



# Heavy Crude Oil Recovery

**James G. Speight**



## **Heavy Crude Oil Recovery:**

Heavy Crude Oil Recovery E. Okandan, 2012-12-06 Within the last 10 years the world has come to a point where the easily explorable oil deposits have now been found and it is anticipated that such deposits will be depleted by the beginning of the Twenty first Century However the increasing demand of man kind for energy has caused technologists to look into ways of finding new sources or to reevaluate unconventional sources which in the past have not been economical In this respect heavy crude and tar sand oils are becoming important in fulfilling the world's energy requirements What are heavy crude and tar sand oils There is still some confusion as to their definitions inasmuch as they vary among organizations and countries In an effort to set agreed meanings UNITAR in a meeting in February 1982 in Venezuela proposed the following definitions see also Table 1 1 Heavy crude oil and tar sand oil are petroleum or petroleum like liquids or semi solids naturally occurring in porous media The porous media are sands sandstone and carbonate rocks 2 These oils will be characterized by viscosity and density Viscosity will be used to define heavy crude oil and tar sand oil and density  $\rho_{API}$  will be used when viscosity measurements are not available 3 Heavy crude oil has a gas free viscosity of 100 10000 mPa s  $\rho_{API}$  at reservoir temperatures or a density of 943 kg m<sup>-3</sup>  $\rho_{API}$  to 1000 kg m<sup>-3</sup>  $\rho_{API}$  at 15.6 °C and at atmospheric pressure

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

*Enhanced Recovery of Residual and Heavy Oils* M. M. Schumacher, 1980

**Heavy Oil Recovery and Upgrading** James G. Speight, 2019-03-05 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

New Directions in Guided Wave and Coherent Optics D.B. Ostrowsky, E. Spitz, 1971-01-31 As optical fiber communication systems have moved out of the laboratory and into commercial use over the past several years the general field of guided wave and coherent optics has undergone a radical transformation Research in optical communication has turned heavily towards single mode technology and totally new phenomena and applications of the existing technology outside the communication field have begun to proliferate It was for this reason that we decided to organize a NATO Advanced Study Institute assembling the leading workers in this new domain in order to define the state of the art and develop an idea of the new directions the field might take The lectures and seminars presented at this Advanced Study Institute form the basis for this book The subjects treated can be roughly grouped as New phenomena in optical fibers such as non linear effects soliton propagation and polarization conservation New applications of fibers to measurements of rotation pressure temperature etc and medical uses Advanced and exploratory work on single mode fiber communication systems including the use of coherent transmission schemes and optical amplification Recent developments of optical information treatment based on four wave mixing Integrated optical devices and technologies including bistable devices parametric oscillators and optical logic In addition to these major topics a number of national reviews and specialized seminars treating new guided wave structures and materials are included The co editors admit being rather pleased with the result

**Heavy Crude Oils** Alain-Yves Huc, 2011 Heavy oils extra heavy oils and tar sands are major players for the future of energy They represent a massive world resource at least the size of conventional oils They are found all over the world but Canada and Venezuela together account by themselves for more than half of world deposits They share the same origin as the lighter conventional oils but their geological fate drove them into thick viscous tar like crude oils Most of them result from alteration processes mediated by microbial degradation They are characterized by a low content of lighter cuts and a high content of impurities such as sulfur and nitrogen compounds and metals so their production is difficult and deployment of specific processes is required in order to enhance their transportability and to upgrade them into valuable products meeting market needs and honouring environmental requirements Although these resources are increasingly becoming commercially producible less than 1% of total heavy crude oil deposits worldwide are under active development The voluntarily wide scope of this volume encompasses geology production transportation upgrading economics and environmental issues of heavy oils It does not pretend to be exhaustive but to provide an authoritative view of this very important energy resource

Heavy Crude Oil: Resource, Reserve, and Potential Production in the United States United States. Bureau of Mines, 1967

**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

**Subsurface Upgrading of Heavy Crude Oils and Bitumen** Cesar Ovalles, 2019-07-24 Heavy crude oils and bitumen represent more than 50% of all hydrocarbons available on the planet These feedstocks have a low amount of distillable material and high level of contaminants that make their production transportation and refining difficult and costly by conventional technologies Subsurface Upgrading of Heavy Crude Oils and Bitumen is of interest to the petroleum industry mainly because of the advantages compared to aboveground counterparts The author presents an in depth account and a critical review of the progress of industry and academia in underground or In Situ upgrading of heavy extra heavy oils and bitumen as reported in the patent and open literature This work is aimed to be a standalone monograph so three chapters are dedicated to the composition of petroleum and fundamentals of crude oil production and refining Key Features Offers a multidisciplinary scope that will appeal to chemists geologists biologists chemical engineers and petroleum engineers Presents the advantages and disadvantages of the technologies considered Discusses economic and environmental considerations for all the routes evaluated and offers perspectives from experts in the field working with highlighted technologies

**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

*Introduction to Enhanced Recovery Methods for Heavy Oil and Tar Sands* James G. Speight, 2016-02-24 Introduction to Enhanced Recovery Methods for Heavy Oil and Tar Sands Second Edition explores the importance of enhanced oil recovery EOR and how it has grown in recent years thanks to the increased need to locate unconventional resources such as heavy oil and shale Unfortunately petroleum engineers and managers aren't always well versed in the enhancement methods that are available when needed or the most economically viable solution to maximize their reservoir's productivity This revised new edition presents all the current methods of recovery available including the pros and cons of each Expanded and updated as a great preliminary text for the newcomer to the industry or subject matter this must have EOR guide teaches all the basics needed including all thermal and non thermal methods along with discussions of viscosity sampling and the technologies surrounding offshore applications Enables users to quickly learn how to choose the most efficient recovery method for their reservoir while evaluating economic conditions Presents the differences between each method of recovery with newly added real world case studies from around the world Helps readers stay competitive with the growing need of extracting unconventional resources with new content on how these complex reservoirs interact with injected reservoir fluids

*Microbial Enhanced Oil Recovery* Lalit Pandey, Pankaj Tiwari, 2021-10-21 This book presents the fundamentals of the reservoir and interfacial engineering The book systematically starts with the basics of primary secondary and tertiary enhanced oil recovery and emphasizes on the theory of microbial enhanced oil recovery MEOR and its potential toward recovery of oil in place Different approaches of MEOR such as in situ ex situ and integration of chemical and microbial enhanced oil recovery EOR are discussed in detail This book highlights the link between the effectiveness of MEOR and the local reservoir conditions crude oil characteristics and indigenous microbial community The latest implementations of MEOR across the globe are highlighted as case studies to outline the potential as well as the scope of MEOR Given the topics covered this book will be useful for professionals and researchers working in the areas of petroleum science and engineering chemical engineering biotechnology bioengineering and other related fields

**Hybrid Enhanced Oil Recovery Processes for Heavy Oil Reservoirs** Xiaohu Dong, Huiqing Liu, Zhangxing Chen, 2021-10-27 Hybrid Enhanced Oil Recovery Processes for Heavy Oil Reservoirs Volume 73 systematically introduces these technologies As the development of heavy oil reservoirs is emphasized the petroleum industry is faced with the challenges of selecting cost effective and environmentally friendly recovery processes This book tackles these challenges with the introduction and investigation of a variety of hybrid EOR processes In addition it addresses the application of these hybrid EOR processes in onshore and offshore heavy oil reservoirs including theoretical experimental and simulation approaches This book will be very useful for petroleum engineers technicians academics and students who need to study the hybrid EOR processes In addition it will provide an excellent reference for field operations by the petroleum industry

Introduces emerging hybrid EOR processes and their technical details Includes case studies to help readers understand the application potential of hybrid EOR processes from different points of view Features theoretical experimental and simulation studies to help readers understand the advantages and challenges of each process      Microbial Enhanced Oil Recovery T.F. Yen, 1989-12-21 This volume provides a comprehensive review that consolidates all of the pertinent information available Microbial Enhanced Oil Recovery MEOR involves many scientific disciplines many different approaches and many different countries This book supplies the information needed for continued development of MEO methods and points out areas where information is lacking and where more research is needed This easy to use resource focuses on the three types of MEOR processes which can be utilized to recover oil from reservoirs Successful MEOR involves contributions from petroleum chemical genetic environmental geotechnical and bioengineering Also geology chemistry and microbiology play a major role as well This critical review book includes a comprehensive reference list and opens the lines of communication among the various fields of study This work will also encourage the exchange of ideas and interaction necessary for success in this quickly developing technology Scientists researchers and practitioners will find this text to be interesting informative and indispensable consolidatesR      *Colloids and Interfaces in Oil Recovery* Spencer Taylor, 2019-06-21 It is well known that colloid and interface science and petroleum production are inextricably linked Whether in the reservoir with its porous structure or during recovery crude oil is intimately associated with rock surfaces and with water often in the form of emulsions This situation leads to highly complex systems comprising multiple colloids and interfaces which require to be optimized if oil is to be recovered efficiently both in terms of economic cost and with due concern for the environment This book contains a compilation of contemporary research topics which illustrate various aspects of the importance of colloids and interfaces in crude oil recovery through modifying conditions between the rock crude oil and water in the reservoir in order to achieve improved oil recovery The specific topics covered relate both to conventional oils in which waterflooding is the most common secondary and tertiary means of recovery and to non conventional heavy oil and natural bitumen which require thermal recovery methods owing to their high viscosity      **Sustainable In-Situ Heavy Oil and Bitumen Recovery** Mohammadali Ahmadi, 2023-03-24 Sustainable In Situ Heavy Oil and Bitumen Recovery Techniques Case Studies and Environmental Considerations delivers a critical reference for today's energy engineers who want to gain an accurate understanding of anticipated GHG emissions in heavy oil recovery Structured to break down every method with introductions case studies technical limitations and summaries this reference gives engineers a look at the latest hybrid approaches needed to tackle heavy oil recoveries while calculating carbon footprints Starting from basic definitions and rounding out with future challenges this book will help energy engineers collectively evolve heavy oil recovery with sustainability applications in mind Explains environmental footprint considerations within each recovery method Includes the latest hybrid methods such as Hybrid of Air CO<sub>2</sub>N<sub>2</sub> and Cyclic Steam Stimulation CSS Bridges practical knowledge through case studies

summaries and remaining technical challenges

### **Innovations in Enhanced and Improved Oil Recovery - New**

**Advances** Mansoor Zoveidavianpoor, 2024-04-24 This book navigates the evolving landscape of Enhanced Oil Recovery EOR and Improved Oil Recovery IOR covering diverse topics such as lithological dynamics in CO<sub>2</sub> EOR the impact of asphaltene precipitation in WAG implementation progress in CO<sub>2</sub> EOR and storage technology in situ foam generation for unconventional fractured reservoirs electromagnetic radiation effects on heavy oil upgrading advancements in hydraulic fracturing in situ synthesis of nanoparticles and operational insights in the Bakken Shale This comprehensive volume serves as an indispensable resource for professionals and researchers in the ever changing field of enhanced and improved oil recovery

**Enhanced Recovery Methods for Heavy Oil and Tar Sands** James G. Speight, 2013-11-25 Recent oil price fluctuations continue to stress the need for more efficient recovery of heavy oil and tar sand bitumen resources With conventional production steadily declining advances in enhanced recovery will be required so that oil production can be extended and reservoirs last longer A practical guide on heavy oil related recovery methods is essential for all involved in heavy oil production To feed this demand James Speight a well respected scientist and author provides a must read for all scientists engineers and technologists that are involved in production enhancement In Enhanced Recovery Methods for Heavy Oil and Tar Sands Speight provides the current methods of recovery for heavy oil and tar sand bitumen technology broken down by thermal and non thermal methods An engineer graduate student or professional working with heavy oil upcoming and current will greatly benefit from this much needed text

**Feasibility Study of Heavy Oil Recovery in the Appalachian, Black Warrior, Illinois, and Michigan Basins**, 1992 This report is one of a series of publications assessing the feasibility of increasing domestic heavy oil production Each report covers select areas of the United States The Appalachian Black Warrior Illinois and Michigan basins cover most of the depositional basins in the Midwest and Eastern United States These basins produce sweet paraffinic light oil and are considered minor heavy oil 10 to 20 API gravity or 100 to 100 000 cP viscosity producers Heavy oil occurs in both carbonate and sandstone reservoirs of Paleozoic Age along the perimeters of the basins in the same sediments where light oil occurs The oil is heavy because escape of light ends water washing of the oil and biodegradation of the oil have occurred over million of years The Appalachian Black Warrior Illinois and Michigan basins heavy oil fields have produced some 450 000 bbl of heavy oil of an estimated 14 000 000 bbl originally in place The basins have been long term major light oil producing areas and are served by an extensive pipeline network connected to refineries designed to process light sweet and with few exceptions limited volumes of sour or heavy crude oils Since the light oil is principally paraffinic it commands a higher price than the asphaltic heavy crude oils of California The heavy oil that is refined in the Midwest and Eastern US is imported and refined at select refineries Imports of crude of all grades accounts for 37 to 95% of the oil refined in these areas Because of the nature of the resource the Appalachian Black Warrior Illinois and Michigan basins are not expected to become major heavy oil producing areas The crude oil collection



system will continue to degrade as light oil production declines The demand for crude oil will increase pipeline and tanker transport of imported crude to select large refineries to meet the areas liquid fuels needs **Enhanced Oil Recovery** Ajay Mandal, Keka Ojha, 2023-11-29 Oil recovery efficiency can be increased by applying the enhanced oil recovery EOR processes which are based on the improvement of mobility ratio reduction of interfacial tension between oil and water wettability alteration reduction of oil viscosity formation of oil banks and so forth This book describes the different EOR methods and their mechanisms which are traditionally used after conventional primary and secondary processes The present scenario of different EOR processes at both the field application stage and research stage is also covered Further it discusses some of the recent advances in EOR processes such as low salinity water flooding the application of nanotechnology in EOR microbial EOR carbonated water injection etc Features Comprehensive coverage of all enhanced oil recovery EOR methods Discussion of reservoir rock and fluid characteristics Illustration of steps in design and field implementation as well as the screening criteria for process selection Coverage of novel topics of nanotechnology in EOR and hybrid EOR method and low salinity waterfloods Emphasis on recent technologies feasibility and implementation of hybrid technologies This book is aimed at graduate students professionals researchers chemists and personnel involved in petroleum engineering chemical engineering surfactant manufacturing polymer manufacturing oil gas service companies and carbon capture and utilization

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## **Table of Contents Heavy Crude Oil Recovery**

1. Understanding the eBook Heavy Crude Oil Recovery
  - The Rise of Digital Reading Heavy Crude Oil Recovery
  - Advantages of eBooks Over Traditional Books
2. Identifying Heavy Crude Oil Recovery
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Heavy Crude Oil Recovery
  - User-Friendly Interface
4. Exploring eBook Recommendations from Heavy Crude Oil Recovery
  - Personalized Recommendations
  - Heavy Crude Oil Recovery User Reviews and Ratings
  - Heavy Crude Oil Recovery and Bestseller Lists
5. Accessing Heavy Crude Oil Recovery Free and Paid eBooks
  - Heavy Crude Oil Recovery Public Domain eBooks
  - Heavy Crude Oil Recovery eBook Subscription Services
  - Heavy Crude Oil Recovery Budget-Friendly Options

6. Navigating Heavy Crude Oil Recovery eBook Formats
  - ePub, PDF, MOBI, and More
  - Heavy Crude Oil Recovery Compatibility with Devices
  - Heavy Crude Oil Recovery Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Heavy Crude Oil Recovery
  - Highlighting and Note-Taking Heavy Crude Oil Recovery
  - Interactive Elements Heavy Crude Oil Recovery
8. Staying Engaged with Heavy Crude Oil Recovery
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Heavy Crude Oil Recovery
9. Balancing eBooks and Physical Books Heavy Crude Oil Recovery
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Heavy Crude Oil Recovery
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Heavy Crude Oil Recovery
  - Setting Reading Goals Heavy Crude Oil Recovery
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Heavy Crude Oil Recovery
  - Fact-Checking eBook Content of Heavy Crude Oil Recovery
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements

- 
- Interactive and Gamified eBooks

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