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## The Effect of Original and Initial Saturation on Residual Nonwetting Phase Capillary Trapping Efficiency

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Injection of supercritical carbon dioxide (CO<sub>2</sub>) into geological formations is used for both atmospheric greenhouse gas reduction (climate change mitigation) and enhanced oil recovery. In an effort to fully understand CO<sub>2</sub> trapping efficiency, the capillary trapping behaviors that immobilize subsurface fluids were analyzed at the pore-scale using pairs of proxy fluids representing the range of in situ (supercritical) nonwetting and wetting fluids. The pairs of fluids were cycled through imbibition and drainage processes using a flow cell apparatus containing a sintered glass bead column. Computed x-ray microtomography (microCT) was used to identify immobilized nonwetting fluid volumes after imbibition and drainage events.

From the images, the trapped residual (post-secondary imbibition) nonwetting phase was spatially correlated to both the original (post-primary imbibition) and the initial (post-primary drainage) nonwetting phase; relationships referred to as the original saturation dependence (So-dependence) and initial saturation dependence (Si-dependence), respectively. Statistically significant trends of decreasing So- and Si-dependence with increasing wetting and nonwetting fluid phase viscosities were observed. This finding implies that the amount of CO<sub>2</sub> injected and ultimately trapped is dependent on the nonwetting phase (e.g. oil or gas) already present in the formation, as well as on the manner in which supercritical CO<sub>2</sub> is initially injected.

### References

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