Modern Oxidation Methods

Edited by
Jan-Erling Bäckvall

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Editor:

Professor Dr. Jan-Erling Bäckvall
Department of Organic Chemistry
Arrhenius Laboratory
Stockholm University
SE 106 91 Stockholm
Sweden

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Preface

Oxidation reactions play an important role in organic chemistry and there is an increasing demand for selective and mild oxidation methods in modern organic synthesis. During the last two decades there has been a spectacular development in the field and a large number of novel and useful oxidation reactions have been discovered. Significant progress has been achieved within the area of catalytic oxidations, which has led to a range of selective and mild processes. These reactions may be based on organocatalysis, metal catalysis or biocatalysis. In this regard enantioselective catalytic oxidation reactions are of particular interest.

Due to the rich development of oxidation reactions in recent years there was a need for a book covering the area. The purpose of this book on "Modern Oxidation Methods" is to fill this need and provide the chemistry community with an overview of some recent developments in the field. In particular some general and synthetically useful oxidation methods that are frequently used by organic chemists are covered. These methods include catalytic as well as non-catalytic oxidation reactions in the science frontier of the field. Today there is an emphasis on the use of environmentally friendly oxidants ("green" oxidants) that lead to a minimum amount of waste. Examples of such oxidants are molecular oxygen and hydrogen peroxide. Many of the oxidation methods discussed and reviewed in this book are based on the use of "green" oxidants.

In this multi-authored book selected authors in the field of oxidation provide the reader with an up to date of a number of important fields of modern oxidation methodology. Chapter 1 summarizes recent advances on the use of "green oxidants" such as H_2O_2 and O_2 in the osmium-catalyzed dihydroxylation of olefins. Immobilization of osmium is also discussed and with these recent achievements industrial applications seem to be near. Another important transformation of olefins is epoxidation. In Chapter 2 transition metal-catalyzed epoxidations are reviewed and in Chapter 3 recent advances in organocatalytic ketone-catalyzed epoxidations are covered. Catalytic oxidations of alcohols with the use of environmentally benign oxidants have developed tremendously during the last decade and in Chapter 4 this area is reviewed. Aerobic oxidations catalyzed by *N*-hydroxyphtalimides (NHPI) are reviewed in Chapter 5. In particular oxidation of hydrocarbons via C–H activation are treated but also oxidations of alkenes and alcohols are covered.

In Chapter 6 ruthenium-catalyzed oxidation of various substrates are reviewed including alkenes, alcohols, amines, amides, β-lactams, phenols, and hydrocarbons. Many of these oxidations involve oxidations by "green oxidants" such as molecular oxygen and alkyl hydroperoxides. Chapter 7 deals with heteroatom oxidation and selective oxidations of sulfides (thioethers) to sulfoxides and tertiary amines to amine oxides are discussed. The chapter covers stoichiometric and catalytic reactions including biocatalytic reactions. Oxidations catalyzed by polyoxymetalates have increased in use during the last decade and this area is covered in Chapter 8. Oxidations with various monooxygen donors, peroxides (including hydrogen peroxide) and molecular oxygen are reviewed. Also, recent attempts to heterogenize homogeneous polyoxymetalate catalysts are discussed. Chapter 9 comprises an extensive review on oxidation of ketones with some focus on recent advances in Baeyer-Villiger oxidations. Catalytic as well as stoichiometic reactions are covered. Finally, in Chapter 10 manganese-catalyzed hydrogen peroxide oxidations are reviewed. The chapter includes epoxidation, dihydroxylation of olefins, oxidation of alcohols and sulfoxidation.

I hope that this book will be of value to chemists involved in oxidation reactions in both academic and industrial research and that it will stimulate further development in this important field.

Stockholm, July 2004 *Jan-E. Bäckvall*

Contents

List of Contributors

Hans Adolfsson
Department of Organic Chemistry
Arrhenius Laboratory
Stockholm University
106 91 Stockholm
Sweden

Isabel W. C. E. Arends
Delft University of Technology
Biocatalysis and Organic Chemistry
Julianalaan 136
2628 BL Delft
The Netherlands

Jan-E. Bäckvall
Department of Organic Chemistry
Arrhenius Laboratory
Stockholm University
106 91 Stockholm
Sweden

Matthias Beller
Institut für Organische Katalyse-
forschung an der Universität Rostock e. V.
(IfOK)
Buchbinderstrasse 5–6
18055 Rostock
Germany

Johannes W. de Boer
Laboratory of Organic Chemistry
Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands

Carsten Bolm
Institute of Organic Chemistry
RWTH Aachen
Professor-Pirlet-Str. 1
52056 Aachen
Germany

Jelle Brinksma
Laboratory of Organic Chemistry
Stratingh Institute
University of Groningen
Nijenborgh 4
9747 AG Groningen
The Netherlands

Christian Döbler
Institut für Organische Katalyse-
forschung an der Universität Rostock e. V.
(IfOK)
Buchbinderstrasse 5–6
18055 Rostock
Germany