Fine Chemicals through Heterogeneous Catalysis

Roger Arthur Sheldon, Herman van Bekkum

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Prof. Dr. R. A. Sheldon
Delft University of Technology
Organic Chemistry and Catalysis
Julianalaan 136
2628 BL DELFT
The Netherlands

Prof. Dr. H. van Bekkum
Delft University of Technology
Organic Chemistry and Catalysis
Julianalaan 136
2628 BL DELFT
The Netherlands

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R. A. Sheldon, H. van Bekkum

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Preface

The subject of this book is the application of heterogeneous catalysis in organic synthesis with emphasis on transformations of relevance to fine chemicals manufacture. Both gas and liquid phase reactions are included although the latter are more numerous, analogous to fine chemicals manufacture where substrates and products often have low volatility and/or thermal stability, necessitating operation in the liquid phase. The subject is divided on the basis of the major types of catalytic conversions employed in organic synthesis: acid and base catalysis, hydrogenation and dehydrogenation, oxidation and C-C bond formation.

Heterogeneous catalysis has a long history, dating back to the early studies of alcohol dehydration over alumina and alcohol oxidation over platinum metal in the nineteenth century. Another milestone was the discovery, by the organic chemists Sabatier and Senderens, of catalytic hydrogenations at the beginning of the twentieth century. The high potential of catalysts as „molecular marriage brokers and divorce lawyers" gradually became apparent and, following the advent of petrochemicals in the nineteen twenties, heterogeneous catalysis by solid acids and supported metals was widely applied in oil refining and petrochemicals. In contrast, fine chemicals manufacture was dominated by synthetic organic chemists who adhered to „stoichiometric" methodologies. But „times are a changing". The pressure of environmental legislation has, in the last decade, provided an important stimulus for the development of clean, catalytic methodologies. And heterogeneous catalysts have the added benefit of ease of separation and reuse.

This book is directed towards chemists engaged in organic synthesis, and catalysis, both in industrial and academic laboratories, who are concerned with research and development as well as education. Our primary aim is to cultivate a deeper understanding and, hence, promote a greater utilization of heterogeneous catalysis in organic synthesis. To this end, an international group of recognized authorities in the field of heterogeneous catalysis has been gathered together.

A general introduction to the subject is followed by a discussion of basic principles regarding types of catalyst and their preparation and characterization and types of catalytic reactors. Chapter 3 deals with the different types of solid acids. In the following chapters (4-6) various (solid) acid-catalyzed transforma-

tions are reviewed, *e. g.* aromatic substitutions and rearrangements and isomerizations. Solid base-catalyzed processes, *e. g.* aldol and related condensations are discussed in Chapter 7. Subsequent chapters deal with catalytic hydrogenation and dehydrogenation (Chapter 8), catalytic oxidation (Chapter 9) and catalytic C-C bond formation (Chapter 10), culminating in a future outlook (Chapter 11).

Each chapter contains an extensive bibliography covering the principal literature through the end of 1999.

Finally, the editors would like to express their sincere thanks to their friends and colleagues who have contributed such fine chapters to this book. We gratefully acknowledge the invaluable assistance of Mrs. Mieke van der Kooij in coordinating the traffic of manuscripts between contributors, editors and publisher. We also thank Wim Jongeleen for the cover illustration. Finally, we thank Dr. Anette Eckerle and Dr. Roland Kessinger of Wiley-VCH for their help in preparing this book.

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Roger Sheldon
Herman van Bekkum

List of Contributors

A. Abbadi
AraChem Contract Research & Custom Synthesis
P. O. Box 2021
6020 AA Budel
The Netherlands

D. J. Ager
Richmond Chemical Corporation
4285 Mumford Drive
Hoffman Estates, IL 60195
USA

A. Baiker
Laboratory of Technical Chemistry
ETH-Zentrum
Universitätstrasse 6
8092 Zürich
Switzerland

S. Bailey
Synetix
P. O. Box 1
Belasis Avenue
Billingham
Cleveland TS23 1LB
UK

U. Barsnick
Technische Chemie und Heterogene Katalyse
Technische Hochschule Aachen
Worringerweg 1
52056 Aachen
Germany

M. Bartók
University of Szeged
Department of Organic Chemistry
Dóm tér 8
6720 Szeged
Hungary

J.-M. Basset
Laboratoire COMS CPE Lyon
UMR CNRS 9986
43 bd du 11 novembre 1918
69616 Villeurbanne Cedex
France

A. E. W. Beers
Section Industrial Catalysis
Delft ChemTech
Delft University of Technology
Julianalaan 136
2628 BL Delft
The Netherlands

H. van Bekkum
Delft University of Technology
Organic Chemistry and Catalysis
Julianalaan 136
2628 BL Delft
The Netherlands

M. Besson
Institut de Recherche sur la Catalyse-CNRS
2 Avenue Albert Einstein
69626 Villeurbanne Cédex
France

H. U. Blaser
Solvias AG
WRO-1055.6.28
Klybeckstrasse 191
Postfach
4002 Basel
Switzerland

D. Brunel
Laboratoire de Matériaux Catalytiques et Catalyse en Chimie Organique
UMR-CNRS-5618
Ecole Nationale Supérieure de Chimie
8, rue de l'Ecole Normale
34296 Montpellier Cedex 05
France

M. Campanati
University of Bologna
Department of Industrial Chemistry
Catalysis Section
Viale Risorgimento 4
40136 Bologna
Italy

M. G. Clerici
EniTecnologie SpA
Via F. Maritano 26
20097 San Donato Milanese (MI)
Italy

C. Copéret
Laboratoire COMS CPE Lyon
UMR CNRS 9986
43, Bd du 11 novembre 1918
69616 Villeurbanne Cedex
France

A. Corma
Instituto de Tecnología Química – UPV-CSIC
Universidad Polytécnica de Valencia
Avenida de los Naranjos s/n
46022 Valencia
Spain

E. J. Creyghton
Shell International Chemicals B. V.
CTCAT/3
Badhuisweg 3
1031 CM Amsterdam
The Netherlands

A. E. van Diepen
Delft University of Technology
Section Industrial Catalysis
Julianalaan 136
2628 BL Delft
The Netherlands

A. J. van Dillen
U-Cat. b.v.
Utrecht University
Room East 807
Hugo R. Kruytbuilding
Padualaan 8
3584 CH Utrecht
The Netherlands

J. G. Donkervoort
Engelhard de Meern B. V.
Chemical Catalyst Group
Strijkviertel 67
3454 PK de Meern
The Netherlands

R. S. Downing
Boekenroodeweg 7
2111 HJ Aerdenhout
The Netherlands

A. Eisenstadt
IMI (TAMI) Institute for R&D Ltd.
P. O. Box 10140
Haifa Bay 26111
Israel

F. Fache
Institut de Recherches sur la Catalyse
Laboratoire de Catalyse et Synthèse Organique
Université Claude Bernard Lyon I, CPE
43, Bd du 11 novembre 1918
69622 Villeurbanne Cedex
France

F. Figueras
Institut de Recherches sur la Catalyse du CNRS
2 Avenue Albert Einstein
69626 Villeurbanne Cedex
France

P. Gallezot
Institut de Recherches sur la Catalyse-CNRS
2 Avenue Albert Einstein
69626 Villeurbanne Cedex
France

J. M. Garces
The Dow Chemical Company
Corporate R & D, Catalysis.
Bldg. 1776
Midland, MI 48674
USA

J. W. Geus
U-Cat. b.v.
Utrecht University
Room East 807
Hugo R. Kruytbuilding
Padualaan 8
3583 CH Utrecht
The Netherlands

K. Griffin
Johnson Matthey Plc
Process Catalyst
Orchard Road
Royston, Herts SG8 5HE
UK

M. Guisnet
Université de Poitiers
Catalyse en Chimie Organique – CNRS – DO350 – UMR 6503
40, Avenue du Recteur Pineau
86022 Poitiers Cedex
France

W. F. Hölderich
Technische Chemie und Heterogene Katalyse
Technische Hochschule Aachen
Worringerweg 1
52056 Aachen
Germany

S. Iborra
Instituto de Tecnología Química – UPV-CSIC
Universidad Polytécnica de Valencia
Avenida de los Naranjos s/n
46022 Valencia
Spain

Y. Izumi
Sugiyama Jogakuen University
Department of Human Environment
17-3, Hoshigaoka, Motomachi,
Chikusa-ku
Nagoya 464-8662
Japan

P. A. Jacobs
Centrum voor Oppervlaktechemie en Katalyse
Katholieke Universiteit Leuven
Kardinaal Mercierlaan 92
3001 Heverlee
Belgium

F. Kapteijn
Section Industrial Catalysis
Delft ChemTech
Delft University of Technology
Julianalaan 136
2628 BL Delft
The Netherlands

F. King
Synetix
P. O. Box 1
Belasis Avenue
Billingham
Cleveland TS23 1LB
UK

A. Kogelbauer
Department of Chemical Engineering and Chemical Technology
Imperial College of Science, Technology and Medicine
London SW7 2AZ
UK

H. W. Kouwenhoven
Laboratorium für Technische Chemie
ETH-Zentrum
8092 Zürich
Switzerland

E. G. M. Kuijpers
Engelhard de Meern B. V.
Chemical Catalyst Group
Strijkviertel 67
3454 PK De Meern
The Netherlands

P. J. Kunkeler
Akzo PQ Silica
Ankerkade 111
6222 NL Maastricht
The Netherlands

G. S. Lee
The Dow Chemical Company
Corporate R&D, Catalysis.
Bldg. 1776
Midland, MI 48674
USA

M. Lemaire
CPE/UCBL/CNRS
Bat. 308
43, Bd du 11 novembre 1918
69622 Villeurbanne Cedex
France

J. Lopez
Institut de Recherches sur la Catalyse du CNRS
2 Avenue Albert Einstein
69626 Villeurbanne Cedex
France

B. Lücke
Institut für Angewandte Chemie
Berlin-Adlershof e. V.
Richard-Wilstätter-Str. 12
12489 Berlin
Germany

D. J. Macquarrie
Centre for Clean Technology
Department of Chemistry
University of York
Heslington, York YO10 5DD
UK

T. Mallat
Laboratory of Technical Chemistry
ETH-Zentrum
Universitätstrasse 6
8092 Zürich
Switzerland

A. Martin
Institut für Angewandte Chemie
Berlin-Adlershof e. V.
Richard-Wilstätter-Str. 12
12489 Berlin
Germany

C. H. McAteer
Reilly Industries, Inc.
1500 South Tibbs Avenue
P. O. Box 42912
Indianapolis, Indiana 46242-0912
USA

G. R. Meima
Corporate R&D
Dow Benelux N. V.
P. O. Box 48
4530 AA Terneuzen
The Netherlands

P. Métivier
Rhodia
Centre de Recherches de Lyon
85, Ave. des Frères Perret – B. P. 62
69192 Saint Fons Cedex
France

G. J. Meuzelaar
Stockholm University
Department of Organic Chemistry
Arrhenius Laboratory
10691 Stockholm
Sweden

J. C. Mol
University of Amsterdam
Faculteit of Chemistry
Institute of Molecular Chemistry
Nieuwe Achtergracht 166
1018 WV Amsterdam
The Netherlands

A. Molnár
University of Szeged
Department of Organic Chemistry
Dóm tér 8
6720 Szeged
Hungary

J. A. Moulijn
Section Industrial Catalysis
DelftChemTech
Delft University of Technology
Julianalaan 136
2628 BL Delft
The Netherlands

T. A. Nijhuis
Section Industrial Catalysis
Delft ChemTech
Delft University of Technology
Julianalaan 136
2628 BL Delft
The Netherlands

F. Notheisz
University of Szeged
Department of Organic Chemistry
Dóm tér 8
6720 Szeged
Hungary

Dr. Peter Panster
Degussa-Huels AG
Sivento Division – R&D and Applied
Technology Chemical Catalysts
Rodenbacher Chaussee 4
P. O. Box 1345
63403 Hanau
Germany

G. Pérot
Université de Poitiers
Catalyse en Chimie Organique – CNRS
DO350 – UMR 6503
40, Avenue du Recteur Pineau
86022 Poitiers Cedex
France

R. Prins
ETH Zürich
Laboratorium für Technische Chemie
8092 Zürich
Switzerland

P. Ratnasamy
National Chemical Laboratory
Pune 411008
India

W. Van Rhijn
Centrum voor Oppervlaktechemie en Katalyse
Katholieke Universiteit Leuven
Kardinaal Mercierlaan 92
3001 Heverlee
Belgium

D. Roberge
Technische Chemie und Heterogene Katalyse
Technische Hochschule Aachen
Worrigerweg 1
52056 Aachen
Germany

E. F. V. Scriven
Reilly Industries, Inc.
1500 South Tibbs Avenue
P. O. Box 42912
Indianapolis, Indiana 46242-0912
USA

T. Setoyama
Mitsubishi Chemical Corporation
Yokohama Research Center
1000, Kamoshida, Aoba-ku
Yokohama 227
Japan

R. A. Sheldon
Delft University of Technology
Organic Chemistry and Catalysis
Julianalaan 136
2628 BL Delft
The Netherlands

U. Siegrist
Solvias AG
WRO-1055.6.28
Klybeckstrasse 191
Postfach
4002 Basel
Switzerland

K. E. Simons
Johnson Matthey Plc
Process Catalyst
Orchard Road
Royston, Herts SG8 5HE
UK

A. P. Singh
National Chemical Laboratory
Pune 411008
India

H. Steiner
Solvias AG
WRO-1055.6.28
Klybeckstrasse 191
Postfach
4002 Basel
Switzerland

M. Studer
Solvias AG
WRO-1055.6.28
Klybeckstrasse 191
Postfach
4002 Basel
Switzerland

K. Swift
Quest International Ltd.
Willesborough Road
Ashford, Kent TN24 0LT
UK

T. Tatsumi
Yokohama National University
Catalysis Laboratory – Faculty of Engineering
Division of Materials Science & Chemical Engineering
79-5 Tokiwadai, Hodogaya-ku
Yokohama 240-8501
Japan

J. Thivolle-Cazat
Laboratoire COMS CPE Lyon
UMR CNRS 9986
43, Bd du 11 novembre 1918
69616 Villeurbanne Cedex
France

A. Vaccari
University of Bologna
Department of Industrial Chemistry
Catalysis Section
Viale Risorgimento 4
40136 Bologna
Italy

F. Valot
Institut de Recherches sur la Catalyse
Laboratoire de Catalyse et Synthèse Organique
Université Claude Bernard Lyon I, CPE
43, Bd du 11 novembre 1918
69622 Villeurbanne
France

M. C. A. van Vliet
Delft University of Technology
Organic Chemistry and Catalysis
Julianalaan 136
2628 BL Delft
The Netherlands

D. E. De Vos
Centrum voor Oppervlaktechemie en Katalyse
Katholieke Universiteit Leuven
Kardinaal Mercierlaan 92
3001 Heverlee
Belgium

J. C. van der Waal
Avantium
Julianalaan 136
2628 BL Delft
The Netherlands

Dr. Stefan Wieland
dmc (superscript: 2) – Degussa Metals Catalysts Cerdec AG
Fuel Cell Division – Research and Applied Technology
Rodenbacher Chaussee 4
P. O. Box 1351
63403 Hanau
Germany

T. Yokoyama
Mitsubishi Chemical Corporation
Yokohama Research Center
100, Kamoshida, Aoba-ku
Yokohama 227
Japan

Contents