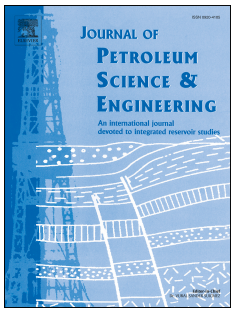
Accepted Manuscript



A study on oxygen consumption mechanism of air-foam flooding in low-temperature oil reservoir

Wu Fei-Peng, Liu Jing, Wei Xue-mei, Pu Chun-sheng

PII: S0920-4105(17)30943-9

DOI: 10.1016/j.petrol.2017.11.061

Reference: PETROL 4477

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 21 February 2017

Revised Date: 19 November 2017

Accepted Date: 23 November 2017

Please cite this article as: Fei-Peng, W., Jing, L., Xue-mei, W., Chun-sheng, P., A study on oxygen consumption mechanism of air-foam flooding in low-temperature oil reservoir, *Journal of Petroleum Science and Engineering* (2017), doi: 10.1016/j.petrol.2017.11.061.

A Study on Oxygen Consumption Mechanism of Air-Foam Flooding in Low-Temperature Oil Reservoir

WU Fei-Peng, LIU Jing[1], Wei Xue-mei, PU Chun-sheng*

School of Petroleum Engineering in China University of Petroleum, Qingdao 266580,China

Summary: Air flooding/air-foam flooding recovery technology has been attracting attention in oilfield development. The key point to the application of this technology is to ensure that the oxygen injected with the air can be fully dissipated inside the reservoir to lower the explosion risk in production wells and reduce the oxidation of the pipeline. It is generally believed that the oxygen and crude oil can react more in low-temperature-oxidation (LTO) reactions above 80°C. As a large amount of oxygen would be spontaneously consumed at this temperature, this technology is mainly used in reservoirs where the temperature is greater than 80°C. In the fractured low-permeability reservoir of China's Yanchang oilfield, where the reservoir temperature is only approximately 30°C, a wide range of crude oil LTO would not be triggered theoretically. However, we found that the oxygen content of the associated gas in the gas channeling wells is significantly lower than that in the air. This phenomenon suggests that, there are other factors that could consume oxygen apart from the LTO reaction. To verify this assumption, an oxygen dissipation core flooding experiment at 30°C and 80°C was carried out to evaluate the oxygen consumption at different temperatures. At the same time, in order to determine the main controlling factors and dissipation mechanisms of oxygen dissipation, theoretical analyses and experimental studies were carried out from the aspects of reductive mineral oxidation reaction in the rock surface and formation water, the physical absorption of the micropore and the dissolution of the reservoir fluid. The results show that at the same experimental conditions, the oxygen consumption at 30°C is 38.14% lower than that at 80°C. The oxygen consumption factors in the low-temperature reservoir mainly include the chemical reactions between the oxygen and reducing minerals, dissolution and retention of formation water and oil, adsorption of Van der Waals forces in the reservoir and physical electronic adsorption of the hydrogen-sulfur bonds and carbon-sulfur bonds. In Chang 6 Reservoir of Ganguyi oilfield, formation water could theoretically consume 56 mg/L (1.75 mmol/L) oxygen through dissolved Fe^{2+}. The

* Corresponding author: Tel.: +86 15066289091 E-mail address: wufeipeng@upc.edu.cn.