Chemistry of PETROCHEMICAL PROCESSES

Second Edition

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

Sami Matar
Lewis F. Hatch

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

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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 is 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 Tropseh 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, lyophilic 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 filed, new-generation metallocenes, which are currently used in many polyethylene and polypropylene processes, can polymerize proplylene 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.

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