Investigating carbonatation processes using geological labs on a chip

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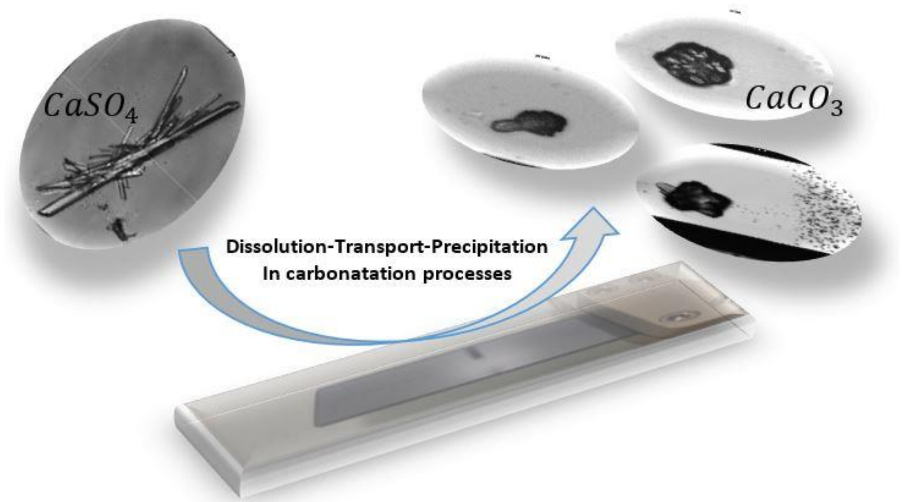
The geological subsoil has been used for a long time, to extract natural resources (water, heat, gas, useful mineral substances, etc.) or to inject or store undesirable compounds (industrial water and desalination brines, petroleum brines, radioactive wastes, acid gases, CO_2, etc.). The understanding of geochemical effects occurring during underground exploitation requires the mastering of reactive transport processes in porous and fractured geological environments at different time and space scales.

The objective of this work is to study, at the pore scale, the precipitation and the dissolution processes of carbonates and silicates minerals, in order to understand the physical and chemical mechanisms at the interface of different phases (mineral/water/gas). For this purpose, we control the parameters that are likely to affect the reaction rates, like pH (from 5 to 10), temperature (from 25 to 100 °C) and the concentration of alkaline elements (Ca, Mg).

The recent development of the geological Lab-On-Chip (GLoCs)[1] for the study of reactive transport mechanisms at the conditions of geological reservoirs (25 <T <100 ° C and 1 <P <200 bar) has opened new ways to study geochemical processes. We use the GLoCs, which can be coupled with their associated instrumentation (*in situ* characterization such as high speed visible imaging, Raman spectroscopy, Particle Image Velocimetry), to study the carbonatation mechanism of a model mineral : calcium sulfate through the following reaction: $C_aSO_4 + CO_3^{2-} \rightarrow C_aCO_3 + SO_4^{2-}$. The results obtained experimentally will be coupled with numerical modeling in the form of kinetic and thermodynamic equations that can be integrated into reactive transport models with CO_2 geological applications.

Key Word: Reactive transport, CO_2 geological storage, Lab-On-Chip, D-T-P processes kinetics.



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