Flow through experiments of CO_2 injection together with impurities in the reservoirs of northeast Netherlands gas fields

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Carbon dioxide (CO_2) capture, transport and storage (CCTS) in deep geological formations can mitigate the atmospheric concentration of greenhouse gases. Purity of CO_2 is an important aspect for CCTS since it affects the cost of capture.

In order to determine the impact of impurities in the CO_2 stream on injectivity, porosity, permeability and geochemistry of the reservoir, a flow through experimental setup is designed, representative of a depleted gas field in northeast Netherlands.

Core samples with a length of 6 cm and diameter of 2.5 cm were analysed with micro computed tomography (CT) scans, as well as porosity and permeability measurements pre and post experiments.

The core samples were stored in vacuum for 28 hours and subsequently saturated with brine for 95 hours. They were then wrapped in teflon and placed in a polyether ether ketone (PEEK) sample holder which in turn was placed in the reactor. Methane was injected up to a pressure of 20 bar to be representative of a depleted gas reservoir. Following that CO_2 and CO_2 + 100 ppm H_2S were injected through the samples up to a pressure of 120 bar. The confining pessure was 130 bar.

Various parameters were tested in these experiments. CO_2 was injected with various differential pressure values in order to assess the impact on injectivity,especially in terms of salt precipitation and drying out effects. Furthermore the influence of initial reservoir permeability was tested in order to provide possible recommendations for the selection of perforation zones in wells. In addition, the impact of drainage and imbibation processes following injection was analysed. Finally, the geochemical effects of the injected gases on the reservoir were studied.