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Simulation study on the distribution of water - gas domains and two-phase seepage characteristics of coal based on the cavity throat network model

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In order to investigate the influence of water gas domain distribution on the relative permeability of water and gas during the injection of hot water into coal, this paper establishes a two-dimensional pore cavity throat model based on fractal theory, and uses the water gas dynamic equilibrium equation as the judgment condition for seepage calculation. The water and gas balance control equation of the cavity throat network was derived, and the distribution law of the water gas domain during coal seam thermal injection and drainage gas production process was clarified. Finally, the relationship between water injection pressure, fractal dimension, temperature and relative permeability was obtained. In the study of constant temperature water injection process, it was found that as the injection pressure increases, the gas chamber is constantly occupied by water, the saturation of water continuously increases, and the relative permeability of water significantly increases. The injection pressure is positively correlated with the relative permeability of water. During the constant pressure heating and drainage process, the increase in free methane leads to an increase in gas pore pressure in the model, overcoming capillary forces to discharge water. The higher the temperature, the water chamber is occupied by the gas chamber, and the distribution of the gas domain is wider. When percolation occurs, the relative permeability of the gas increases sharply, which is positively correlated with temperature and conducive to the discharge of water.

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