Contribution ID: **510** Type: **Oral 20 Minutes**

INVESTIGATING UNDERGROUND CO_2 STORAGE IN POROUS MEDIA USING GEOLOGICAL LABS ON CHIP

Monday, 14 May 2018 11:00 (15 minutes)

CO_2 geological storage in deep saline aquifers represents a mediation solution for reducing the anthropogenic CO_2 emissions. So far, little is known about both the CO_2 storage impact on the underground geochemistry and on the microbial diversity inhabiting deep aquifers. Consequently, this kind of storage required adequate scientific knowledge and tools at the pore scale to evaluate injection scenarios or to estimate reservoir capacity. In this context, porous media designed inside high pressure / high temperature microfluidic reactors (micromodel or geological labs on chip –GloCs [1]) turn out to be excellent tools to complement the classical core-scale experimental approaches to investigate the different mechanisms associated with CO_2 geological storage in deep saline aquifers [2].

This talk will first highlight the latest results obtained at ICMCB concerning the application of the GLoCs to study the invasion processes of CO_2 in water and brine saturated GLoCs. In particular, direct optical visualization and image treatments allow following the evolution of the CO_2/brine phase distribution within the pores, including displacement mechanisms and pore saturation levels [3]. We will then present some ongoing work aiming at integrating *in situ* spectroscopy techniques in HP microreactors to get information about the dissolution and mineralization trapping. We have developed an experimental set-up to recreate 3D reactive porous media within a microfluidic channel (fixed packed bed of calcium carbonate –$CaCO_3$ microparticles). Thanks to X-ray laminography carried out at the european Synchrotron facility (ESRF), we have observed on reconstructed 2D images, the dissolution phenomena occurring during the successive injection of constant volumes of non-equilibrium solution. This proof of concept has opened new possibilities for using this methodology to acquire kinetic data on 3D reactive front phenomena in porous media.

Eventually, we will introduce the use of GLoCs as a significant tool to mimic the *in situ* biogeological reservoirs conditions to study CO_2 bioconversion (in the frame of the ERC project "Big Mac"). Indeed, beyond CO_2 geological storage investigations, the GLoCs could provide new insights into bioremediation process to restore the CO_2 as a valuable energy resource (*i.e.* CH_4 via methanogenesis process). These tools could also find wider applications in geological-related studies such as Enhanced Oil Recovery, shale gas recovery or geothermal energy.

References

[1] S. Marre, A. Adamo, S. Basak, C. Aymonier, K.F. Jensen, Design and Packaging of Microreactors for High Pressure and High Temperature Applications, Industrial & Engineering Chemistry Research, 49 (2010) 11310-11320.

[2] N. Liu, Microfluidic investigations of CO2 / Water systems at high pressures and temperatures, in: ICMCB, Supercritical Fluids group, University of Bordeaux, 2013.

[3] S. Morais, N. Liu, A. Diouf, D. Bernard, C. Lecoutre, Y. Garrabos, S. Marre, Monitoring CO2 invasion processes at the pore scale using geological labs on chip, Lab on a Chip, 16 (2016) 3493-3502.

Acceptance of Terms and Conditions

Click here to agree

Primary author: CARIO, Anaïs (ICMCB-CNRS)

Co-authors: DIOUF, Abdou Khadre (ICMCB-CNRS); LECOUTRE, Carole (ICMCB-CNRS); NGUYEN, Olivier (ICMCB-CNRS); BERNARD, Dominique (ICMCB-CNRS); GARRABOS, Yves (ICMCB-CNRS); MARRE, Samuel (ICMCB-CNRS)

Presenter: CARIO, Anaïs (ICMCB-CNRS)

Session Classification: Parallel 1-D

Track Classification: GS 3: Experimental achievements