

Heavy and Extra-heavy Oil Upgrading Technologies

James G. Speight, PhD, DSc



Heavy And Extra Heavy Oil Upgrading Technologies

Ramasamy Marappa Gounder



Heavy And Extra Heavy Oil Upgrading Technologies:

Heavy and Extra-heavy Oil Upgrading Technologies James G. Speight, 2013-04-12 Unconventional reservoirs of oil and gas represent a huge additional global source of fossil fuels. However, there is much still to be done to improve techniques for their processing to make recovery and refining of these particular energy sources more cost effective. Brief but readable, *Heavy and Extra heavy Oil Upgrading Technologies* provides readers with a strategy for future production, the up stream and upgrading the down stream. The book provides the reader with an understandable overview of the chemistry and engineering behind the latest developments and technologies in the industry as well as the various environmental regulations. Clear and rigorous, *Heavy and Extra heavy Oil Upgrading Technologies* will prove a tool for those scientists and engineers already engaged in fossil fuel science and technology as well as scientists, non scientists, engineers and non engineers who wish to gain a general overview or update of the science and technology of unconventional fossil fuels in general and upgrading technologies in particular. The use of microorganisms and a number of physical methods such as ultrasound, median microwave, cold plasma, electrokinetic and monocrystalline intermetallics etc will be discussed for the first time. Overview of the chemistry, engineering and technology of oil sands. Microorganisms and a number of physical methods such as ultrasound, median microwave, cold plasma, electrokinetic and monocrystalline intermetallics. Evolving and new environmental regulations regarding oil sands production processes. *Upgrading of Heavy and Extra-Heavy Crude Oils by Catalytic Hydrotreating* Jorge Ancheyta, 2023-09-26 This book explores the common approaches to upgrade heavy and extra heavy crude oils by means of catalytic hydrotreating, emphasizing hydrogen addition technology as well as carbon rejection alternatives. Kinetic and reactor models are combined with experimental data to simulate and optimize commercial scale reactor performance. Key Features: Focuses on fixed bed catalytic hydrotreating and catalysts and process scheme characteristics for commercial application. Guides readers on hydrotreating process technology development from batch reactor experiments to semi commercial test. Describes step by step methodologies for development of kinetic models based on experimental data generated at different reaction scales. Provides detailed explanation on how to formulate a reactor model for the simulation of catalytic hydrotreating of heavy oils. A comprehensive guide to the upgrading of crude oils. This book has particular appeal for petroleum refining industry professionals, catalyst developers, workshop instructors, professors and their graduate and postgraduate students. *Catalytic In-Situ Upgrading of Heavy and Extra-Heavy Crude Oils* Mikhail A. Varfolomeev, Chengdong Yuan, Jorge Ancheyta, 2023-06-12 *Catalytic In Situ Upgrading of Heavy and Extra Heavy Crude Oils* A comprehensive guide to a cutting edge and cost effective refinement process for heavy oil. Oil sufficiently viscous that it cannot flow normally from production wells is called heavy oil and constitutes as much as 70% of global oil reserves. Extracting and refining this oil can pose significant challenges including very high transportation costs. As a result, processes which produce and partially refine heavy oil in situ, known as catalytic upgrading, are an increasingly important part of the

heavy oil extraction process and the reduced carbon footprint associated with these methods promises to make them even more significant in the coming years

Catalytic In Situ Upgrading of Heavy and Extra Heavy Crude Oils provides a comprehensive introduction to these processes. It introduces the properties and characteristics of heavy and extra heavy oil before discussing different catalysts and catalyzing processes, their mechanisms and underlying physics, and more. It offers the full sweep of description and analysis required for petroleum and chemical engineers to understand this vital aspect of the modern oil industry. Readers will also find detailed discussion of subjects including electron paramagnetic resonance spectroscopy, nuclear magnetic resonance spectroscopy, and more. Analysis of both liquid catalysts and nanoparticle catalysts. A numerical simulation of the catalytic in situ oil upgrading process.

Catalytic In Situ Upgrading of Heavy and Extra Heavy Crude Oils is a valuable reference for petroleum and chemical engineers as well as advanced undergraduate and graduate students in related fields.

Heavy Oil Recovery and Upgrading James G. Speight, 2019-02-28. Heavy Oil Recovery and Upgrading covers properties, factors, methods, and all current and upcoming processes, giving engineers new and experienced the full spectrum of recovery choices, including SAGD, horizontal well technology, and hybrid approaches. Moving on to the upgrading and refining of the product, the book also includes information on in situ upgrading, refining options, and hydrogen production. Rounding out with environmental effects, management methods on refinery waste, and the possible future configurations within the refinery, this book provides engineers with a single source to make decisions and manage the full range of challenges. Presents the properties, mechanisms, screening criteria, and field applications for heavy oil enhanced recovery projects. Includes current upgrading options and future methods for refining heavy oil development. Fills in the gaps between literature and practical application for everyday industry reference.

Crude Oil Refining Marcio Wagner da Silva, 2022-10-04. This book provides an overview of crude oil refining processes and presents a deep analysis of the current context and challenges imposed on players in the downstream industry.

Crude Oil Refining: A Simplified Approach covers traditional processes of the refining industry, the impact of current trends, and technological routes available to help these players survive in a highly competitive environment.

FEATURES: Offers a simplified approach to crude oil refining processes. Discusses economic information related to the downstream business, including refining margins and profitability. Introduces newer trends in the industry, such as petrochemical integration, crude to chemicals, refineries, and renewables coprocessing in crude oil refineries. Presents the challenges related to these new trends and offers technological solutions to overcome them for profitable and sustainable operations. Describes how the use of biofuels can minimize the environmental impact of transportation fuel in nations of high demand like Brazil. Offering a contemporary view of current challenges and opportunities in the downstream oil and gas business, this practical book is aimed at readers working in the fields of petroleum and chemical engineering.

Thermal and Catalytic Processing in Petroleum Refining Operations James G. Speight, 2023-04-11. This book presents the thermal and catalytic processes in refining. The differences between each type of

process and the types of feedstock that can be used for the processes are presented Relevant process data is provided and process operations are fully described This accessible guide is written for managers professionals and technicians as well as graduate students transitioning into the refining industry Key Features Describes feedstock evaluation and the effects of elemental chemical and fractional composition Details reactor types and bed types Explores the process options and parameters involved Assesses coke formation and additives Considers next generation processes and developments

Handbook of Petroleum Refining James G. Speight, 2016-10-26 Petroleum refining involves refining crude petroleum as well as producing raw materials for the petrochemical industry This book covers current refinery processes and process types that are likely to come on stream during the next three to five decades The book includes 1 comparisons of conventional feedstocks with heavy oil tar sand bitumen and bio feedstocks 2 properties and refinability of the various feedstocks 3 thermal processes versus hydroprocesses and 4 the influence of refining on the environment **Hydrocarbon Biotechnology** Wael Ahmed Ismail, Jonathan Van Hamme, 2022-11-24 This volume offers environmentally friendly technical solutions that can be implemented to solve problems throughout the value chain of the fossil fuel industry This new book presents an up to date view of hydrocarbon microbiology and biotechnology presented by experts around the world with interest in how our expanding understanding of hydrocarbonoclast ecology and physiology can translate to better tools for bioremediation oil recovery bio upgrading of unconventional crudes the development of biorefining technologies and the production of hydrogen and electricity from hydrocarbon wastes The common theme across the chapters in this book is an interest in how developing hydrocarbon biotechnologies may reduce our impact on the global environment Written by eminent scientists from both academia and industry the book starts with a historical perspective on hydrocarbon chemistry and formation petroleum microbiology and biotechnology This is followed by a review of recent research developments in bioremediation and other biotechnologies for hydrocarbons the principal constituents of petroleum and natural gas

Handbook of Refinery Desulfurization Nour Shafik El-Gendy, 2015-09-18 Handbook of Refinery Desulfurization describes the operation of the various desulfurization process units in a petroleum refinery It also explains the processes that produce raw materials for the petrochemical industry It illustrates all the possible processes to lower the sulfur contents in petroleum and its fractions to decrease emissions of sulfur oxides This book introduces you to desulfurization concepts including biodesulfurization as well as technology giving guidance on how to accomplish desulfurization in various refining processes It contains background chapters on the composition and evaluation of feedstocks and includes diagrams and tables of feedstocks and their respective produce It also outlines how to decide which method should be employed to remove sulfur from different feedstocks A practical and thorough discussion of the field Handbook of Refinery Desulfurization gives you a strong grasp of the various processes involved with industrial desulfurization while giving you pointers on which procedures to use under certain conditions **Asphalt Materials Science and Technology** James G. Speight, 2015-10-01 Asphalt is a

complex but popular civil engineering material Design engineers must understand these complexities in order to optimize its use Whether or not it is used to pave a busy highway waterproof a rooftop or smooth out an airport runway Asphalt Materials Science and Technology acquaints engineers with the issues and technologies surrounding the proper selection and uses of asphalts With this book in hand researchers and engineering will find a valuable guide to the production use and environmental aspect of asphalt Covers the Nomenclature and Terminology for Asphalt including Performance Graded PG Binders Asphalt Cement AC Asphalt Rubber A R Binder Asphalt Emulsion and Cutback Asphalt Includes Material Selection Considerations Testing and applications Biodegradation of Asphalt and environmental aspects of asphalt use **Refinery**

Feedstocks James G. Speight, 2020-10-20 Over the last several decades the petroleum industry has experienced significant changes in resource availability petro politics and technological advancements dictated by the changing quality of refinery feedstocks However the dependence on fossil fuels as the primary energy source has remained unchanged Refinery Feedstocks addresses the problems of changing feedstock availability and properties the refining process and solids deposition during refining This book will take the reader through the various steps that are necessary for crude oil evaluation and refining including the potential for the use of coal liquids shale oil and non fossil fuel materials biomass as refinery feedstocks Other features Describes the various types of crude oil and includes a discussion of extra heavy oil and tar sand bitumen Includes basic properties and specifications of crude oil and the significance in refinery operations This book is a handy reference for engineers scientists and students who want an update on crude oil refining and on the direction the industry must take to assure the refinability of various feedstocks and the efficiency of the refining processes in the next fifty years Non technical readers with help from the extensive glossary will also benefit from reading this book **Fouling in**

Refineries James G. Speight, 2015-05-14 Fouling in Refineries is an important and ongoing problem that directly affects energy efficiency resulting in increased costs production losses and even unit shutdown requiring costly expenditures to clean up equipment and return capacity to positive levels This text addresses this common challenge for the hydrocarbon processing community within each unit of the refinery As refineries today face a greater challenge of accepting harder to process heavier crudes and the ongoing flow of the lighter shale oil feedstocks resulting in bigger challenges to balance product stability within their process equipment this text seeks to inform all relative refinery personnel on how to monitor fouling characterize the deposits and follow all available treatments With basic modeling and chemistry of fouling and each unit covered users will learn how to operate at maximum production rates and elongate the efficiency of their refinery s capacity Presents an understanding of the breakdown of fouling per refinery unit including distillation and coking units Provides all the factors crude types and refining blends that cause fouling especially the unconventional feedstocks and high acid crudes used today Helps users develop an analysis based treatment and control strategy that empowers them to operate refinery equipment at a level that prevents fouling from occurring *Sustainable Utilization of Natural Resources* Prasenjit

Mondal,Ajay K. Dalai,2017-03-16 Increased research is going on to explore the new cleaner options for the utilization of natural resources This book aims to provide the scientific knowhow and orientation in the area of the emerging technologies for utilization of natural resources for sustainable development to the readers The book includes production of energy and lifesaving drugs using natural resources as well as reduction of wastage of resources like water and energy for sustainable development in both technological as well as modeling aspects

Hydrotreating and Hydrocracking Processes in Refining Technology James G. Speight,2023-09-29 Written by an industry expert with over 50 years of experience this book details the various solvent processes that are used in crude oil refineries Providing an in depth exploration of the different types of processes as well as the types of feedstocks that can be used with them this book prepares readers for changes as the industry evolves Key Features Describes feedstock evaluation and the effects of elemental chemical and fractional composition Contains an extensive glossary of all related concepts in hydrotreating and hydrocracking processes Considers next generation processes and developments This book is an essential guide for engineers scientists and students in the field of petroleum processing and refining technology including professionals technicians management personnel and academics

Handbook of Offshore Oil and Gas Operations James G. Speight,2014-10-22 Handbook of Offshore Oil and Gas Operations is an authoritative source providing extensive up to date coverage of the technology used in the exploration drilling production and operations in an offshore setting Offshore oil and gas activity is growing at an expansive rate and this must have training guide covers the full spectrum including geology types of platforms exploration methods production and enhanced recovery methods pipelines and environmental management and impact specifically worldwide advances in study control and prevention of the industry s impact on the marine environment and its living resources In addition this book provides a go to glossary for quick reference Handbook of Offshore Oil and Gas Operations empowers oil and gas engineers and managers to understand and capture on one of the fastest growing markets in the energy sector today Quickly become familiar with the oil and gas offshore industry including deepwater operations Understand the full spectrum of the business including environmental impacts and future challenges Gain knowledge and exposure on critical standards and real world case studies

Hydrogen Production Processes in Refining Technology James G. Speight,2024-06-26 This book details the various approaches to the production of hydrogen in petroleum refining The need for hydrogen is addressed and then the differences between the processes are detailed This practical and accessible guide is written for managers professionals and technicians as well as graduate students transitioning into the refining industry Key Features Describes hydrogen purification methods and processes providing relevant process data and fully describing process operations Describes hydrogen purification methods and processes detailing the types of feedstock that can be used and exploring the options and parameters of each process Details commercial processes including gasification pretreatment and reactions and considers next generation processes and developments

Petroleum Biodegradation and Oil Spill Bioremediation Karuna K.

Arjoon, James G. Speight, 2022-12-22 The prime focus of the book is to determine the mechanism extent and efficiency of biodegradation processes as it is necessary to know the composition of the original crude oil or crude oil product The technology of bioremediation and the concerns of whether or not bioremediation technologies can accelerate this natural process enough to be considered practical and if so whether they might find a niche as replacements for or adjuncts to other crude oil spill response technologies This book also introduces the reader to the science of the composition of crude oil and crude oil products is at the core of understanding the chemistry of biodegradation and bioremediation processes

Handbook of Gasification Technology James G. Speight, 2020-04-14 Gasification is one of the most important advancements that has ever occurred in energy production Using this technology for example coal can be gasified into a product that has roughly half the carbon footprint of coal On a large scale gasification could be considered a revolutionary development not only prolonging the life of carbon based fuels but making them greener and cleaner As long as much of the world still depends on fossil fuels gasification will be an environmentally friendlier choice for energy production But gasification is not just used for fossil fuels Waste products that would normally be dumped into landfills or otherwise disposed of can be converted into energy through the process of gasification The same is true of biofeedstocks and other types of feedstocks thus making another argument for the widespread use of gasification The Handbook of Gasification Technology covers all aspects of the gasification in a one stop shop from the basic science of gasification and why it is needed to the energy sources processes chemicals materials and machinery used in the technology Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook this outstanding new volume is a must have for any library

Handbook of Petrochemical Processes James G. Speight, 2019-06-13 The petrochemical industry is a scientific and engineering field that encompasses the production of a wide range of chemicals and polymers The purpose of this book is not only to provide a follow on to form the later chapters of the highly successful Chemistry and Technology of Petroleum 5th Edition but also provides a simplified approach to a very diverse chemical subject dealing with the chemistry and technology of various petroleum and petrochemical process Following from the introductory chapters this book provides the readers with a valuable source of information containing insights into petrochemical reactions and products process technology and polymer synthesis Provides readers with a valuable source of information containing insights into petrochemical reactions and products process technology and polymer synthesis Introduces the reader to the various petrochemical intermediates are generally produced by chemical conversion of primary petrochemicals to form more complicated derivative products The reactions and processes involved in transforming petroleum based hydrocarbons into the chemicals that form the basis of the multi billion dollar petrochemical industry are reviewed and described The book includes information on new process developments for the production of raw materials and intermediates for petrochemicals Includes a description of the origin of the raw materials for the petrochemicals industry including an overview of the coal chemicals industry Processing of

Heavy Crude Oils Ramasamy Marappa Gounder, 2019 Unconventional heavy crude oils are replacing the conventional light crude oils slowly but steadily as a major energy source Heavy crude oils are cheaper and present an opportunity to the refiners to process them with higher profit margins However the unfavourable characteristics of heavy crude oils such as high viscosity low API gravity low H C ratio chemical complexity with high asphaltenes content high acidity high sulfur and increased level of metal and heteroatom impurities impede extraction pumping transportation and processing Very poor mobility of the heavy oils due to very high viscosities significantly affects production and transportation Techniques for viscosity reduction drag reduction and in situ upgrading of the crude oil to improve the flow characteristics in pipelines are presented in this book The heavier and complex molecules of asphaltenes with low H C ratios present many technological challenges during the refining of the crude oil such as heavy coking on catalysts Hydrogen addition and carbon removal are the two approaches used to improve the recovery of value added products such as gasoline and diesel In addition the heavy crude oil needs pre treatment to remove the high levels of impurities before the crude oil can be refined This book introduces the major challenges and some of the methods to overcome them

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