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Chalk-calcite-microfluidic experiments: construction and flooding of microsystems with reactive fluids

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Direct in situ observation of the pore structure changes that occur when chalk is flooded with brines could resolve many of the open questions that remain about the interactions between mineralogical alterations and oil-liberating mechanisms. Experiments on core scale and field tests that have been carried out the last decade have clearly shown that water chemistry affects the final oil recovery. However, there is generally no consensus in the scientific community of why additional oil is released.
In this work, our aim is to focus on in-situ observations of single phase flow and interactions at the pore scale. To do so, we create several types of custom-made microsystems with chalk and calcite crystals. We then do experiments with reacting fluids in these microsystems. During these experiments, we realize in-situ observations (geometrical characteristics, reaction rate) using microsopy techniques (white light vertical/phase shift interferometric microscopy, and classical microscopy), and show how they vary as function as the water chemistry. In simple systems made of calcite, we obtain reactive rates that are coherent with the litterature and with numerical simulations based on Lattice-Boltzmann methods.