Enhanced Oil Recovery Field Case Studies Chapter 11 Foams And Their Applications In Enhancing Oil Recovery

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ALEXIS DONNA

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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
Polymer-Improved Oil Recovery Enhanced Oil Recovery Field Case Studies
This chapter first reviews thermal properties of rock and fluids and related energy concepts. The fundamentals of heat transfer and heat loss, theories to estimate the heated area and oil recovery performance are briefly presented. The mechanisms and screening criteria of steam flooding are discussed. After the general practice in steam flooding projects is discussed, field cases are presented which include Kern River in California, Duri steam flood in Indonesia, West Coalinga Field in California, Karamay Field and the Qi-40 block in Laohe, China.
Enhanced Oil Recovery Field Case Studies Elsevier Inc. Chapters
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 indispensible 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 Field Case Studies Gulf Professional Publishing
This chapter briefly presents the interactions between alkali and polymer and the drive mechanisms of alkaline-polymer flooding. The alkaline-polymer field cases presented in this chapter include those in Almy Sands (Isenhour Unit), Moorcroft West and Thompson Creek in Wyoming, David Lloydminster “A” Pool and Etzikom in Canada, and Xing-28 Block (Liaohe Field) and Yangsanmu in China.
Enhanced Oil Recovery Field Case Studies Elsevier Inc. Chapters
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 CO2 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, CO2 injection and thermal
Enhanced Oil Recovery Field Case Studies Elsevier
This chapter first summarizes the fundamentals about foams used in enhancing oil recovery. These fundamentals include characteristics of foams, foam stability, mechanisms of foam flooding to enhance oil recovery, and foam flow behavior. Foam application modes and the factors that need to be considered in designing foam flooding applications are discussed. Some survey results about foam projects are summarized. Finally, several field application cases to enhance oil recovery are presented.
Enhanced Oil Recovery Field Case Studies Elsevier Inc. Chapters
Oil and gas companies are looking for proven hydrocarbon reserves from their existent drained reservoirs with the objective to extend the production and economical life of their fields. The chemical enhanced oil recovery (CEOR) has raised with a myriad type of process that goes beyond the primary and secondary recovery. The polymer flooding (PF) is a widely applied process in reservoirs with low swept efficiency after the water flooding (WF) process. Colombian field has one of the first polymer pilots in the region with positive results of oil recovery in “A” sands. Thus, the operator is interested in the expansion of PF for the same reservoir and even in deeper reservoir sands. This thesis focuses in the evaluation of different scenarios of PF and surfactant polymer flooding (SPF) for the producer layers A and B with a mechanistic model, thus obtaining new recommendations for the recovery strategy in the field. Therefore, a sector model was constructed from a full field commercial simulator to the in-house simulator: UTCHEMRS. In addition, this sector model was migrated to a second commercial simulator allowing a performance comparison for three simulators. UTCHEMRS model was validated with the commercial simulators through the history matching (HM) phase. The primary and waterflood history match was in agreement with the field data. Simulation results suggested that PF for the base case in “A” sands presented an incremental oil recovery of up to 12% additional to water flooding. Additionally, PF was extended to the lower layer “B” sand to investigate the potential of polymer injection. The PF injection in both reservoirs simultaneously loses swept efficiency and decreases the oil recovery in 3%. However, a hypothetical case of new infill producer wells with the objective of testing the individual reservoir performance has revealed that PF is having important raises in oil recovery for B sands as well. Though, further research should be developed in order to strengthen this interpretation. Finally, the results of SPF case for A sands are inconclusive because a laboratory tests of surfactant phase behavior is needed to ensure the lowest IFT in reservoir conditions
Enhanced Oil Recovery Field Case Studies Elsevier Inc. Chapters
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 Enhanced Oil Recovery Handbook Elsevier Inc. Chapters
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
Enhanced Oil Recovery Field Case Studies Elsevier Inc. Chapters
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 remainil)g 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 ofthe 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 Gulf Professional Publishing
This chapter covers the alkaline surfactant–polymer (ASP) process and field results. Background information describing the history of alkaline, alkaline surfactant, alkaline polymer, and ASP flooding processes is given, followed by a review of the requirement of high acid content in the crude oil for these processes to be effective.
Hybrid Enhanced Oil Recovery Processes for Heavy Oil Reservoirs Gulf Professional Publishing
This chapter contains a thorough coverage of in situ combustion (ISC) as an enhanced oil recovery method, describing its complex aspects in a simple and practical manner. It is the first really international treatise of the subject as the international experience was carefully put together.
Enhanced Oil Recovery Field Case Studies Gulf Professional Publishing
Enhanced-Oil Recovery (EOR) evaluations focused on asset acquisition or rejuvenation involve a combination of complex decisions, using different data sources. EOR projects have been traditionally associated with high CAPEX and OPEX, as well as high financial risk, which tend to limit the number of EOR projects launched. In this book, the authors propose workflows for EOR evaluations that account for different volumes and quality of information. This flexible workflow has been successfully applied to oil property evaluations and EOR feasibility studies in many oil reservoirs. The methodology associated with the workflow relies on traditional (look-up tables, XY correlations, etc.) and more advanced (data mining for analog reservoir search and geology indicators) screening methods, emphasizing identification of analogues to support decision making. The screening phase is combined with analytical or simplified numerical simulations to estimate full-field performance by using reservoir data-driven segmentation procedures. Case Studies form Asia, Canada, Mexico, South America and the United States Assets evaluated include reservoir types ranging from oil sands to condensate reservoirs. Different stages of development and information availability are discussed
Chemical Nanofluids in Enhanced Oil Recovery Elsevier
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
Formation Damage During Improved Oil Recovery Elsevier Inc. Chapters
This chapter introduces the reader to the fundamentals of field implementation for chemical EOR projects. Chemical handling, processing, and injection schemes are discussed and current-day facilities and equipment systems are shown from actual projects. Design requirements for processing polymer, alkaline agents, and surfactants provide the reader with an understanding of special considerations for facility process flow design, materials of construction, project logistics, and daily operations. Useful spreadsheets for calculating chemical consumption rates and polymer system design basics are shown. Basic water quality issues are introduced for polymer, surfactant-polymer, alkaline-polymer, and alkaline-surfactant-polymer projects.
Chemical Enhanced Oil Recovery Simulation in Highly Stratified Heterogeneous Reservoir Elsevier Inc. Chapters
In this chapter, we briefly present the fundamentals of alkaline flooding which include comparison of alkalis, alkaline reactions with crude oil, water and reservoir rock, and alkaline flooding mechanisms. Typical field injection data like alkaline injection concentrations and volumes, and field application conditions are discussed. Finally, we present two mobility-control cases in Russia, one case using high alkaline concentration in Hungary, one caustic-flooding case in India, three cases in the United States, and one case in a Canadian heavy oil field.
Enhanced Oil Recovery Field Case Studies Elsevier Inc. Chapters
Chemical Enhanced Oil Recovery Handbook: Screening, Formulation, and Implementation offers engineers a platform to discover the latest strategies and technologies for maximizing the ultimate recovery factor from operating fields. This comprehensive handbook, based on years of field experience, provides engineers with the methods, tools, and techniques needed to successfully plan, evaluate, manage, and complete an enhanced oil recovery project. The book features a clear and rigorous exposition of theory, sections concerning real-world applications, and a password protected website. The handbook illustrates the EOR decision-making workflow using field case examples from several countries. Assets evaluated include reservoir types ranging from oil sands to condensate reservoirs. Different stages of development and information availability are discussed. Results show the advantage of a flexible decision-making workflow. This approach combines geologic and engineering data, minimizing experts' bias, and also combines technical and financial figures. The proposed methodology has proved useful to evaluating projects and properties very rapidly to identify when upside potential exists. Other topics covered include: chemical injection, gas injection, ultrasonic stimulation equipment and process, microbial injection, thermal recovery, and carbon dioxide-enhanced oil recovery. Each topic is accompanied by a description of the equipment and processes, case studies, and modeling methods. Features the latest case studies from Asia, Canada, Mexico, South America, and the United States Evaluates assets including reservoir types ranging from oil sands to condensate reservoirs Discusses different stages of development and information

availability Provides preliminary analytical simulations to estimate oil recovery potential Includes step-by-step modeling techniques for each method
Enhanced Oil Recovery Field Case Studies Gulf Professional Publishing
The fundamentals of individual chemical process (alkaline, surfactant, and polymer) and their two-component combinations have been discussed in preceding chapters. This chapter only briefly discusses the synergy and practical issues in the three-component combination—Alkaline-surfactant-polymer process. The practical issues discussed are produced emulsion, scaling, and chromatographic separation. Overall performance and amount of chemicals used in field projects are summarized. Most of the Chinese field cases were presented in Sheng (2011). In this chapter, we only present a few field cases outside China. These projects are the Lawrence field in Illinois, the Cambridge Minnelusa field, the West Kiehl field and Tanner field in Wyoming, and Lagomar LVA-6/9/21 area in Venezuela.
Enhanced Oil Recovery Field Case Studies BoD – Books on Demand
Based on the enhanced oil recovery (EOR) survey in Oil and Gas Journal (2010), approximately 280,000bbl of oil per day or 6% of US crude oil production was produced by carbon dioxide (CO_2) EOR. Just like any other gas injection processes, field CO_2 flooding projects suffer from poor sweep efficiency due to early gas breakthrough, unfavorable mobility ratio, reservoir heterogeneity, viscous fingering and channeling, and gravity segregation. Many of these problems are believed to be alleviated or overcome by foaming the injected CO_2. Since the 1970s, CO_2-foam flooding has been used as a commercially viable method for EOR processes. Foams, defined as a mixture of internal gas phase in a continuous external liquid phase containing surfactant molecules, can improve sweep efficiency significantly by reducing gas mobility, especially in the reservoirs with a high level of geological heterogeneity. This chapter consists of three main parts: the first part (Section 2.1) deals with fundamentals on foams in porous media and recent advances in this field of research, including three foam states (weak-foam, strong-foam, and intermediate states) and two steady-state flow regimes of strong foams; the second part (Section 2.2) overviews field examples of foam-assisted CO_2-EOR processes; and the third part (Section 2.3) covers typical field injection and production responses if CO_2-foam pilot or field-scale treatments are successful.
Chemical Enhanced Oil Recovery (cEOR) Elsevier Inc. Chapters
This chapter presents models of wettability alteration using surfactants and upscaling models related to oil recovery in fractured carbonate reservoirs. Chemicals used in carbonate reservoirs are reviewed. The presented field cases where surfactants were used to stimulate oil recovery are the Mauddud carbonate in Bahrain, the Yates field and the Cretaceous Upper Edwards reservoir in Texas, the Cottonwood Creek field in Wyoming, and the Baturaja formation in the Semoga field in Indonesia.

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