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

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TYRONE ACEVEDO

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

Walter de Gruyter GmbH & Co KG

Selection of the optimal recovery method is significantly influenced by economic issues in today's oil and gas markets. Consequently, the development of cost-effective technologies, which bring maximum oil recovery, is the main interest in today's petroleum research communities.

Theory and Practice in Microbial Enhanced Oil Recovery provides the fundamentals, latest research and creditable field applications. Microbial Enhanced Oil Recovery (MEOR) is potentially a low-priced and eco-friendly technique in which different microorganisms and their metabolic products are implemented to recover the remaining oil in the reservoir. Despite drastic advantages of MEOR technology, it is still not fully supported in the industry due to lack of knowledge on microbial activities and their complexity of the process. While some selected strategies have demonstrated the feasibility to be used on a mass scale

through both lab and field trials, more research remains to implement MEOR into more oil industry practices. This reference delivers comprehensive descriptions on the fundamentals including basic theories on geomicrobiology, experiments and modeling, as well as current tested field applications. Theory and Practice in Microbial Enhanced Oil Recovery gives engineers and researchers the tool needed to stay up to date on this evolving and more sustainable technology. Covers fundamental screening criteria and theories selective plugging and mobility control mechanisms Describes the basic effects on environmental parameters and the mechanics of simulation, including microbial growth kinetics Applies up to date practical applications proven in both the lab and the field

Chemical Enhanced Oil Recovery (cEOR)

Elsevier Inc.

Chapters

This chapter presents microbial-enhanced oil recovery (MEOR) mechanisms first. Microbes and nutrients used in MEOR are introduced. Screening criteria are listed. Finally, several microbial field applications are presented.

These applications include single-well microbial huff-and-puff, microbial waterflooding, wellbore stimulation to remove wellbore or formation damage, and MEOR using indigenous microbes.

Chemical Enhanced Oil Recovery

Gulf Professional Publishing

Steam assisted gravity drainage (SAGD), since its inception over 30 years ago, has been developed into one of the primary thermal recovery processes for bitumen in Canadian oil sands deposits. This chapter is aimed to provide a high-level description of process principle, features, and challenges. The focuses will be on the evaluation of resource quality suited for SAGD development, the process of start-up to initiate and establish the gravity drainage, the well design, and operational aspects to achieve stable operation and maximize thermal performance, as well as the importance of integration between the subsurface and surface processes, and finally the trend of solvent addition to steam to improve the thermal performance of SAGD.

Hybrid Enhanced Oil Recovery Processes for Heavy Oil Reservoirs

Gulf Professional Publishing

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

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** BoD – Books on Demand Microbial-enhanced oil recovery (MEOR) is the use of microorganisms to increase the recovery of oil from existing oil reservoirs. There are nearly 400 US patents dealing with MEOR, some of which add microorganisms to nearly depleted oil reservoirs while others rely on the indigenous microorganisms. The patent literature is reviewed and two successful field trials by the author are described. A completed field trial using microbial permeability profile modification (MPPM) in a field using waterflooding

as the secondary method of oil recovery was proven to recover over 360,000bbl of oil since 2004 and is predicted to recover another 230,000bbl of oil by 2018. A second field trial using MPPM is being employed in a field with a petroliferous formation at 115°C. The field is undergoing CO2 flooding as the secondary recovery method and MPPM has been proven to produce extra oil from five surrounding wells.

Enhanced Oil Recovery Field Case Studies

Elsevier Inc. Chapters

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). *Enhanced Oil Recovery Field*

Case Studies Gulf Professional Publishing 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

Elsevier Inc. Chapters 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

Polymer-Improved Oil Recovery

Elsevier Inc.

Chapters

One of the most accepted and widely used technologies for enhanced oil recovery is injection of gas or solvent that is miscible or near miscible with reservoir

oil. Understanding gas flooding requires a good understanding of the interaction of phase behavior and flow in the reservoir, and how oil and gas develop miscibility.

Chemical Enhanced Oil Recovery Handbook

Elsevier Inc.

Chapters

Commercial application of chemical enhanced oil recovery (cEOR) processes is expected to grow significantly over the next decade. Thus, Chemical Enhanced Oil Recovery (cEOR): A Practical Overview offers key knowledge and understanding of cEOR processes using an evidence-based approach intended for a broad audience ranging from field operators, researchers, to reservoir engineers dealing with the development and planning of cEOR field applications.

This book is structured into three sections; the first section surveys overall EOR processes. The second section focuses on cEOR processes, while the final section describes the electrorheology technology. These sections are presented using a practical and realistic approach tailored for readers looking to improve their knowledge and understanding of cEOR

processes in a nutshell. **Enhanced Oil Recovery Field Case Studies** 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** Elsevier Inc. Chapters Formation Damage during Improved Oil Recovery: Fundamentals and Applications bridges the gap between theoretical knowledge and field practice by presenting information on formation damage issues that arise during enhanced oil recovery. Multi-contributed technical chapters include sections on modeling and simulation, lab experiments, field case studies, and newly proposed technologies and methods that are related to formation damage during secondary and tertiary recovery processes in both conventional and unconventional reservoirs. Focusing on both the fundamental theories related to EOR and formation damage, this

reference helps engineers formulate integrated and systematic designs for applying EOR processes while also considering formation damage issues. Presents the first complete reference addressing formation damage as a result of enhanced oil recovery Provides the mechanisms for formation damage issues that are coupled with EOR Suggests appropriate preventative actions or responses Delivers a structured approach on how to understand the fundamental theories, practical challenges and solutions Enhanced Oil Recovery Field Case Studies Gulf Professional Publishing 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 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-surfactant-polymer, and alkaline-surfactant-polymer projects. Enhanced Oil Recovery Field Case Studies Elsevier Developments in microbial-enhanced oil recovery (MEOR) have made huge advancements over the last few years. A new programmatic approach to MEOR is organic oil recovery (OOR), the management of the microbial ecology to facilitate the release of oil from the

reservoir. Using this breakthrough process, which does not require microbes to be injected, over 180 applications have been conducted between 2007 and 2011 in producing oil and water-injection wells in the United States and Canada. This chapter reviews the OOR process, a summary of results and two case studies in detail.

Theory and Practice in Microbial Enhanced Oil Recovery

Elsevier Inc. Chapters

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

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

Chemical Methods

Elsevier Inc. Chapters

Water flooding of oil reservoirs has been performed for a century in order to improve oil recovery for

two reasons: (1) give pressure support to the reservoir to prevent gas production and (2) displace the oil by viscous forces. During the last 30 years, it was discovered that the wetting properties of the reservoir played a very important role for the efficiency of the water flood. Even though much work have been published on crude oil–brine–rock (CBR) interaction related to wetting properties, Professor N.R. Morrow, University of Wyoming, asked the audience the following question at the European enhanced oil-recovery (EOR) meeting in Cambridge, April 2011: Do we understand water flooding of oil reservoirs? If we are not able to explain why injection fluids of different ionic composition can have a great impact on displacement efficiency and oil recovery, the answer to Morrow's question is NO. Researchers have to admit that we do not know the phenomena of water flooding well enough. The key to improve our understanding is to obtain fundamental chemical understanding of the CBR interaction by controlled laboratory studies, and then propose chemical mechanisms, which should be validated also from field experience. In

this chapter, I have tried to sum up our experience and chemical understanding on water-based EOR in carbonates and sandstones during the last 20 years with a specific focus on initial wetting properties and possibilities for wettability modification to optimize oil recovery. Chemically, the CBR interaction is completely different in carbonates and sandstones. The proposed chemical mechanisms for wettability modification are used to explain field observations.