

Chemistry of **PETROCHEMICAL PROCESSES**

Second Edition

Provides Quick and Easy
Access to Hundreds of
Reactions, Processes
and Products

Sami Matar
Lewis F. Hatch

G | P

This book is dedicated to the memory of Professor Lewis Hatch (1912–1991), a scholar, an educator, and a sincere friend.

Chemistry of **PETROCHEMICAL PROCESSES**

2nd Edition

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Contents

Preface to Second Edition	xi
Preface to First Edition	xiii

CHAPTER ONE

Primary Raw Materials for Petrochemicals

Introduction	1
Natural Gas	1
Natural Gas Treatment Processes 2, Natural Gas Liquids 8,	
Properties of Natural Gas	10
Crude Oils	11
Composition of Crude Oils 12, Properties of Crude Oils 19, Crude	
Oil Classification	21
Coal, Oil Shale, Tar Sand, and Gas Hydrates	22
References	26

CHAPTER TWO

Hydrocarbon Intermediates

Introduction	29
Paraffinic Hydrocarbons	29
Methane 30, Ethane 30, Propane 31, Butanes 31	
Olefinic Hydrocarbons	32
Ethylene 32, Propylene 33, Butylenes 34	
Dienes	36
Butadiene 37, isoprene 37	
Aromatic Hydrocarbons	37
Extraction of Aromatics	38
Liquid Petroleum Fractions and Residues	42
Naphtha 43, Kerosine 45, Gas Oil 46, Residual Fuel Oil 47	
References	47

CHAPTER THREE**Crude Oil Processing and Production of Hydrocarbon****Intermediates 49**

Introduction 49

Physical Separation Processes 49

Atmospheric Distillation 50, Vacuum Distillation 51, Absorption
Process 52, Adsorption Process 52, Solvent Extraction 53

Conversion Processes 54

Thermal Conversion Processes 55, Catalytic Conversion
Processes 60

Production of Olefins 91

Steam Cracking of Hydrocarbons 91, Production of Diolefins 101

References 107

CHAPTER FOUR**Nonhydrocarbon Intermediates 111**

Introduction 111

Hydrogen 111

Sulfur 114

Uses of Sulfur 116, The Claus Process 116, Sulfuric Acid 117

Carbon Black 118

The Channel Process 119, The Furnace Black Process 119, The
Thermal Process 119, Properties and Uses of Carbon Black 120

Synthesis Gas 121

Uses of Synthesis Gas 123

Naphthenic Acids 130

Uses of Naphthenic Acid and Its Salts 130

Cresylic Acid 131

Uses of Cresylic Acid 133

References 133

CHAPTER FIVE**Chemicals Based on Methane 135**

Introduction 135

Chemicals Based on Direct Reactions of Methane 136

Carbon Disulfide 136, Hydrogen Cyanide 137, Chloromethanes 138

Chemicals Based on Synthesis Gas	143
Ammonia	144
Methyl Alcohol	149
Oxo Aldehydes and Alcohols	163
Ethylene Glycol	166
References	167

CHAPTER SIX

Ethane and Higher Paraffins-Based Chemicals 169

Introduction	169
Ethane Chemicals	169
Propane Chemicals	171
Oxidation of Propane	171
Chlorination of Propane	172
Dehydrogenation of Propane	172
Nitration of Propane	173
n-Butane Chemicals	174
Oxidation of n-Butane	175
Aromatics Production	177
Isomerization of n-Butane	180
Isobutane Chemicals	180
Naphtha-Based Chemicals	181
Chemicals from High Molecular Weight n-Paraffins	182
Oxidation of Paraffins	183
Chlorination of n-Paraffins	184
Sulfonation of n-Paraffins	185
Fermentation Using n-Paraffins	185
References	186

CHAPTER SEVEN

Chemicals Based on Ethylene 188

Introduction	188
Oxidation of Ethylene	189
Derivatives of Ethylene Oxide	192
Acetaldehyde	198
Oxidative Carbonylation of Ethylene	201
Chlorination of Ethylene	201
Vinyl Chloride	202
Perchloro- and Trichloroethylene	203
Hydration of Ethylene	204
Oligomerization of Ethylene	205
Alpha Olefins Production	206
Linear Alcohols	207
Butene-1	209
Alkylation Using Ethylene	210
References	211

CHAPTER EIGHT**Chemicals Based on Propylene 213**

Introduction 213

Oxidation of Propylene 214

Acrolein 215, Mechanism of Propene Oxidation 215, Acrylic Acid 217, Ammoxidation of Propylene 218, Propylene Oxide 221

Oxyacylation of Propylene 226

Chlorination of Propylene 226

Hydration of Propylene 227

Properties and Uses of Isopropanol 228

Addition of Organic Acids to Propene 232

Hydroformylation of Propylene: The Oxo Reaction 232

Disproportionation of Propylene (Metathesis) 234

Alkylation Using Propylene 235

References 236

CHAPTER NINE**C₄ Olefins and Diolefins-Based Chemicals 238**

Introduction 238

Chemicals from n-Butenes 238

Oxidation of Butenes 239, Oligomerization of Butenes 248

Chemicals from Isobutylene 249

Oxidation of Isobutylene 250, Epoxidation of Isobutylene 251, Addition of Alcohols to Isobutylene 252, Hydration of Isobutylene 253, Carbonylation of Isobutylene 255, Dimerization of Isobutylene 255

Chemicals from Butadiene 255

Adiponitrile 256, Hexamethylenediamine 257, Adipic Acid 257, Butanediol 258, Chloroprene 258, Cyclic Oligomers of Butadiene 259

References 260

CHAPTER TEN**Chemicals Based on Benzene, Toluene, and Xylenes 262**

Introduction 262

Reactions and Chemicals of Benzene 262

Alkylation of Benzene 263, Chlorination of Benzene 276, Nitration of Benzene 278, Oxidation of Benzene 280, Hydrogenation of Benzene 281

Reactions and Chemicals of Toluene 284

Dealkylation of Toluene 284, Disproportionation of Toluene 285, Oxidation of Toluene 286, Chlorination of Toluene 291, Nitration of Toluene 292, Carbonylation of Toluene 294

Chemicals from Xylenes 294

Terephthalic Acid 295, Phthalic Anhydride 296, Isophthalic Acid 297

References 299

CHAPTER ELEVEN

Polymerization 301

Introduction 301

Monomers, Polymers, and Copolymers 302

Polymerization Reactions 303

Addition Polymerization 304, Condensation Polymerization 312, Ring Opening Polymerization 314

Polymerization Techniques 315

Physical Properties of Polymers 317

Crystallinity 317, Melting Point 317, Viscosity 317, Molecular Weight 318, Classification of Polymers 320

References 321

CHAPTER TWELVE

Synthetic Petroleum-Based Polymers 323

Introduction 323

Thermoplastics 324

Polyethylene 324, Polypropylene 329, Polyvinyl Chloride 332, Polystyrene 334, Nylon Resins 336, Thermoplastic Polyesters 336, Polycarbonates 337, Polyether Sulfones 339, Poly(phenylene) Oxide 340, Polyacetals 341

Thermosetting Plastics 342

Polyurethanes 342, Epoxy Resins 344, Unsaturated Polyesters 346, Phenol-Formaldehyde Resins 346, Amino Resins 348

Synthetic Rubber 350	
Butadiene Polymers and Copolymers 352, Nitrile Rubber 353, Polyisoprene 354, Polychloroprene 356, Butyl Rubber 356, Ethylene Propylene Rubber 357, Thermoplastic Elastomers 358	
Synthetic Fibers 359	
Polyester Fibers 359, Polyamides 362, Acrylic and Modacrylic Fibers 368, Carbon Fibers 369, Polypropylene Fibers 370	
References 371	
Appendix One: Conversion Factors	374
Appendix Two: Selected Properties of Hydrogen. Important C₁-C₁₀ Paraffins Methylcyclopentane, and Cyclohexane	376
Index	378
About the Authors	392

Preface to Second Edition

When the first edition of *Chemistry of Petrochemical Processes* was written, the intention was to introduce to the users a simplified approach to a diversified subject dealing with the chemistry and technology of various petroleum and petrochemical process. It reviewed the mechanisms of many reactions as well as the operational parameters (temperature, pressure, residence times, etc.) that directly effect products' yields and composition. To enable the readers to follow the flow of the reactants and products the processes were illustrated with simplified flow diagrams.

Although the basic concept and the arrangement of the chapters in this second edition are the same as the first, this new edition includes many minor additions and updates related to the advances in processing and catalysis.

The petrochemical industry is a huge field that encompasses many commercial chemicals and polymers. As an example of the magnitude of the petrochemical market, the current global production of polyolefins alone is more than 80 billion tons per year and is expected to grow at a rate of 4–5% per year. Such growth necessitates much work be invested to improve processing technique and catalyst design and ensure good product qualities. This is primarily achieved by the search for new catalysts that are active and selective. The following are some of the important additions to the text:

- Because ethylene and propylene are the major building blocks for petrochemicals, alternative ways for their production have always been sought. The main route for producing ethylene and propylene is steam cracking, which is an energy extensive process. Fluid catalytic cracking (FCC) is also used to supplement the demand for these light olefins. A new process that produces a higher percentage of light olefins than FCC is deep catalytic cracking (DCC), and it is described in Chapter 3.

- The search for alternative ways to produce monomers and chemicals from sources other than oil, such as coal, has revived working using Fisher Tropsch technology, which produces in addition to fuels, light olefins, sulfur, phenols, etc. These could be used as feedstocks for petrochemicals as indicated in Chapter 4.
- Catalysts for many petroleum and petrochemical processes represent a substantial fraction of capital and operation costs. Heterogeneous catalysts are more commonly used due to the ease of separating the products. Homogeneous catalysts, on the other hand, are normally more selective and operate under milder conditions than heterogeneous types, but lack the simplicity and ease of product separation. This problem has successfully been solved for the oxo reaction by using rhodium modified with triphenylphosphine ligands that are water soluble. Thus, hydrophilic products could be easily separated from the catalyst in the aqueous phase. A water soluble cobalt cluster can effectively hydroformylate higher olefins in a two-phase system using polyethylene glycol as the polar medium. This approach is described in Chapter 5.
- In the polymer field, new-generation metallocenes, which are currently used in many polyethylene and polypropylene processes, can polymerize propylene in two different modes: alternating blocks of rigid isotactic and flexible atactic. These new developments and other changes and approaches related to polymerization are noted in Chapters 11 and 12.

I hope the new additions that I felt necessary for updating this book are satisfactory to the readers.

Sami Matar, Ph.D.