Investigation of Chemical Conformance Control at Core and Pore Scale - Results from Core Flooding and the Design of a Microfluidic Setting

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In the current research project DGMK 844 different chemical approaches for conformance control in the reservoir are investigated with core flooding and microfluidic experiments. The project aims to extend the research on different relative permeability modifiers (RPMs), cross-linking polymer gels and micro gels undertaken in DGMK 704, which focused on stability tests and sandpack flooding first. Besides their performance during core flooding, those agents and their working mechanisms are observed at pore scale with advanced micromodels of the microfluidic technology that was developed at the TU Clausthal in the prior DGMK project 746.
Part of this research are cross-linking polymer gels as well as micro gels that are activated either by temperature or upon contact of a polymer solution with a cross-linker. Those agents bear the potential to be placed in high permeable areas of a reservoir, where they form a rigid gel that blocks the water flow through the rock and redirects it to areas with lower permeability. Another approach, suitable for reservoirs with no distinct heterogeneities such as fractures or high permeable strata, is the use of a relative permeability modifier (RPM). Those change the relative permeability of water and oil differently, resulting in a larger decrease of water permeability and promoting oil mobility. Here we present results of rheological measurements and flooding experiments in Bentheimer and Dogger β cores. The permeability of water and oil is monitored before and after the treatment of the cores with described conformance control agents. Furthermore, new micromodels are designed based on both rock types to observe changes in flow of water and oil caused by applied methods. Those micromodels will come in different configurations: a homogeneous pore and grain structure based on µCT images of real rock samples for benchmark experiments, a fractured matrix and a rock matrix with high and low permeable streaks. Both heterogeneous configurations will enable the investigation of blocking high permeable areas in a reservoir and the redirection of fluid flow.