

## Preface

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The application of catalytic principles to energy and chemical production as well as the challenges of environmental issues remains an important field of study. There continue to be new ideas, new problems to be solved, and new insight into how catalysts work. It is my hope that this volume of the Catalysis book series will be a resource for those who are working in this exciting area.

This volume consists of reviews devoted to a range of important subjects. Vadim Guliants and Moises Carreon (University of Cincinnati) review the selective oxidation of butane. This is an excellent example of a catalytic process designed to add value to an inexpensive raw material, and is the only vapor phase selective oxidation of an alkane that is practiced industrially. This process also avoids the use of benzene, which eliminates the risk of handling this carcinogenic compound. The authors review the synthesis, activation, and mechanism of this reaction on V-P-O catalysts.

Gabriele Centi and Siglinda Perathoner (University of Messina, Italy) examine the use of solid catalysts for the removal of contaminants from water supplies. This includes photocatalytic processes as well as oxidation and reduction reactions. There are a wide range of catalysts used in these various processes. In addition to their activity, deactivation is often a critical concern. The authors show that there are significant challenges remaining in this area.

The use of polynuclear metal complexes provides a novel approach to the synthesis of supported metals and metal oxides. Mark White (Georgia Tech) shows how these materials can be synthesized and characterized. Quantum mechanics are used to compare predicted and experimental results of the interactions of the metal complexes and surfaces. The use of these materials as both adsorbents and catalysts suggests the importance of understanding both how they are synthesized, and their post-synthesis structure.

In-Sik Nam and Moon Hyeon Kim (Pohang University of Science and Technology, Korea) review new materials for the selective catalytic reduction of  $\text{NO}_x$  from combustion processes. Despite significant research efforts over the last 20 years, there are still unresolved issues, such as inhibition and deactivation by steam. The authors show how new synthesis methods, especially for zeolites, can be used to improve these catalysts.

Finally, Steve Chuang (University of Akron) reviews catalysts for use in solid oxide fuel cells. These fuel cells hold the promise of significant improvements in energy efficiency with minimum emissions, but challenges remain – particularly for the catalysts. A particular challenge is the effect of the high temperature operation on the oxide electrolyte. Also important is the stability of the anode in

the reducing environment and its tolerance to sulfur. These and other constraints on the catalysts used in this fuel cell are the subject of this review.

I wish to thank the authors for the effort they have put into these chapters, and the Royal Society of Chemistry for their support, particularly Janet Freshwater. Comments and suggestions are welcome.

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