

Modern Oxidation Methods

Edited by
Jan-Erling Bäckvall



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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*-hydroxyphthalimides (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 stoichiometric 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

	Preface	V
	List of Contributors	<i>XIII</i>
1	Recent Developments in the Osmium-catalyzed Dihydroxylation of Olefins	1
	UTA SUNDERMEIER, CHRISTIAN DÖBLER, and MATTHIAS BELLER	
1.1	Introduction	1
1.2	Environmentally Friendly Terminal Oxidants	2
1.2.1	Hydrogen Peroxide	2
1.2.2	Hypochlorite	5
1.2.3	Oxygen or Air	7
1.3	Supported Osmium Catalyst	12
1.4	Ionic Liquids	16
	References	17
2	Transition Metal-catalyzed Epoxidation of Alkenes	21
	HANS ADOLFSSON	
2.1	Introduction	21
2.2	Choice of Oxidant for Selective Epoxidation	22
2.3	Epoxidations of Alkenes Catalyzed by Early Transition Metals	23
2.4	Molybdenum and Tungsten-catalyzed Epoxidations	23
2.4.1	Homogeneous Catalysts – Hydrogen Peroxide as the Terminal Oxidant	24
2.4.2	Heterogeneous Catalysts	27
2.5	Manganese-catalyzed Epoxidations	28
2.6	Rhenium-catalyzed Epoxidations	32
2.6.1	MTO as an Epoxidation Catalyst – Original Findings	35
2.6.2	The Influence of Heterocyclic Additives	35
2.6.3	The Role of the Additive	38
2.6.4	Other Oxidants	39
2.6.5	Solvents/Media	41
2.6.6	Solid Support	42
2.6.7	Asymmetric Epoxidations Using MTO	43

2.7	Iron-catalyzed Epoxidations	44
2.8	Concluding Remarks	46
	References	47
3	Organocatalytic Oxidation. Ketone-catalyzed Asymmetric Epoxidation of Olefins	51
	YIAN SHI	
3.1	Introduction	51
3.2	Early Ketones	52
3.3	C ₂ Symmetric Binaphthyl-based and Related Ketones	53
3.4	Ammonium Ketones	58
3.5	Bicyclo[3.2.1]octan-3-ones	59
3.6	Carbohydrate Based and Related Ketones	60
3.7	Carbocyclic Ketones	72
3.8	Ketones with an Attached Chiral Moiety	75
3.9	Conclusion	76
	Acknowledgments	78
	References	78
4	Modern Oxidation of Alcohols Using Environmentally Benign Oxidants	83
	I. W. C. E. ARENDS and R. A. SHELDON	
4.1	Introduction	83
4.2	Oxoammonium-based Oxidation of Alcohols – TEMPO as Catalyst	83
4.3	Metal-mediated Oxidation of Alcohols – Mechanism	87
4.4	Ruthenium-catalyzed Oxidations with O ₂	88
4.5	Palladium-catalyzed Oxidations with O ₂	100
4.6	Copper-catalyzed Oxidations with O ₂	105
4.7	Other Metals as Catalysts for Oxidation with O ₂	109
4.8	Catalytic Oxidation of Alcohols with Hydrogen Peroxide	111
4.9	Concluding Remarks	113
	References	114
5	Aerobic Oxidations and Related Reactions Catalyzed by N-Hydroxyphthalimide	119
	YASUTAKA ISHII and SATOSHI SAKAGUCHI	
5.1	Introduction	119
5.2	NHPI-catalyzed Aerobic Oxidation	120
5.2.1	Alkane Oxidations with Dioxygen	120
5.2.2	Oxidation of Alkylarenes	125
5.2.2.1	Oxidation of Alkylbenzenes	125
5.2.2.2	Synthesis of Terephthalic Acid	127
5.2.2.3	Oxidation of Methylpyridines and Methylquinolines	129
5.2.2.4	Oxidation of Hydroaromatic and Benzylic Compounds	131
5.2.3	Preparation of Acetylenic Ketones by Direct Oxidation of Alkynes	132
5.2.4	Oxidation of Alcohols	133

5.2.5	Epoxidation of Alkenes Using Dioxxygen as Terminal Oxidant	136
5.2.6	Baeyer-Villiger Oxidation of KA-Oil	137
5.2.7	Preparation of ϵ -Caprolactam Precursor from KA-Oil	138
5.3	Functionalization of Alkanes Catalyzed by NHPI	139
5.3.1	Carboxylation of Alkanes with CO and O ₂	139
5.3.2	First Catalytic Nitration of Alkanes Using NO ₂	140
5.3.3	Sulfoxidation of Alkanes Catalyzed by Vanadium	142
5.3.4	Reaction of NO with Organic Compounds	144
5.3.5	Ritter-type Reaction with Cerium Ammonium Nitrate (CAN)	145
5.4	Carbon–Carbon Bond Forming Reaction <i>via</i> Generation of Carbon Radicals Assisted by NHPI	147
5.4.1	Oxyalkylation of Alkenes with Alkanes and Dioxxygen	147
5.4.2	Synthesis of α -Hydroxy- γ -lactones by Addition of α -Hydroxy Carbon Radicals to Unsaturated Esters	148
5.4.3	Hydroxyacylation of Alkenes Using 1,3-Dioxolanes and Dioxxygen	149
5.4.4	Hydroacylation of Alkenes Using NHPI as a Polarity-reversal Catalyst	150
5.5	Conclusions	152
	References	153

6 Ruthenium-catalyzed Oxidation of Alkenes, Alcohols, Amines, Amides, β -Lactams, Phenols, and Hydrocarbons 165

SHUN-ICHI MURAHASHI and NARUYOSHI KOMIYA

6.1	Introduction	165
6.2	RuO ₄ -promoted Oxidation	165
6.3	Oxidation with Low-valent Ruthenium Catalysts and Oxidants	169
6.3.1	Oxidation of Alkenes	169
6.3.2	Oxidation of Alcohols	172
6.3.3	Oxidation of Amines	175
6.3.4	Oxidation of Amides and β -Lactams	179
6.3.5	Oxidation of Phenols	181
6.3.6	Oxidation of Hydrocarbons	183
	References	186

7 Selective Oxidation of Amines and Sulfides 193

JAN-E. BÄCKVALL

7.1	Introduction	193
7.2	Oxidation of Sulfides to Sulfoxides	193
7.2.1	Stoichiometric Reactions	194
7.2.1.1	Peracids	194
7.2.1.2	Dioxiranes	194
7.2.1.3	Oxone and Derivatives	195
7.2.1.4	H ₂ O ₂ in “Fluorous Phase”	195
7.2.2	Chemocatalytic Reactions	196
7.2.2.1	H ₂ O ₂ as Terminal Oxidant	196
7.2.2.2	Molecular Oxygen as Terminal Oxidant	205

7.2.2.3	Alkyl Hydroperoxides as Terminal Oxidant	207
7.2.2.4	Other Oxidants in Catalytic Reactions	209
7.2.3	Biocatalytic Reactions	209
7.2.3.1	Haloperoxidases	209
7.2.3.2	Ketone Monooxygenases	210
7.3	Oxidation of Tertiary Amines to <i>N</i> -Oxides	211
7.3.1	Stoichiometric Reactions	212
7.3.2	Chemocatalytic Oxidations	213
7.3.3	Biocatalytic Oxidation	216
7.3.4	Applications of Amine <i>N</i> -oxidation in Coupled Catalytic Processes	216
7.4	Concluding Remarks	218
	References	218

8 Liquid Phase Oxidation Reactions Catalyzed by Polyoxometalates 223

RONNY NEUMANN

8.1	Introduction	223
8.2	Polyoxometalates (POMs)	224
8.3	Oxidation with Mono-oxygen Donors	226
8.4	Oxidation with Peroxygen Compounds	231
8.5	Oxidation with Molecular Oxygen	238
8.6	Heterogenization of Homogeneous Reaction Systems	245
8.7	Conclusion	247
	References	248

9 Oxidation of Carbonyl Compounds 253

JACQUES LE PAIH, JEAN-CÉDRIC FRISON and CARSTEN BOLM

9.1	Introduction	253
9.2	Oxidations of Aldehydes	253
9.2.1	Conversions of Aldehydes to Carboxylic Acid Derivatives by Direct Oxidations	253
9.2.1.1	Metal-free Oxidants	254
9.2.1.2	Metal-based Oxidants	255
9.2.1.3	Halogen-based Oxidants	257
9.2.1.4	Sulfur- and Selenium-based Oxidants	258
9.2.1.5	Nitrogen-based Oxidants	259
9.2.1.6	Miscellaneous	259
9.2.2	Conversions of Aldehydes into Carboxylic Acid Derivatives by Aldehyde Specific Reactions	259
9.2.2.1	Dismutations and Dehydrogenations	259
9.2.2.2	Oxidative Aldehyde Rearrangements	261
9.2.3	Conversions of Aldehyde Derivatives into Carboxylic Acid Derivatives	263
9.2.3.1	Acetals	263
9.2.3.2	Nitrogen Derivatives	263
9.2.3.3	Miscellaneous Substrates	264
9.2.4	Oxidative Decarboxylations of Aldehydes	265

9.3	Oxidations of Ketones	265
9.3.1	Ketone Cleavage Reactions	265
9.3.1.1	Simple Acyclic Ketones	265
9.3.1.2	Simple Cyclic Ketones	266
9.3.1.3	Functionalized Ketones	267
9.3.2	Oxidative Rearrangements of Ketones	267
9.3.2.1	Baeyer-Villiger Reactions	267
9.3.2.2	Ketone Amidations	272
9.3.2.3	Miscellaneous Rearrangements	275
9.3.3	Willgerodt Reactions	276
9.4	Conclusions	277
	References	277
10	Manganese-based Oxidation with Hydrogen Peroxide	295
	JELLE BRINKSMA, JOHANNES W. DE BOER, RONALD HAGE, and BEN L. FERGINGA	295
10.1	Introduction	295
10.2	Biomimetic Manganese Oxidation Catalysis	296
10.3	Bleaching Catalysis	298
10.4	Catalytic Epoxidation	298
10.4.1	Manganese Porphyrin Catalysts	299
10.4.2	Manganese–salen Catalysts	302
10.4.3	Mn-1,4,7-triazacyclononane Catalysts	305
10.4.4	Miscellaneous Catalysts	311
10.5	<i>cis</i> -Dihydroxylation	314
10.6	Alcohol Oxidation to Aldehydes	317
10.7	Sulfide to Sulfoxide Oxidation	318
10.8	Conclusions	321
	References	321
	Subject Index	327

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