Book review

Alternative energy sources for green chemistry

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Georgios Stefanidis and Andrzej Stankiewicz (Eds.)
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Utilization of safe, energy efficient, and controllable alternative energy forms towards greener chemical processes and sustainable chemical manufacturing is being explored vigorously. This book, entitled *Alternative Energy Sources for Green Chemistry* (edited by Georgios Stefanidis and Andrzej Stankiewicz), gives a comprehensive overview of some well-used alternative energy sources in the field of chemical process intensification. It contains 12 chapters, which covers the current developments of microwave, magnetic field, photo catalysis, plasma and high-gravity technologies and their applications.

The first part of this book is concerned with microwave technology. Chapters 1 and 2 give the impact and advantage of microwave irradiation in the fields of organic synthesis and plant extraction processes. The ability of microwaves to deliver energy or heat rapidly to the reaction mixture or plant that can enable to decrease the processes time, improve the efficiency, and reduce the solvents. Chapter 3 has some related contents with the previous chapter. It begins with the microwave heating technology, and summarizes the microwave technology in the low-temperature decomposition of biologically derived materials and its application on both laboratory and commercial scales. Specific attention is given to large-scale microwave activation of biomass for the production of bio-chars and bio-oils in this chapter. Chapter 4 concludes the microwave applicator types and puts forward the design rules for successful implementation of microwave-assisted chemical processing systems.

Cavitational reactors show considerable promise for intensification of chemical reactions and separations in a lot of application areas. In Chapter 5, mechanisms of cavitation-based process intensification, reactor configurations, and guidelines for optimum selection are introduced. Two approaches of inducing cavitation (acoustic and hydrodynamic cavitation) are compared based on the energy transfer efficiencies and expected benefits for the specific application.

Chapters 6 and 7 place the focus on magnetic field assisted technology for separation and mixing. Chapter 6 introduces the mechanism of magnetically assisted fluidization, particle separations, and gravity sedimentation. The application of magnetic solids involving nontailored, tailored, and functionalized in chemical engineering and biotechnology are also discussed in this chapter. Chapter 7 specifically discusses the advantage of magnetic field in magnetic nanofluids field. Mechanisms of magnetic field excitation for fluid-phase mixing based on ferrohydrodynamics and Lorentz force-driven are presented.

Chapters 8 and 9 are about photocatalysis. Chapter 8 reviews the development of photocatalytic systems from two aspects of photocatalytic materials and reactors. The current focus of the photocatalytic materials is on the metal-organic frameworks, and challenge in design of photocatalytic reactors as an alternative option for the light source to enhance efficiency. Chapter 9 focuses on the different photocatalytic reactors design in wastewater treatment. It reviews the photocatalytic reactor design concepts, compares the slurry reactors and immobilized catalyst reactors at wastewater treatment, and gives a benchmark to evaluate the performance of the photocatalytic reactors.

Chapter 10 introduces the plasma-assisted valuable chemicals production. It includes investigation of the plasma reactors, heat exchange, and synergy between plasma and catalysts during the plasma-assisted nitric oxide, ammonia, and cyanide synthesis reactions.

The last two chapters of this book explore the applications of high gravity fields in chemical processing. Design features, operation principles, unique characteristics, and applications of the well-known higee technologies such as spinning disc reactor and the rotating packed bed are summarized in Chapter 11. Chapter 12 introduces high-gravity operation in vortex chambers for the generation of the rotating fluidized beds. The design aspects are discussed in detail, illustrations of (potential) applications taking advantage of the intensified interfacial mass and heat transfer and of the intensified reactions are presented.

This book is intended for chemical engineers and researchers working in the field of green processing intensification with a certain foundation. Apart from providing a good review of the current development in the selected alternative energy sources for green chemistry, it proposes some potential applications of the alternative energy

sources mentioned in each chapter. However, some expression of same proprietary concepts are not unified and some contents of this book in different chapters are related, such as microwave-assisted biomass activation most often refers to microwave-assisted plants or plants based material extraction, magnetic nanofluid is a kind of special magnetic fluidization form, wastewater treatment is one of the most common application field of photocatalytic and the introductions of photolytic reactors in Chapters 8 and 9 have some similar parts, and "higee" and "high-gravity" in the title of the last two chapters should be the same technology. So it could be better structured for readers who just contact or are not fully familiar with the related areas if divided into several parts according to the form of the alternative energy.

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