Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Using colloidal deposition to mobilize immiscible fluids from porous media JOANNA SCHNEIDER, Department of Chemical and Biological Engineering, Princeton University, NAVID BIZMARK, Princeton Institute for the Science and Technology of Materials, RODNEY PRIESTLEY, SUJIT DATTA, Department of Chemical and Biological Engineering, Princeton University — Nanoparticles are thought to enhance immiscible fluid mobilization from porous media primarily through interactions at fluid interfaces that decrease interfacial energy. Most studies focus on optimizing the transport of these particles to prevent them from depositing onto solid surfaces in a porous medium because deposition is broadly linked with clogging and unfavorable permeability reduction characteristics that prevent flow through the pore space. We investigate how controlled permeability reduction of a three-dimensional porous medium plays a surprisingly positive role in mobilizing trapped oil using confocal microscopy of a transparent, 3D porous medium. We find that nanoparticle deposition results in a large decrease in the amount of oil that remains trapped in the porous medium and expand upon an existing framework to quantify how this reduction in permeability changes the geometric properties of the medium and flow through it. Importantly, our results thus show that slightly reducing the permeability of a porous medium can be beneficial, presenting a new method of mobilizing immiscible fluids from a porous medium.

Joanna Schneider
Princeton University

Date submitted: 28 Jul 2020 Electronic form version 1.4