



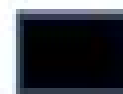
- Drive water



- Polymer solution



- Surfactant



- Oil and water

# Improved Oil Recovery By Surfactant And Polymer Flooding

**Patrizio Raffa, Pablo Druetta**



## **Improved Oil Recovery By Surfactant And Polymer Flooding:**

**Improved Oil Recovery by Surfactant and Polymer Flooding** D.O. Shah, 2012-12-02 Improved Oil Recovery by Surfactant and Polymer Flooding contains papers presented at the 1976 AIChE Symposium on Improved Oil Recovery by Surfactant and Polymer Flooding held in Kansas City Organized into 18 chapters the book includes papers that introduce petroleum reservoirs and discuss interfacial tension molecular forces molecular aspects of ultralow interfacial tension the structure formation and phase inversion of microemulsions and thermodynamics of micellization and related phenomena Papers on adsorption phenomena at solid liquid interfaces and reservoir rocks as well as on flow through porous media studies on polymer solutions microemulsions and soluble oils are also provided Significant topics on molecular microscopic and macroscopic aspects of oil displacement in porous media by surfactant and polymer solutions and related phenomena are also discussed The literature cited in this book forms a comprehensive list of references in relation to improved oil recovery by surfactant and polymer flooding This book will be useful to experts and non experts in this field of research **Improved Oil Recovery by Surfactant and Polymer Flooding. Papers from the AIChE Symposium, Kansas City, Kan. 1976. Shah and R.S. Schechter ,1977** **Improved Oil Recovery by Surfactant and Polymer Flooding** Dinesh Ochhavlal Shah, Robert Samuel Schechter, 1977 Improved Oil Recovery by Surfactant and Polymer Flooding ,1977 *Chemical Enhanced Oil Recovery* Patrizio Raffa, Pablo Druetta, 2019-07-22 This book aims at presenting describing and summarizing the latest advances in polymer flooding regarding the chemical synthesis of the EOR agents and the numerical simulation of compositional models in porous media including a description of the possible applications of nanotechnology acting as a booster of traditional chemical EOR processes A large part of the world economy depends nowadays on non renewable energy sources most of them of fossil origin Though the search for and the development of newer greener and more sustainable sources have been going on for the last decades humanity is still fossil fuel dependent Primary and secondary oil recovery techniques merely produce up to a half of the Original Oil In Place Enhanced Oil Recovery EOR processes are aimed at further increasing this value Among these chemical EOR techniques including polymer flooding present a great potential in low and medium viscosity oilfields Describes recent advances in chemical enhanced oil recovery Contains detailed description of polymer flooding and nanotechnology as promising boosting tools for EOR Includes both experimental and theoretical studies About the Authors Patrizio Raffa is Assistant Professor at the University of Groningen He focuses on design and synthesis of new polymeric materials optimized for industrial applications such as EOR coatings and smart materials He co authored about 40 articles in peer reviewed journals Pablo Druetta works as lecturer at the University of Groningen RUG and as engineering consultant He received his Ph D from RUG in 2018 and has been teaching at a graduate level for 15 years His research focus lies on computational fluid dynamics CFD **Surfactants for Enhanced Oil Recovery Applications** Muhammad Sagir, Muhammad Mushtaq, M. Suleman Tahir, Muhammad Bilal Tahir, Abdul Ravoof

Shaik,2020-01-29 This book provides a concise treatise on the use of surfactants in enhanced oil recovery EOR including information on key types of surfactants and their respective applications in the wider petroleum industry The authors discuss carbon dioxide EOR alkaline surfactant polymer flooding strategies and the use of surfactants as a means of reducing interfacial tension while also paying special attention to the challenges involved in using surfactants for enhanced oil recovery such as the difficult issue of surfactant adsorption on reservoir rock All chapters highlight and are based on the authors own laboratory scale case studies Given its content the book offers a valuable asset for graduate students of petroleum and chemical engineering as well as researchers in the field of chemical enhanced oil recovery It will also be of interest to professionals involved in enhanced industrial oil recovery *Improved Oil Recovery by Surfactant and Polymer Flooding. AIChE ( American Institute of Chemical Engineers ) Symposium, Kansas City, Kansas, 1976 Dinech Ochhavlad Shah (1938- ( editor )),Robert Samuel ( editor ) Schechter,1977 Polymer-Improved Oil Recovery K.S. Sorbie,2013-11-21* The importance of oil in the world economy cannot be overstated and methods for recovering oil will be the subject of much scientific and engineering research for many years to come Even after the application of primary depletion and secondary recovery processes usually waterflooding much oil usually remains in a reservoir and indeed in some heterogeneous reservoir systems as much as 70% of the original oil may remain Thus there is an enormous incentive for the development of improved or enhanced methods of oil recovery aimed at recovering some portion of this remaining oil The techniques used range from improved secondary flooding methods including polymer and certain gas injection processes through to enhanced or tertiary methods such as chemical surfactant caustic foam gas miscible carbon dioxide gas reinjection and thermal steam soak and drive in situ combustion The distinction between the classification of the methods usually refers to the target oil that the process seeks to recover That is in improved recovery we are usually aiming to increase the oil sweep efficiency whereas in tertiary recovery we aim to mobilise and recover residual or capillary trapped oil There are a few books and collections of articles which give general overviews of improved and enhanced oil recovery methods However for each recovery method there is such a wide range of interconnected issues concerning the chemistry physics and fluid mechanics of flow in porous media that rarely are these adequately reviewed Enhanced Oil Recovery Field Case Studies James J. Sheng,2013-04-10 In this chapter the fundamentals of surfactant flooding are covered which include microemulsion properties phase behavior interfacial tension capillary desaturation surfactant adsorption and retention and relative permeabilities The surfactant polymer interactions are discussed The mechanisms and screening criteria are briefly discussed The field cases presented include low tension waterflooding Loma Novia Wichita County Regular field sequential micellar polymer flooding El Dorado Sloss micellar polymer flooding Torchlight and Delaware Childers and Minas SP project preparation and SP flooding Gudong *Chemical Nanofluids in Enhanced Oil Recovery* Rahul Saha,Pankaj Tiwari,Ramgopal V.S. Uppaluri,2021-09-14

Sustainable world economy requires a steady supply of crude oil without any production constraints Thus the ever increasing

energy demand of the entire world can be mostly met through the enhanced production from crude oil from existing reservoirs. With the fact that newer reservoirs with large quantities of crude oil could not be explored at a faster pace it will be inevitable to produce the crude oil from matured reservoirs at an affordable cost. Among alternate technologies the chemical enhanced oil recovery EOR technique has promising potential to recover residual oil from matured reservoirs being subjected to primary and secondary water flooding operations. Due to pertinent complex phenomena that often have a combinatorial role and influence the implementation of chemical EOR schemes such as alkali surfactant polymer flooding and their combinations necessitates upon a fundamental understanding of the potential mechanisms and their influences upon one another and desired response variables. Addressing these issues the book attempts to provide useful screening criteria guidelines and rules of thumb for the identification of process parametric sets including reservoir characteristics and response characteristics such as IFT adsorption etc that favor alternate chemical EOR systems. Finally the book highlights the relevance of nanofluid nanoparticle for conventional and unconventional reservoirs and serves as a needful resource to understand the emerging oil recovery technology. Overall the volume will be of greater relevance for practicing engineers and consultants that wish to accelerate on field applications of chemical and nano fluid EOR systems. Further to those budding engineers that wish to improvise upon their technical know how the book will serve as a much needed repository.

*SURFACTANT - POLYMER INTERACTION FOR IMPROVED OIL RECOVERY.*, 1998 The goal of this research is to use the interaction between a surfactant and a polymer for efficient displacement of tertiary oil by improving slug integrity adsorption and mobility control. Surfactant polymer flooding has been shown to be highly effective in laboratory scale linear floods. The focus of this proposal is to design an inexpensive surfactant polymer mixture that can efficiently recover tertiary oil by avoiding surfactant slug degradation high adsorption and viscous heterogeneity fingering. A mixture comprising a pseudo oil with appropriate surfactant and polymer has been selected to study micellar polymer chemical flooding. The physical properties and phase behavior of this system have been determined. A surfactant polymer slug has been designed to achieve high efficiency recovery by improving phase behavior and mobility control. Recovery experiments have been performed on linear cores and a quarter 5 spot. The same recovery experiments have been simulated using a commercially available simulator UTCHEM. Good agreement between experimental data and simulation results has been achieved.

**Enhanced Oil Recovery, II** E.C. Donaldson, G.V. Chilingarian, T.F. Yen, 1989-07-01 Written by foremost experts in the field and formulated with attention to classroom use for advanced studies in reservoir characterization and processes this book reviews and summarises state of the art progress in the field of enhanced oil recovery EOR. All of the available techniques alkaline flooding surfactant flooding carbon dioxide flooding steam flooding in situ combustion gas injection miscible flooding microbial recovery and polymer flooding are discussed and compared. Together with Volume I it presents a complete text on enhanced recovery technology and hence is an almost indispensable reference text. This second volume

compliments the first by presenting as complete an analysis as possible of current oilfield theory and technology for accomplishment of maximum production of oil. Many different processes have been developed and field tested for enhancement of oil recovery. The emerging philosophy is that no single process is applicable to all petroleum reservoirs. Each must be treated as unique and carefully evaluated for characteristics that are amenable to one or two of the proven technologies of EOR. This book will aid the engineer in field evaluation and selection of the best EOR technology for a given oilfield. Even the emerging technology of microbial applications to enhance oil recovery are reviewed and explained in terms that are easily understood by field engineers. The book is presented in a manner suitable for graduate studies. The only addition required of teachers is to supply example problems for class work. An appendix includes a reservoir mathematic model and program for general application that can also be used for teaching.

**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.

Principles of Enhanced Oil Recovery Caili Dai, Qing You, Mingwei Zhao, Guang Zhao, Fulin Zhao, 2023-05-11. This book presents the latest progress in enhanced oil recovery technology and introduces the application of various enhanced oil recovery methods in oilfield development. Enhanced oil recovery EOR is a continuous theme in oilfield development. Due to the influence of geological conditions development mode and physical and chemical factors more than half of the proven oil reserves remain underground and cannot be accessed. Therefore many enhanced oil recovery methods have been developed to achieve higher oil recovery. This book presents the basic principles and provides the chemistry knowledge related to enhanced oil recovery. It also expounds the applicable criteria of chemical agents. In addition combined with field application examples the limitations of existing enhanced oil recovery methods are analyzed and the future development direction of enhanced oil recovery technology is highlighted. It is worth noting that the integral profile control and water shutoff technology in this book is widely recognized in the enhanced oil recovery industry and has achieved remarkable economic benefits. Given its scope this book is useful for the scientific and technical personnel engaged in the study of oil recovery chemistry and enhanced oil recovery and also as a teaching reference for teachers and students majoring in petroleum engineering and oilfield chemistry.

*Introduction to Enhanced Oil Recovery (EOR) Processes and*

*Bioremediation of Oil-Contaminated Sites* Laura Romero-Zerón, 2012-05-23 This book offers practical concepts of EOR processes and summarizes the fundamentals of bioremediation of oil contaminated sites The first section presents a simplified description of EOR processes to boost the recovery of oil or to displace and produce the significant amounts of oil left behind in the reservoir during or after the course of any primary and secondary recovery process it highlights the emerging EOR technological trends and the areas that need research and development while the second section focuses on the use of biotechnology to remediate the inevitable environmental footprint of crude oil production such is the case of accidental oil spills in marine river and land environments The readers will gain useful and practical insights in these fields

*Application of Surfactant-polymer Enhanced Oil Recovery in a High- Salinity, High-temperature Carbonate Reservoir* Hassan Jassim Alshaer, 2021 As the world energy demand increases and the discovery of new conventional reservoirs diminishes the need of using enhanced oil recovery EOR methods such as chemical flooding grows A widely used type of chemical EOR is surfactant polymer flooding SP In SP flooding a surfactant reduces the interfacial tension between oil and water to ultra low values allowing residual oil to be mobilized and recovered On the other hand polymer increases the viscosity of the SP slug thus providing better sweep efficiency than waterflooding This EOR method shows promising results in clastic formations Although SP flooding works well in sandstone reservoirs it faces major drawbacks when applied in high temperature high salinity carbonate formations Such harsh environment leads to both surfactant and polymer degradation Moreover because of the positive charge of carbonate surfaces and the large concentration of divalent cations large surfactant retention occurs Here we present the performance of a novel SP formulation that achieves ultra low interfacial tension between oil and water at injected brine salinity of 57 000 ppm with lower surfactant retention than current retention values in carbonates We conducted four core flooding experiments in Indiana limestone cores at 100 C to evaluate the performance of the SP formulation in recovering residual oil The formulation consists of carboxylates internal olefin sulfonates and lauryl betaine surfactants A mixture of dead oil and 20 wt % toluene was used to represent the live oil at ambient pressure The first three core floods recovered 75 5% 72% and 71% respectively However when 1wt% NaPA was injected before the chemical flood in the fourth experiment 90% of the original oil in place was recovered reducing the residual oil to only 4 5% We found that the optimum SP slug size is 0 39PV at which the surfactant retention is 0 29mg g rock In addition reducing the frontal velocity to 0 5ft day resulted in doubling the retention The moderate surfactant retention makes SP flooding in carbonates feasible because less surfactant is needed to reach ultra low interfacial tension This new formulation enables application of SP flooding in high temperature high salinity carbonate reservoirs which in return will increase ultimate oil recovery from conventional reservoirs

Polymer Flooding W. Littmann, 1988-09-01 This book covers all aspects of polymer flooding an enhanced oil recovery method using water soluble polymers to increase the viscosity of flood water for the displacement of crude oil from porous reservoir rocks Although this method is becoming increasingly

important there is very little literature available for the engineer wishing to embark on such a project In the past polymer flooding was mainly the subject of research The results of this research are spread over a vast number of single publications making it difficult for someone who has not kept up to date with developments during the last 10 to 15 years to judge the suitability of polymer flooding to a particular field case This book tries to fill that gap The basic mechanisms of the process are described and criteria given where it may be employed Basic elements of the chemistry of EOR polymers are provided The fundamentals of polymer physics such as rheology flow in porous media and adsorption are derived Practical hints on mixing and testing of polymers in the laboratory are given as well as instructions for their application in the oil field Polymer flooding is illustrated by some case histories and the economics of the methods are examined For the essential subjects example calculations are added An indispensable book for reservoir engineers production engineers and laboratory technicians within the petroleum industry

**Modern Chemical Enhanced Oil Recovery** James J.Sheng,2010-11-25 Crude oil development and production in U S oil reservoirs can include up to three distinct phases primary secondary and tertiary or enhanced recovery During primary recovery the natural pressure of the reservoir or gravity drive oil into the wellbore combined with artificial lift techniques such as pumps which bring the oil to the surface But only about 10 percent of a reservoir s original oil in place is typically produced during primary recovery Secondary recovery techniques to the field s productive life generally by injecting water or gas to displace oil and drive it to a production wellbore resulting in the recovery of 20 to 40 percent of the original oil in place In the past two decades major oil companies and research organizations have conducted extensive theoretical and laboratory EOR enhanced oil recovery researches to include validating pilot and field trials relevant to much needed domestic commercial application while western countries had terminated such endeavours almost completely due to low oil prices In recent years oil demand has soared and now these operations have become more desirable This book is about the recent developments in the area as well as the technology for enhancing oil recovery The book provides important case studies related to over one hundred EOR pilot and field applications in a variety of oil fields These case studies focus on practical problems underlying theoretical and modelling methods operational parameters e g injected chemical concentration slug sizes flooding schemes and well spacing solutions and sensitivity studies and performance optimization strategies The book strikes an ideal balance between theory and practice and would be invaluable to academicians and oil company practitioners alike Updated chemical EOR fundamentals providing clear picture of fundamental concepts Practical cases with problems and solutions providing practical analogues and experiences Actual data regarding ranges of operation parameters providing initial design parameters Step by step calculation examples providing practical engineers with convenient procedures

**Chemical Methods** Abdolhossein Hemmati-Sarapardeh,Mahin Schaffie,Mohammad Ranjbar,Mingzhe Dong,Zhaomin Li,2021-11-30 Chemical Methods a new release in the Enhanced Oil Recovery series helps engineers focus on the latest developments in one fast growing area



Different techniques are described in addition to the latest technologies in data mining and hybrid processes Beginning with an introduction to chemical concepts and polymer flooding the book then focuses on more complex content guiding readers into newer topics involving smart water injection and ionic liquids for EOR Supported field case studies illustrate a bridge between research and practical application thus making the book useful for academics and practicing engineers This series delivers a multi volume approach that addresses the latest research on various types of EOR Supported by a full spectrum of contributors this book gives petroleum engineers and researchers the latest developments and field applications to drive innovation for the future of energy Presents the latest research and practical applications specific to chemical enhanced oil recovery methods Helps users understand new research on available technology including chemical flooding specific to unconventional reservoirs and hybrid chemical options Includes additional methods such as data mining applications and economic and environmental considerations      *Basic Concepts in Enhanced Oil Recovery Processes* M. Baviere,1991

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## **Table of Contents Improved Oil Recovery By Surfactant And Polymer Flooding**

1. Understanding the eBook Improved Oil Recovery By Surfactant And Polymer Flooding
  - The Rise of Digital Reading Improved Oil Recovery By Surfactant And Polymer Flooding
  - Advantages of eBooks Over Traditional Books
2. Identifying Improved Oil Recovery By Surfactant And Polymer Flooding
  - 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 Improved Oil Recovery By Surfactant And Polymer Flooding
  - User-Friendly Interface
4. Exploring eBook Recommendations from Improved Oil Recovery By Surfactant And Polymer Flooding
  - Personalized Recommendations
  - Improved Oil Recovery By Surfactant And Polymer Flooding User Reviews and Ratings
  - Improved Oil Recovery By Surfactant And Polymer Flooding and Bestseller Lists
5. Accessing Improved Oil Recovery By Surfactant And Polymer Flooding Free and Paid eBooks
  - Improved Oil Recovery By Surfactant And Polymer Flooding Public Domain eBooks
  - Improved Oil Recovery By Surfactant And Polymer Flooding eBook Subscription Services
  - Improved Oil Recovery By Surfactant And Polymer Flooding Budget-Friendly Options
6. Navigating Improved Oil Recovery By Surfactant And Polymer Flooding eBook Formats
  - ePub, PDF, MOBI, and More
  - Improved Oil Recovery By Surfactant And Polymer Flooding Compatibility with Devices
  - Improved Oil Recovery By Surfactant And Polymer Flooding Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Improved Oil Recovery By Surfactant And Polymer Flooding
  - Highlighting and Note-Taking Improved Oil Recovery By Surfactant And Polymer Flooding
  - Interactive Elements Improved Oil Recovery By Surfactant And Polymer Flooding

8. Staying Engaged with Improved Oil Recovery By Surfactant And Polymer Flooding
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Improved Oil Recovery By Surfactant And Polymer Flooding
9. Balancing eBooks and Physical Books Improved Oil Recovery By Surfactant And Polymer Flooding
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Improved Oil Recovery By Surfactant And Polymer Flooding
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Improved Oil Recovery By Surfactant And Polymer Flooding
  - Setting Reading Goals Improved Oil Recovery By Surfactant And Polymer Flooding
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Improved Oil Recovery By Surfactant And Polymer Flooding
  - Fact-Checking eBook Content of Improved Oil Recovery By Surfactant And Polymer Flooding
  - 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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