Gas driven fracture during gas production using 3D synchrotron computed tomography

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Abstract

During methane gas production from hydrate bearing sandy sediments, fine particles can migrate or clog the pores of sediments. Fines clogging induces a change in pressure gradient which affects the gas flow pattern and might in-duce gas driven fracture. A fundamental understanding of these phenomena is needed to enhance gas production strategies. Effects of fines migration and clogging on gas flow path and gas driven fracture were studied for Carbon Dioxide (CO2) using 3D Synchrotron Micro-computed Tomography (SMT). Multiphase flow experiments were conducted on brine saturated uniform F75 silica sand mixed with kaolinite at different percentages by weight (2%, 4%, and 6%). Sand-fines mixtures were deposited into a small acrylic cylinder that has two ports; one connected to a flow pump to withdraw the brine solution and the other one was used to inject CO2 gas at a constant pressure (4 psi). The gas migrated through percolation with no major particle displacement of sand for low fines concentration (2% and 4%). Moreover, gas driven fracture was ob-served for higher fines content. Fines were observed to clog the pores near the CO2-brine boundary interface. SMT is considered to be a powerful tool that can be used to monitor and visualize fines clogging and the flow of gas through sandy sediments.