Geophysical Research Abstracts,
Vol. 11, EGU2009-4859, 2009
EGU General Assembly 2009

Reactivity of rock and well in a geological storage of CO_2 : role of co-injected gases

S. Renard, J. Sterpenich, and J. Pironon

Nancy-University, CNRS, CREGU, UMR G2R, B.P. 239, F-54506 Vandœuvre-lès-Nancy, France (stephane.renard@g2r.uhp-nancy.fr)

The CO_2 capture and geological storage from high emitting sources (coal and gas power plants) is one of a panel of solutions proposed to reduce the global greenhouse gas emissions. Different pre- , post- or oxy-combustion capture processes are now available to separate associated gases (SOx, NOx, etc…) and the CO_2. However, complete purification of CO_2 is unachievable for cost reasons as well as for CO_2 surplus of emissions due to the separation processes. By consequence, a non-negligible part (more or less 5%) of these gases, called “annex gases”, could be co-injected with the CO_2. Their impact on the chemical stability of reservoir rocks, caprocks and wells has to be evaluated before any large scale injection procedure. Physico-chemical transformations could modify mechanical and injectivity properties of the site and possibly alter storage safety. One of the aims of the CCS pilot project leaded by TOTAL at Lacq (France) is to develop, through a real case study, a methodology for a long-term safe storage qualification. Greenhouse gases are captured from an oxy-combustion power plant, transported along 30 km to the carbonate reservoir of Rousse at around 4500 m in depth. The study presented here is focused on laboratory simulations of geochemical interactions between the reservoir rock (fractured dolomite), the caprock (marl) and the injected CO_2 with some potential annex gases. In the same time, experiments are performed on the reactivity of reference minerals such as calcite, dolomite, muscovite, quartz and pyrite to better understand the implication of each phase on bulk rock reactivity. Moreover, well reactivity is observed through specific steel and cement used by petroleum industry. Two annex gases (SO_2 and NO) have been selected.. Their reactivity is compared to that of N_2 considered as an inert annex gas from a chemical point of view. Solid samples are placed in $1cm^3$ gold capsules in presence or not of water with a salinity of 25 NaCl g/l. Gases are hermetically transferred by cold trap into the gold reactors that are sealed by electrical welding and placed in an autoclave during one month at 150°C and 100 bar, which represent the geological conditions in the Rousse reservoir after two years of injection.

After experiments, solid samples (rock, cement, steel) are observed and analysed with different techniques (SEM, TEM, Raman and XRD). Gases are also collected and analysed by Raman spectrometry whereas the aqueous solution is analysed with ICP-MS, ICP-AES and ionic chromatography. As sampling methods cannot be used during experiment the synthetic fluid inclusions technique has been developed to trap and analyse the fluids in experimental conditions. It allows to characterise the number of phase and the nature of dissolved species. Mass balances are established in order to quantify the reaction rates.

This study shows the first results concerning the mineralogical transformation of rocks and well materials that have undergone $CO_2$and co-injected annex gases. The results are used to better constrain thermodynamical approaches leading to a predictive geochemical modelling. The results are interpreted in terms of petrophysical and chemical impacts of the injected gases on the mineral assemblages of a storage site.

This work is supported by TOTAL and ADEME (national agency for energy control and development, France).