بررسی آزمایشگاهی تزریق آب گرم در یک مخزن نفت سنگین کربناته

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چکیده

انبساط حرارتی، کاهش ویسکوزیته،تغییر ترشوندگی و کاهش کشش سطحی بین آب و نفت از مکانیسم‌های غالب در روش تزریق آب گرم هستند. در این مطالعه، آزمایشات تزریق آب گرم برروی مغزه‌های کربناته یک مخزن نفت سنگین در شرایط مخزن و در دمای مختلف تا ۵۰۰°F و با بکاربردن نفت‌های متنوع انجام پذیرفته‌است. میزان بازیافت نهایی، اشباع نفت باقیمانده، اشباع آب غیر قابل کاهش و افت فشار هر کدام از آزمایشات بررسی و مقایسه شده‌اند.

نتایج نشان می‌دهد که امکان بازیافت درصد بالایی از نفت سنگین در مخازن کربناته با اعمال فشار و دمای تزریق بالا وجود دارد. میزان نفت تولیدی به ازای آب گرم تزریقی مقدار بالایی می‌باشد اما این پارامتر کمتر از مقادیر گزارش شده در مخازن نفت سنگین معمولی می‌باشد. همچنین نتایج بدست آمده نشان می‌دهد که با افزایش دما، اشباع نفت باقیمانده کاهش و اشباع آب غیرقابل کاهش افزایش می‌یابد.

کلمات کلیدی: تزریق آب گرم، مخازن کربناته، نفت سنگین، اشباع نفت باقیمانده، اشباع آب غیرقابل کاهش، نفت سنگین، سیلابزنی با مغزه

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Experimental Investigation of Clay Effects in Reservoir Rock on Permeability Reduction in Water Injection Process to Hydrocarbon Reservoirs

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Abstract

Easiness in water injection process into oil reservoir is one of the important factors in water injection projects. The presence of clay in reservoir rock may cause undesire effects. Because of different structures, clays have different quality degree on reservoir rocks permeability. Clays can be aggregated in pores and throats by injected water or exist in rock structure. Clay swelling with consideration of types and structures may lead to permeability reduction. In this research, three core samples have been selected from an oil field in south of Iran to investigate clay effects and its mechanism during water injecting in to the surrounded aquifer. Firstly, type and amount of clay was estimated by XRD tests. Then permeability reduction was the measured in core flooding experiments by distillated water injection to create maximum clay swelling in case clay swelling is effective in permeability reduction.

Keywords: Water Injection, Clay, Clay Swelling, Permeability, Core Flooding

Feasibility Study of Produced Water Re-injection in Sirri Oil Field in Iran

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Abstract

The current drive within the Persian Gulf to reduce the environmental burden of chemicals and oil discharge to the environment has focused attention on challenge of produced water re-injection and has introduced new challenges for compatibility of sea, produced and formation waters. This paper investigates the feasibility of produced water re-injection and water managment in an Iranian offshore oil field named Siri.

Sirri oil field located in south Iran's border producing from a common formation between Iran and United Arab Emirates, which is under seawater injection since 1983. Recently, produced water re-injection has been considering in order to abolish environmental threat and improve the oil recovery. The major active damaging mechanisms during waterflooding could be Solid invasion, Mineral scale deposition and Corrosion. In this study, the first two mechanisms have been investigated.

Several atmospheric and core flood tests, were performed to investigate the mentioned damages and the results were compared with the field outcomes. A special core holder has been designed and constructed by the research group for the better results. According to the achievements, appropriate ratio of produced water to the seawater, the right filter size and suitable chemical treatment are proposed to avoid such damages in Siri.

Keywords: Water management, Produced Water Re- injection, Mineral Scale Deposition, Solid Invasion

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Investigation of Affecting Factors on the Wettability and Wettability Alteration of Low-permeable Carbonate Reservoir Rocks in Presence of Mixed Ionic Surfactants

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Abstract

Altering the wettability of the carbonate reservoir rocks from oil-wet to water-wet has been figured prominently as one of the enhanced oil recovery methods in recent years. Putting the idea into practice requires a basic understanding of the wettability and the controlling factors. In this work, the influence of the factors such as; presence of polar components, electrical surface charges and the initial aqueous phase on formation of oil-wet carbonate surfaces have been investigated by measuring the contact angles in n-hexane (or n-decane)/aqueous phase/calcite systems at different compositional conditions.

A very low permeable carbonate rock from one of the Iranian oil reservoirs has been selected for this study. The rock has an absolute permeability less than 1md and a measured porosity of 16.5 %. The effect of different ionic surfactants on wettability alteration of the rock, saturated with crude oil, has been measured and the consequent improvement in oil production is investigated by spontaneous imbibitions of solutions containing cationic, anionic and cationic-anionic surfactant mixtures. The results of imbibition tests are furthermore supported by measuring contact angles; taking pictures of producing oil drops from different exterior core plug surfaces and also observing the distribution of the remaining oil in cores at the end of experiments. The results show that cationic surfactants at concentrations higher than CMC can cause a remarkable oil production through alteration of wettability and, moreover, the extent of oil production increases with temperature. In contrast, it is observed that the anionic surfactants are not able to change the wettability of an oil-wet surface and their combination with the cationic type would reduce the oil production potential of cationic surfactants.

Study of the sulfate ion concentration in water on wetting characteristics of carbonate surfaces at two different temperatures, 20 and 80°C, demonstrated that the sulfate ions could improve the wettability towards water wetness at higher temperature, and the contact angle would further decrease by increasing the concentration.

Keywords: Wettability, Carbonate, Imbibition, Contact angle, Surfactant, Capillary