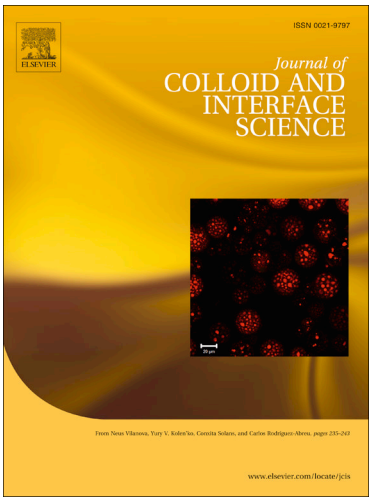

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Carbon Dioxide/brine wettability of porous sandstone versus solid quartz: an experimental and theoretical investigation

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Abstract

Hypothesis: Wettability plays an important role in underground geological storage of carbon dioxide because the fluid flow and distribution mechanism within porous media is controlled by this phenomenon. CO_2 pressure, temperature, brine composition, and mineral type have significant effects on wettability. Despite past research on this subject, the factors that control the wettability variation for CO_2/water/minerals, particularly the effects of pores in the porous substrate on the contact angle at different pressures, temperatures, and salinities, as well as the physical processes involved are not fully understood.

Experiments: We measured the contact angle of deionised water and brine/CO_2/porous sandstone samples at different pressures, temperatures, and salinities. Then, we compared the results with those of pure quartz. Finally, we developed a physical model to explain the observed phenomena.

Findings: The measured contact angle of sandstone was systematically greater than that of pure quartz because of the pores present in sandstone. Moreover, the effect of pressure and temperature on the contact angle of sandstone was similar to that of pure quartz. The results showed that the contact angle increases with increase in temperature and pressure and decreases with increase in salinity.

Keywords: carbon geo-sequestration, contact angle, porous sandstone, surface roughness, carbon dioxide, residual trapping