Geophysical Research Abstracts
Vol. 15, EGU2013-1758, 2013
EGU General Assembly 2013

Predicting capillarity of mudrocks for geological storage of CO_2

Andreas Busch (1) and Alexandra Amann-Hildenbrand (2)

(1) Shell Global Solutions, Rijswijk, Netherlands (andreas.busch@shell.com), (2) RWTH Aachen University, Institute of Petroleum and Coal, Aachen, Germany (amann@lek.rwth-aachen.de)

Various rock types were investigated, with the main focus on the determination and prediction of the capillary breakthrough and snap-off pressure in mudrocks (e.g. shales, siltstones, mudstones). Knowledge about these two critical pressures is important for the prediction of the capillary sealing capacity of CO_2 storage sites. Capillary pressure experiments, when performed on low-permeable core plugs, are difficult and time consuming. Laboratory measurements on core plugs under in-situ conditions are mostly performed using nitrogen, but also with methane and carbon dioxide. Therefore, mercury porosimetry measurements (MIP) are preferably used in the industry to determine an equivalent value for the capillary breakthrough pressure. These measurements have the advantage to be quick and cheap and only require cuttings or trim samples.
When evaluating the database in detail we find that (1) MIP data plot well with the drainage breakthrough pressures determined on sample plugs, while the conversion of the system Hg/air to CO_2/brine using interfacial and wettability data does not provide a uniform match, potentially caused by non fully water-wet conditions; (2) brine permeability versus capillary breakthrough pressure determined on sample plugs shows a good match and could provide a first estimate of Pc-values since permeability is easier to determine than capillary breakthrough pressures. For imbibition snap-off pressures a good correlation was found for CH4 measured on sample plugs only; (3) porosity shows a fairly good correlation with permeability for sandstone only, and with plug-derived capillary breakthrough pressures for sandstones, carbonates and evaporates. No such correlations exist for mudrocks; (4) air and brine-derived permeabilities show an excellent correlation and (5) from the data used we do not infer any direct correlations between specific surface area (SSA), mineralogy or organic carbon content with permeability or capillary pressure however were able to predict permeabilities using a more sophisticated model that relies on several of these parameters.