

Preface

The completion of Volume 12 in the *Catalysis* series has been especially rewarding. I have continued a conscious effort to cover a wide range of subjects in our field. More publications in catalysis are available each year, reflecting a healthy interest in catalysis as an important tool with which to address concerns in environment control, energy conversion processes, and synthesis of chemicals. The chapters presented to you here deal with these areas, as well as the more fundamental analytical methods and material synthesis.

Dr. Matsuhisa presents a review of the nature of Cu-ZnO catalysts, which are widely used for the industrially important synthesis of methanol. Despite the importance of these materials, there have been relatively few reviews on the mechanism and the review presented here attempts to add to our knowledge of this reaction.

Drs. Ishihara and Takita focus on a specific catalyst, the aluminophosphate molecular sieves. These materials have some useful properties that distinguish them from the more widely used aluminosilicates. These include generally milder acidity, somewhat different ion exchange properties, and higher thermal stability. This allows them to be used in a number of reactions in which aluminosilicates are not suitable, such as low-temperature catalytic combustion.

Drs. Raje and Davis present interesting work on the use of isotopes to study Fischer-Tropsch synthesis. This route to synthetic chemicals, despite having been studied for some time, must be more cost-competitive before it will be widely used. The work presented in this chapter will help us understand the mechanism of the reactions and how to maximize yields.

Dr. Eguchi presents a review of catalysts used for high-temperature catalytic combustion. This process offers the possibility of greatly reducing NO_x emissions from gas turbines, but there is considerable work needed to develop materials that have both the low-temperature activity and durability at 1,200 to 1,400 °C to be of practical interest. This review summarizes the most recent research in this area.

Dr. Ai reviews the condensation of formaldehyde and methanol with other hydrocarbons to form the widely used vinyl compounds, such as methacrylic acid and methyl methacrylate. The development of active and stable solid catalysts for these reactions can eliminate the significant environmental problems faced with the current industrial routes to these chemicals.

Drs. Vayenas and Neophytides present a thorough review of electrochemical activation of catalysts. This process can be used in situ to control the catalytic process and improve selectivity and yield for certain reactions. This is especially important as new

solid ion conducting electrolytes with better thermal stability and ion conductivity are developed.

Dr. Horányi reviews a fundamental area of electrocatalysis, one in which there is a solid-fluid boundary. He presents a thorough review of the key parameters in this field and provides background information and nomenclature for the uninitiated.

Drs. Seehra and Ibrahim summarize recent advances in the important analytical tool of electron spin resonance, particularly as it is used in the direct catalytic liquefaction of coal. This tool is especially important because it can now be used in situ. There is some question about the role of free radicals in direct liquefaction, and the authors explore this subject.

Finally, Dr. Mandai presents a summary of the use of theoretical analysis of catalytic combustion as used in gas turbines. This allows the understanding of the processes occurring at conditions that are difficult to reproduce in the laboratory, but which are extremely important at conditions of practical interest.

I have appreciated the efforts of the authors and reviewers in meeting the schedule we set for ourselves. I also wish to thank the Royal Society of Chemistry for their support of the series. The thoroughness and attention to detail of Ms. Jan Shirley and Ms. Linda Gaydosh of RTI's Publication and Design Services are evident in the presentation of the book, which is prepared entirely from camera-ready mats. They deserve more credit than I am able to give them here.

James J. Spivey
Research Triangle Institute
Research Triangle Park, NC USA