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Multiscale pore structure evolution of shale induced by dilute acid

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Hydraulic fracturing to generate complex fracture networks is the most effective stimulation method to develop shale reservoirs. However, the stimulated reservoir volume (SRV) is limited due to the high stress difference, high breakdown pressure and undeveloped natural fracture. Acid treatment has been approved to be an effective way to enhance SRV by reducing shale rock mechanical strength and improving petrophysical properties. In this work, acid soaking experiments are conducted on Longmaxi shale samples to study the mechanism of acid treatment. Cylindrical and powdered shale samples were thoroughly immersed in 15 wt% hydrochloric acid for 10 days. X-ray micro-computed tomography (micro-CT) scanning and low-pressure nitrogen gas adsorption experiments are performed on cylindrical and powdered samples before and after acid treatment. Inductively coupled plasma mass spectrometry (ICP-OES) and X-ray diffraction (XRD) are used for elemental analysis during the acid rock reaction. The nanopore size distribution and pore structure parameters obtained from nitrogen adsorption/desorption isotherms are compared before and after acid soaking. The changes of microscale pores and fractures are directly visualized in micro-CT images. The mechanism of multiscale pore structure evolution during acid-shale interaction is quantitatively discussed. The results show that the pore diameter and pore volume increase significantly, nanopores in shale are enlarged after the acid soaking experiment. Some pores and fractures are generated due to the acid dissolution. The elemental analysis from ICP-OES and XRD indicates that carbonate minerals (calcite and dolomite) are partially dissolved, generating the pores and fractures. Only the pyrite near the fracture is dissolved due to the poor pore connectivity of shale. The findings presented in this work help understand the pore structure evolution mechanism during acid treatment in shale, which would have great significance in shale reservoir development.

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References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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