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CO_2/ brine substitution experiments at simulated reservoir conditions

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Capillary properties of rocks affect the mobility of fluids in a reservoir. Therefore, the understanding of the capillary pressure behaviour is essential to assess the long-term behaviour of CO_2 reservoirs. Beyond this, a calibration of the petrophysical properties on water saturation of reservoir rocks at simulated *in situ* conditions is crucial for a proper interpretation of field monitoring data. We present a set-up, which allows for the combined measurements of capillary pressure, electric resistivity, and elastic wave velocities under controlled reservoir conditions (p_{conf} = 400 bar, p_{pore} = 180 bar, T = 65 ˚C) at different brine-CO_2 saturations. The capillary properties of the samples are measured using the micropore membrane technique.

The sample is jacketed with a Viton tube (thickness = 4 mm) and placed between two current electrode endcaps, which as well contain pore fluid ports and ultrasonic P and S wave transducers. Between the sample and the lower endcap the hydrophilic semi-permeable micro-pore membrane (pore size = 100 nm) is integrated. It is embedded into filter papers to establish a good capillary contact and to protect the highly sensitive membrane against mechanical damage under load. Two high-precision syringe pumps are used to displace a quantified volume of brine by CO_2 and determine the corresponding sample saturation. The fluid displacement induces a pressure gradient along the sample, which corresponds to the capillary pressure at a particular sample saturation. It is measured with a differential pressure sensor in the range between 0 - 0.2 MPa. Drainage and imbibition cycles are performed to provide information on the efficiency of capillary trapping and to get a calibration of the petrophysical parameters of the sample.