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The effect of CO_2 mineralization on the microstructure and mechanical properties of sandstone

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Changes in microstructure and mechanical properties of sandstone induced by CO2 mineralization were identified as important factor to the safe CO2 sequestration. To date, extensive studies reported mineral alterations influenced by $scCO_2$-water-rock interactions, but limited investigations focused on the time-lapsed evolution of in-situ microstructure and mechanical properties of sandstone during CO2 storage. Thus, we employed a low field nuclear magnetic resonance (LF-NMR) technology to evaluate the dynamic microstructure and dynamic mechanical properties as a function of $scCO_2$-water exposure time. The experimental results indicate that multiple-scale pore have different responding characteristics to scCO2-water exposure. Large pore and microcrack happen CO2-water-mineral interaction more easily, which maybe result in the increase in porosity. Moreover, scCO2-water exposure could result in mechanical weakening of sandstone, corresponding to the decrease of rock's strength and elastic modulus. Moreover, the increase in exposure time can lead to a more complex fracture network after damage. This investigation reveals the effect of $scCO_2$-water exposure on in-situ microstructure and mechanical properties of sandstone and thus facilitates the evaluation to CO_2 storage security and capacity in sandstone.