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Effect of phosphonate scale inhibitor (DETPMP) concentration, application pH and adsorption on inhibitor and cation return concentrations in carbonate cores

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In this paper, we present results from four core floods (P2, RC1, RC2 and RC3) from the Jurassic Portlandian chalk ($\hat{o} \sim 19.80$ % and k = 606 mD) using 5000ppm, 10000ppm and 25000ppm of partly neutralised DETPMP at pH 4 and 2. Two topics are considered in this work. Firstly, the effect of pH (with no inhibitor present) on the behaviour of calcium and magnesium in a carbonate core is described. The test (P2) was performed on a 2.5 inch long core using alternating slugs of pH adjusted lithium tracer and pH adjusted brine (no lithium). The second topic considered is the effect of inhibitor concentration and pH on inhibitor adsorption and on the behaviour of the inhibitor and cation (calcium and magnesium) return concentrations (core floods RC1, RC2 and RC3). These core floods were performed using longer cores (12 inch), which were treated with just 0.5 pore volume (PV) of inhibitor. The purpose of these core floods was to study the transport and inhibitor/carbonate interactions of phosphonate inhibitor when less than 1 PV is injected. This allows for consumption of the inhibitor during propagation and return, rather than saturating the core with many PV to full adsorptive capacity of the inhibitor/rock system. This study showed that the degree of dissolution increases as injection fluid pH decreases. A relatively high level of mixing (dispersion) was observed in floods RC1 and RC2. Flood RC3 performed with 25000ppm DETPMP at pH 2 gives higher inhibitor adsorption than for flood RC1 performed with 5000ppm DETPMP at pH 4 and flood RC2 performed with 10000ppm DETPMP at pH 4. This indicates that the effect of pH on inhibitor adsorption is more important than the inhibitor concentration under these conditions. Flood RC3 also shows more calcium carbonate dissolution and thus higher permeability after

treatment than did floods RC1 and RC2.