catalytic chemistry can take. The authors also provide a thorough and useful survey of the chemisorption of NO.

In Chapter 5, Tom Baird follows another new path by providing a most helpful review of one of the principal techniques for characterising practical catalysts. Everyone who uses electron microscopy will, we are sure, learn something of use from this chapter.

There is enormous interest, especially in the United States, in the processing of coal to give liquid fuels, and pilot plants of considerable size are already in operation. There is a new challenge for catalysis in this field, and we are indebted to Derek Gavin of the Coal Research Establishment for giving us a simple account of the technology involved and of how catalysis contributes. Simple inorganic salts such as ZnCl_2 are employed, a far cry from the complex and costly catalysts which other processes demand.

In the remaining chapters we return to more familiar ground. Charles Cullis and David Hucknall contribute an up-dating of an earlier article in Volume 3 on the selective oxidation of hydrocarbons, which is another area showing no sign of losing its appeal. Photocatalysis is a field which is rapidly gaining in importance, and the photolysis of water by sunlight on a commercial basis represents the greatest challenge yet to catalysis. Roger Bickley's review should therefore be of wide interest. In Chapter 9 Gary Haller and his colleague Ted Oyama inspect two classes of inorganic compounds which are of current but more limited interest as catalysts. Carbides and nitrides behave quite differently from the corresponding metals, while intermetallic compounds, some of which have the ability to form multi-atom hydrides, represent a situation intermediate between the carbides and nitrides, and the pure metals.

Finally Ron Cross considers homogeneously-catalysed insertion reactions. This is one of the most common types of process occurring at a single metal atom, and one which is sometimes postulated in surface reactions. We expect to develop this theme in Volume 6 with a review of homogeneous hydroformylation.

We hope that every reader will find more than a modicum of interest within this volume. What follows is the end-product of a large investment of time and mental energy, and we are much indebted to those who have undertaken these tasks to simplify our own. We solicit the views of our readers on the contents of this volume, and welcome suggestions for subjects which might be covered in later volumes.

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