Contribution ID: **213**

Type: **Poster Presentation**

Experimental study on microscopic pore-scales crude oil production characteristics and influencing factors during dynamic imbibition of shale reservoir with online NMR

Tuesday, 14 May 2024 16:05 (1h 30m)

Dynamic imbibition and displacement between the matrix and fractures in shale reservoirs can significantly enhance oil recovery (EOR) following initial depletion. However, the microscopic production characteristics and seepage mechanisms at different pore scales during the dynamic imbibition process remain incompletely understood. In this study, we established an online physical simulation experiment method that combines dynamic displacement and imbibition based on nuclear magnetic resonance (NMR), and a series of online NMR water flooding dynamic imbibition experiments were conducted. Through real-time dynamic monitoring of multiphase flow and migration behavior of crude oil in each stage of dynamic imbibition, the microscopic production characteristics and influencing factors were quantitatively studied from the recovery and residual oil saturation field distribution of different scale pores, the contribution mechanism of imbibition and displacement to EOR were investigated, and the multiphase and multi-scale dynamic imbibition crude oil migration and seepage models are discussed. The results show that shale oil occurrence pores can be categorized into two types based on the corresponding production mode (imbibition + displacement). The imbibition effect predominantly governs the recovery of small and large pore walls, while displacement primarily occurs in large pores and fractures. The water flooding dynamic imbibition process in shale reservoirs unfolds in three stages: strong displacement and weak imbibition stage characterized by the rapid production of large pores and fractures under displacement action; weak displacement and strong imbibition stage involving the slow production of small pores under reverse imbibition; and dynamic equilibrium stage characterized by weak displacement and weak imbibition. Viewing the entire water flooding dynamic imbibition process as an organism, it becomes imperative to maximize the recovery of large pores while ensuring the recovery degree of small pores. High permeability contributes to better pore throat connectivity, shorter imbibition equilibrium time, and a greater imbibition and displacement production degree. The contribution of the two production modes to the recovery of small and large pores increased by 4.67% and 3.17%, respectively. A negative correlation was observed between high displacement pressure and imbibition recovery, yet it is conducive to the contribution of displacement to total recovery. Notably, fractures can effectively increase the imbibition contact area, reduce oil-water seepage resistance, and increase the contribution of displacement to recovery by 21.65%. Effectively utilizing the bridge flow conductivity of fractures is crucial for improving matrix oil production. This study provides theoretical support for clarifying the interaction between matrix-fracture imbibition and displacement and for the efficient development of shale oil.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

I would like to submit this presentation into the MDPI student poster award.

Country

China

Porous Media & Biology Focused Abstracts

References

Conference Proceedings

I am interested in having my paper published in the proceedings.

Primary authors: Dr DU, Meng (University of Chinese Academy of Sciences, Beijing, 100049, China); Dr LU, Shuyi; Prof. YANG, Zhengming (University of Chinese Academy of Sciences, Beijing, 100049, China); Dr YAO, Lanlan (University of Chinese Academy of Sciences, Beijing, 100049, China); Prof. LV, Weifeng (Research Institute of Petroleum Exploration & Development, PetroChina, Beijing, 100083, China); Dr FANG, Pengwei (University of Chinese Academy of Sciences, Beijing, 100049, China); Prof. XIAO, Qainhua

Presenter: Dr DU, Meng (University of Chinese Academy of Sciences, Beijing, 100049, China)

Session Classification: Poster

Track Classification: (MS03) Flow, transport and mechanics in fractured porous media