Nanoparticles and Catalysis

Edited by
Didier Astruc

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Preface

Catalysis is a central concept in chemistry, playing, for instance, a key role in biological and industrial processes. For a century, catalysis has been divided into homogeneous and heterogeneous reactions, and scientific communities have crystallized around each aspect. The advent of nanosciences has now clearly promoted the bottom-up strategy over the top-down one, making this traditional frontier obsolete. Thus, the molecular approach is presently most useful for the definition of selective and efficient heterogeneous catalysts that can be removed from reaction media and re-used. Nanocrystals of size one to only a few nanometers present the best catalytic efficiency, yet their support is most important for the synergistic activation of substrates, as best illustrated by Haruta's famous catalysis of CO oxidation by O_2 at 200 K by oxide-supported gold nanoparticles (NP).

Therefore, this book is timely in gathering together the best experts in catalysis, coming originally from both homogeneous and heterogeneous catalysis communities, who have imagined a large number of synthetic approaches to catalytically active transition-metal NPs and their derivatives. All of them now focus on aspects that promote selectivity and efficiency for a broad variety of molecular-activation processes with goals ranging from organic synthesis to hydrocarbon reforming and environmental problems.

Thus the first part of the book (Chapters 1 to 9) deals with NP catalysis, emphasizing the key role of NP supports; the second part (Chapters 10 to 12) concerns specific metals (namely Pd, Ru, Ir and Au), and the last part (Chapters 13 to 18) focuses on specific substrates of particular interest for organic chemistry, hydrocarbon reforming and environmental aspects. Among the metals, Pd and Au are the most effective catalysts. Palladium is the most efficient catalyst for carbon–carbon bond formation thus, besides Chapter 10 that is devoted to PdNPs, their catalytic properties also spread over the first part of the book. Gold is the most efficient NP catalyst for a variety of aerobic (thus low-cost) oxidation reactions, and AuNP catalysis is covered in four chapters at the end of the second part and beginning of the third part. Each chapter is introduced in more detail in Chapter 1.

All the chapters have been reviewed by two to three independent referees. For their invaluable refereeing assistance and expertise (some have served twice), we are grateful to:

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We strongly believe that this book will greatly catalyze research in this key field in the forthcoming years for the benefit of our Society. Have a nice read!

Bordeaux, July 2007 *Didier Astruc*

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