Editorial

Transport Phenomena in Porous Media and Fractal Geometry

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The concept of porous media is used in many areas of applied science and engineering [1–3]. Transport phenomena in porous media, including single phase and multiphase fluid flow through porous media, heat transfer in porous media, and electrical and acoustical transport in porous media, are a subject of most common interest and have emerged as a separate field of study [4–6]. Transport phenomena in porous media, from microscopic to upward scales, cover general theories behind flow and transport in porous media and form the basis for deterministic and stochastic models that describe them. However, the microstructures and transport mechanisms in porous media are very complex in nature. Fractal geometry has been shown to have potential in the analysis of flow and transport properties of porous media (consult recent special issue [7–11]). This special issue includes a number of recent works on transport phenomenon and applications of fractal geometry theory in porous media.

The first group of papers focuses on the transport phenomena in porous media. L. Wang et al. presented the applicability of different fluid media to measure effective stress coefficient for rock permeability. T. Huang et al. established a multiscale comprehensive mathematical model to simulate different flow regimes. C. Li et al. constructed a mathematical model to describe gas from porous coalbed methane reservoirs with complex boundary conditions. A water alternating CO₂-LPG enhanced oil recovery simulation model was developed by J. Cho et al.

For transport process in complex reservoir media, J. Guo et al., D. Li et al., Z. Jia et al., and W. Xie et al. studied

the transient flow in fractured/shale reservoirs. L. Yuan et al. proposed a model for local skin factor and productivity of horizontal well. L. You et al. investigated the adsorption stability of surfactant on the rock mineral surface. R. Cao et al. theoretically modeled the wettability variation during long-term water flooding. B. Zheng et al. reported the results of experimental investigation of flow resistance in a coal mine ventilation air methane preheated catalytic oxidation reactor. Y. Kang et al. measured the physical properties of samples from representative tight gas reservoirs before and after high temperature treatment. L. Zhang et al. developed a new compositional model to characterize non-Darcy flow in tight/shale gas reservoirs. L. Zhang et al. established a discrete network model for fracture-cave reservoirs to study fluid flow characteristics and pressure distributions.

Z. Dou et al. numerically simulated the immiscible liquid transport in cavity-fractures by Lattice Boltzmann (LB) method. Y. Xu et al. presented a LB model of the uniform velocity and driven convective thermal conductivity in a porous cavity. H. Lu et al. investigated the hydraulic conductivity of soil under different wetting-drying cycles.

The second group of papers focuses on the applications of fractal geometry in porous media. M. A. Martín et al. provided an explanation to the complexity of spatial variability of chemicals or pollutants in soil via an extremely simple model. Z. Wang et al. presented a review on the major development on fractal analysis of porous metal materials. J. Zhao et al. used similar construction method of solution to solve mathematical models of spherical flow in a fractal reservoir.

We hope that this special issue will help to further advance this multidisciplinary endeavor of fractal geometry theory and porous media.

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