

## **PREFACE: SPECIAL ISSUE OF FLOW AND MULTIPHYSICAL TRANSPORT IN POROUS MEDIA, PT. II**

This special issue of “Flow and Multiphysical Transport in Porous Media in Special Topics & Reviews in Porous Media—An International Journal” contains mainly invited papers, whose authors presented their work at one or more of the following three conferences: “The National Conference of Porous Flow of China” and “The International Symposium of Transport in Porous Media,” both in Hangzhou on August 24–25, 2017, and “The Chinese Congress of Theoretical and Applied Mechanics” in Beijing on August 15–18, 2017. From the more than 2000 papers submitted, including some 30 keynote lectures, approximately 25 of the highest-quality papers were invited. These papers went through a complete review process. After peer review, seven papers were accepted for publication in this issue.

Contained herein, for experimental studies, the article “Physical Simulation Experiment and Application of Water-Flooding Huff and Puff using Tight Large-Scale Model” by Wang et al. establishes a physical simulation system of a cyclic water injection process in tight oil reservoirs, together with a physical simulation method of back-flooding percolation resistance measurement using high-pressure experimentation for large-scale outcrops. The results show that the dispersed phase of oil and water increases flow resistance in the cyclic water injection process, reducing production under certain conditions. The authors caution that the cycle must not be excessive during the water-flooding process.

The article “Study on Weak Gel Mobility in Porous Media using Nuclear Magnetic Resonance Technique” by Di et al. describes typical seepage characteristics of weak gel in porous media by using a nuclear magnetic resonance (NMR) core displacement system. The results show that MR T2 spectra and images can be used to characterize the distribution, migration, and sealing characteristics of weak gel within a rock. During injection, weak gel is distributed mainly in the middle and large pores at the front end of the core, akin to a lower triangular distribution. In the initial stage of water flooding, weak gel migrates as a whole and can effectively block the flow channel, which can improve water-flooding volume. In the later stage of water flooding, retention of weak gel in the rock gradually reduces, and channeling appears in the core.

In the article “Study on Gas Wettability Based on Single Straight Capillary,” Zhang et al. present experiments of quasistatic water-driving gas in a gas/water system in capillaries. The paper investigates the effect of gas wetness on the front of water displacing gas. Results show that gas wettability of capillaries inside walls strengthens with increasing fluorocarbon polymer solution concentration, gas/water interfaces of the water driving the gas front show different shapes under varying gas-wetness conditions, and capillary force is the resistance of water displacing gas in the case of preferential gas wettability, whereas it is the power in the case of nongas wettability.

The article “Water Quality Optimization for Effective Water Injection into Low-Permeability Reservoirs” by Xiong et al. presents laboratory experiments related to water-flooding simulations to quantitatively analyze the impact of clay-particle migration and hydration expansion on seepage ability and, depending on characteristics of throat distribution, to quantify the damage to reservoirs caused by particle size and concentration of suspended solids in injected water. The authors propose particle size and concentration limits of suspended solids in injected water for low-permeability reservoirs.

In the article “A Study of Gas Bubble Formation Mechanism during Foamy Oil Depletion Experiment,” Lv et al. design a sand pack to investigate a foamy oil displacement mechanism using computed tomography scanning. The results indicate that the foamy oil stage is the major contribution to the whole process. Gas is presented as disconnected bubbles at this stage to better use the expansion energy of gas, until the gas saturation breaks through the critical saturation to form a continuous gas phase that decreases oil recovery.

The article “The Molecular Dynamic Simulation and Experiments about Nonlinear Flow Characteristics of Deionized Water in Nanotubes” by Song et al. reports atomic simulation and experimental studies of nonlinear flow characteristics in microstructures and nanostructures. Molecular dynamics (MD) results show that the fluid molecules are absorbed to form stick layers on hydrophilic solid walls. Although the experiment shows that the linear flow characteristic is valid in microtubes, as the diameter decreases to the nanoscale range the resistance coefficient is larger than the theoretical value, and the horsepower equation fails to accurately describe the nanofluid mechanics. The experiments and the MD simulation both show that the stick layer decreases with increasing driving pressure. In fact, the nonlinear relationship between stick-layer thickness and driving pressure is the main reason for the nonlinear flow characteristics below the nanoscale range.

Finally, in the article “Low-Field NMR Analysis of Fluids in Glutenite Cores from Xinjiang Oilfield,” Wang et al. studies the relationship between core transverse relaxation time ( $T_2$ ) and pore size by combining the results of low-field NMR with those of core-flooding experiments. The authors use interpolation and the least-squares method to establish the relationship between pore size and  $T_2$  spectra of core NMR after water saturation. Gravel samples with medium-high (256 mD) and low (7.51 mD) permeability were collected from Xinjiang Oilfield. Experimental results show that the average pore diameter of the medium-high permeability core was 72  $\mu\text{m}$ , with pore size distribution ranging from 1 to 500  $\mu\text{m}$ . The average pore diameter of the low-permeability core was 86 nm, with pore size varying from 10 nm to 1  $\mu\text{m}$ . The results of flooding experiments reveal that water flooding is mainly distributed in pores with diameters greater than 10  $\mu\text{m}$ . A polymer crude oil-producing zone corresponds to water flooding. In addition, more than 80% of residual oil is concentrated in pores with diameters that are less than 1  $\mu\text{m}$ .

The Guest Editors thank the authors of the papers for their scientific contributions and the article reviewers for their time and effort to ensure that the high standards for submitted manuscripts are maintained. We are also grateful to Begell House (the Home of Sciences and Engineering) and its team for their work in the publication of this special issue. Finally, we are grateful to the Editor-in-Chief of the journal, Kambiz Vafai, for his kind contributions throughout the entire process.

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