Abstract Submitted
for the NEF17 Meeting of
The American Physical Society

Nanophysics for improving industrial oil extraction NANCY BURNHAM, Worcester Polytechnic Institute, SHANNON EICHMANN, Aramco Services Company: Aramco Research Center – Boston — Oil powers modern economies. Yet only 30% of oil is recovered from a typical reservoir. The reservoirs of Saudi Arabia provide over 10% of the world's oil. They are highly saline, with concentrations of up to 120,000 ppm total dissolved solids (TDS), and the oil and brine is dispersed within small fissures in carbonate rock. These conditions are challenging for the unhindered diffusion of the nanoparticle tracers that could be used to map an oil field from one well to the next. In this study, bare and carboxyl-terminated atomic-force microscope tips and calcite surfaces acted as surrogates for nanoparticle tracers and carbonate rocks, respectively. They were immersed in three fluids: brine (120K ppm TDS), seawater (60K ppm TDS), and calcium-doped seawater (˜60K ppm TDS). Surprisingly, the amount of TDS was not a good predictor of the tip-sample adhesion. Rather, adding calcium to seawater brought the adhesion down to the levels of brine. The addition of calcium to seawater should mitigate nanoparticle-rock adhesion and allow more efficient diffusion of nanoparticle tracers through a reservoir, which could help ensure a stable supply of an essential global resource.

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Date submitted: 03 Oct 2017 Electronic form version 1.4