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# Investigating the effects of temperature and moisture on CH4 recovery after CO2 injection: flow simulation based on coal pore network model

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The massive burning of fossil fuels has led to a dramatic increase in the level of CO2 in the atmosphere, which has greatly affected the global ecology and climate. CO2 enhanced coalbed methane recovery technology not only reduces the CO2 footprint in the atmosphere, but also effectively promotes the extraction of CBM. Coal has strong heterogeneity and dual pore structure, and after CO2 is injected into the coal reservoir, a complex binary gases (CO2 and CH4) flow and multi-physical field coupling problems will occur. we are still confronting of tricky challenges in study the flow of binary gases under multi-field coupling conditions in complex pore networks.

In order to truly restore the pore structure of coal and the flow characteristics of binary gas, this work conducted X-ray scanning on coal samples collected in South Junggar, China, and 3D reconstructed the coal samples using the obtained two-dimensional CT slices. Based on the reconstructed pore network model, permeability simulation was performed using the finite element method. Penetration and diffusion of binary gases and water as well as heat and mass transfer are considered during the simulation. This study aims to investigate: (1) The main factors controlling the competitive adsorption/desorption capabilities of binary gases. By comparing the simulation results of different CO2 injection pressures, reservoir temperatures and moisture content, to clarify the main factors affecting the competitive adsorption capacity of CO2 and CH4. (2) Reservoir temperature changes induced by binary gas adsorption/desorption. Gas adsorption is an exothermic reaction, and the desorption is an endothermic reaction. Due to the adsorption/ desorption dynamic changes of dual gases in the system, the temperature of the reservoir has a periodic law. (3) Permeability evolution rules of binary gases and recovery efficiency of CH4. Reservoir temperature and water content in pore network have a great impact on gas production efficiency. By ignoring and considering two factors during the simulation process, to determine the impact on the permeability change of the binary gas and the recovery efficiency of CH4.

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