

# Improved Oil Recovery by Surfactant and Polymer Flooding

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# Improved Oil Recovery By Surfactant And Polymer Flooding

**Rahul Saha,Pankaj Tiwari,Ramgopal  
V.S. Uppaluri**



## **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 ,1977** **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 **Improved Oil Recovery by Surfactant and Polymer Flooding** Dinesh Ochhavlad Shah, Robert Samuel Schechter, 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      **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      **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      **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      **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

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

*Improved Oil Recovery*, 1983 *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

*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

**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

Enhanced Oil Recovery Field Case Studies James J. Sheng, 2013-04-10 Enhanced Oil Recovery Field Case Studies bridges the gap between theory and practice in a range of real world EOR settings Areas covered include steam and polymer flooding use of foam in situ combustion microorganisms smart water based EOR in carbonates and sandstones and many more Oil industry professionals know that the key to a successful enhanced oil recovery project lies in anticipating the differences between plans and the realities found in the field This book aids that effort providing valuable case studies from more than 250 EOR pilot and field applications in a variety of oil fields The case studies cover practical problems underlying theoretical and modeling methods operational parameters solutions and sensitivity studies and performance optimization strategies benefitting academicians and oil company practitioners alike Strikes an ideal balance between theory and practice Focuses on practical problems underlying theoretical and modeling methods and operational parameters Designed for technical professionals covering the fundamental as well as the advanced aspects of EOR

**SURFACTANT - POLYMER INTERACTION FOR IMPROVED OIL RECOVERY.** ,1997 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 This report contains data concerning selection of appropriate fluids for use in laboratory experiments and numerical simulations A mixture comprising a pseudo oil with appropriate surfactant and polymer is proposed The

properties of this system has been determined The experimental set up has been conditioned for use and experiments involving the aforementioned system have already started A commercial simulator has been acquired for use in reproducing the experiments A graduate student has been trained in its use Linear stability analysis equations have been developed and phase maps for one and two dimensions are currently computed

*Fundamentals of Enhanced Oil and Gas Recovery from Conventional and Unconventional Reservoirs* Alireza Bahadori, 2018-08-18 Fundamentals of Enhanced Oil and Gas Recovery from Conventional and Unconventional Reservoirs delivers the proper foundation on all types of currently utilized and upcoming enhanced oil recovery including methods used in emerging unconventional reservoirs Going beyond traditional secondary methods this reference includes advanced water based EOR methods which are becoming more popular due to CO<sub>2</sub> injection methods used in EOR and methods specific to target shale oil and gas activity Rounding out with a chapter devoted to optimizing the application and economy of EOR methods the book brings reservoir and petroleum engineers up to speed on the latest studies to apply Enhanced oil recovery continues to grow in technology and with ongoing unconventional reservoir activity underway enhanced oil recovery methods of many kinds will continue to gain in studies and scientific advancements Reservoir engineers currently have multiple outlets to gain knowledge and are in need of one product go to reference Explains enhanced oil recovery methods focusing specifically on those used for unconventional reservoirs Includes real world case studies and examples to further illustrate points Creates a practical and theoretical foundation with multiple contributors from various backgrounds Includes a full range of the latest and future methods for enhanced oil recovery including chemical waterflooding CO<sub>2</sub> injection and thermal

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

**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

## Whispering the Secrets of Language: An Emotional Quest through **Improved Oil Recovery By Surfactant And Polymer Flooding**

In a digitally-driven earth where displays reign supreme and immediate connection drowns out the subtleties of language, the profound secrets and psychological nuances concealed within phrases usually move unheard. Yet, set within the pages of **Improved Oil Recovery By Surfactant And Polymer Flooding** a charming fictional value pulsating with raw feelings, lies a fantastic journey waiting to be undertaken. Penned by an experienced wordsmith, that wonderful opus encourages readers on an introspective trip, softly unraveling the veiled truths and profound influence resonating within the very material of each and every word. Within the psychological depths with this emotional evaluation, we shall embark upon a genuine exploration of the book is core styles, dissect their fascinating publishing model, and yield to the strong resonance it evokes serious within the recesses of readers hearts.

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