Controlling CO_2 movement with nanoparticles

Scientific Achievement

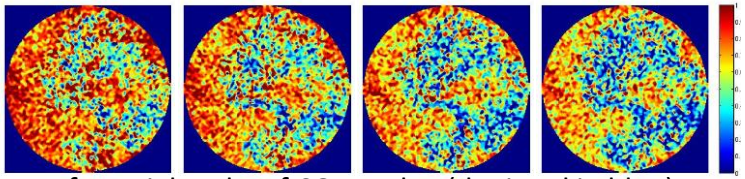
Shown experimentally that the mobility of CO_2 analog fluid is reduced when it displaces a brine laden with suitably treated nanoparticles.

Significance and Impact

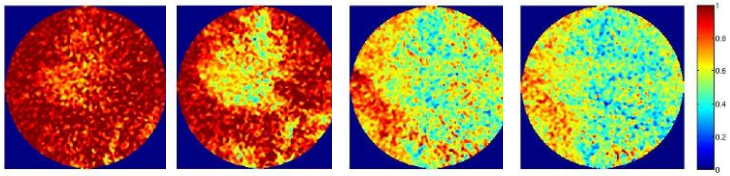
CO_2 is a low viscosity, high mobility fluid that moves through preferential paths through the subsurface. Our discovery raises the possibility of reducing the mobility of the CO_2 only where needed, i.e. at incipient preferential paths. This can reduce the risk of leakage and increase the efficiency of CO_2 storage.

Research Details

- CO_2 and CO_2 analog fluids injected into sandstone cores with/without nanoparticles in the initial brine
- Measured patterns and saturations using CT scanning
- Preferential flow paths greatly reduced (see images)
- Low mobility phase likely the result of displacement processes creating micron droplets of CO_2 that are stabilized by the in-situ nanoparticles



Preferential paths of CO_2 analog (depicted in blue) observed in CT cross-sections without nanoparticles



Elimination of preferential paths in the presence of nanoparticles

D. A. DiCarlo, B. Aminzadeh, M. Roberts, D.H. Chung, S.L. Bryant, and C. Huh, " Mobility control through spontaneous formation of nanoparticle stabilized emulsions," Geophysical Research Letters, 38, L24404, 5 PP. doi:10.1029/2011GL050147 (2011).