Electronic Supplementary Material (ESI) for Lab on a Chip

Steam-on-a-chip for oil recovery: The role of alkaline additives in steam assisted gravity drainage

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The Electronic Supplementary Information contains two videos (separate files) showing bitumen draining under the force of gravity from a micropillar array with (1) pure steam and (2) with steam together with an alkaline additive. Figure S1 shows the results from a preliminary experiment conducted to assess the effect of adding alkaline additive to steam during SAGD. An etched glass substrate was covered with Cold Lake bitumen and a razor blade was scraped across the surface so that the etched channels were filled with bitumen and the non-etched surface was free of bitumen. The substrates were then taped to a vertical surface and put into a vessel filled with atmospheric pressure steam for 20 min. One trial had the alkaline additive and the other did not. Figure S1 shows the water-in-oil emulsions formed during this experiment. The emulsions in the alkaline case are notably smaller; the same result was observed during on-chip testing.

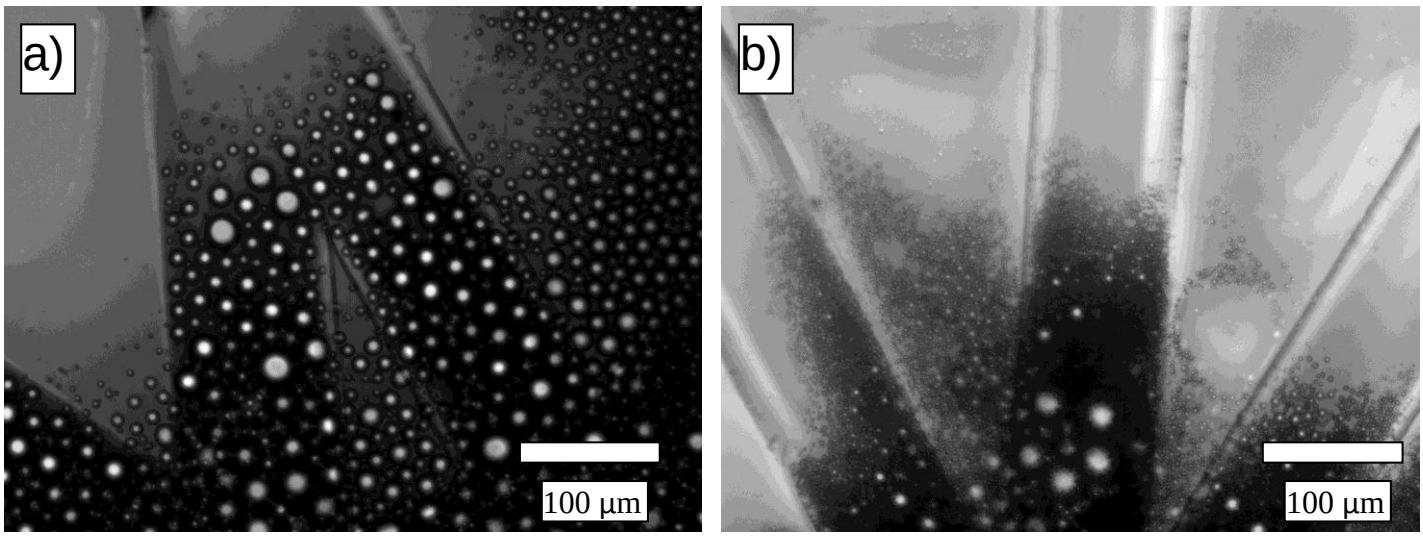

Fig. S1 Microscope images of a bitumen coated etched glass substrates after exposure to steam. a) Pure steam case. b) Alkaline additive case. Note the dramatic difference in the water-in-oil emulsion size between these two trials.