Geophysical Research Abstracts
Vol. 15, EGU2013-4488, 2013
EGU General Assembly 2013

Numerical investigation of microbially induced calcite precipitation as a leakage mitigation technology

Johannes Hommel (1), Alfred Cunningham (2), Rainer Helmig (1), Anozie Ebigbo (3), and Holger Class (1)

(1) Department of Hydromechanics and Modelling of Hydrosystems, University of Stuttgart, Stuttgart, Germany , (2) Center for Biofilm Engineering, Montana State University, Bozeman, USA, (3) E.ON Energy Research Center, RWTH Aachen University, Aachen, Germany

One of the key issues of carbon capture and storage (CCS) is the long term security of the storage site, i.e. the permanent enclosure of the stored carbon dioxide (CO_2) in the target reservoir. Amongst the different storage mechanisms, cap rock integrity is crucial for preventing leakage of CO_2. Leakage to shallower regions or back to the atmosphere would reduce the efficiency and pose a threat to the environment, for example to groundwater resources or human residence areas. Ureolysis-driven microbially induced calcite precipitation (MICP) is one of the technologies in the current focus of research aiming at mitigation of potential leakage by sealing high permeability zones in cap rocks.

In our current work, a numerical model has been developed and validated using MICP experiments in sand filled columns under atmospheric pressure conditions [1]. Based on new experimental data under reservoir pressure conditions in sandstone rock cores [2] the model will be improved and optimized. The focus is on extending the model to 3-D radial flow and the validation of the model under conditions relevant for field scale CCS. The improved numerical model will be used to design field scale MICP experiments and evaluate the results of those experiments to get a better understanding of the potential of MICP as a sealing technology.

[1] Ebigbo A., Phillips A., Gerlach R., Helmig R., Cunningham A.B., Class H., and Spangler L. H. (2012), Darcy-scale modeling of microbially induced carbonate mineral precipitation in sand columns, Water Resour. Res., 48

[2] Phillips A., Lauchnor E., Eldring J., Esposito R., Mitchell A.C., Gerlach R., Cunningham A.B., and Spangler L. H. (2013), Potential CO_2 leakage reduction through biofilm-induced calcium carbonate precipitation, Environ. Sci. Technol., 47(1)