Geophysical Research Abstracts
Vol. 19, EGU2017-15058, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

Lab-X-ray multidimensional imaging of processes inside porous media

Jose Godinho

Mamchester University, School of materials, Manchester, United Kingdom (jose.godinho@manchester.ac.uk)

Time-lapse and other multidimensional X-ray imaging techniques have mostly been applied using synchrotron radiation, which limits accessibility and complicates data analysis. Here, we present new time-lapse imaging approaches using laboratory X-ray computed microtomography (CT) to study transformations inside porous media. Specifically, three methods will be presented: 1) Quantitative time-lapse radiography to study sub-second processes. For example to study the penetration of particles into fractures and pores, which is essential to understand how proppants keep fractures opened during hydraulic fracturing and how filter cakes form during borehole drilling. 2) Combination of time-lapse CT with diffraction tomography to study the transformation between bio-inspired polymorphs in 6D, e.g. mineral phase transformation between ACC, Vaterite and Calcite - $CaCO_3$, and between ACS, Anhydrite and Gypsum - CaSO4. Crystals can be resolved in nanopores down to 7 nm (over 100 times smaller than the resolution of CT), which allows studying the effect of confinement on phase stability and growth rates. 3) Fast iterative helical micro-CT scanning to study samples of high ratio height to width (e.g. long cores) with optimal resolution. Here we show how this can be useful to study the distribution of the products from fluid-mediated mineral reactions throughout longer reaction paths and more representative volumes. Using state of the art reconstruction algorithms allows reducing the scanning times from over ten hours to below two hours enabling time-lapse studies. It is expected that these new techniques will open new possibilities for time-lapse imaging of a wider range of geological processes using laboratory X-ray CT, thereby increasing the accessibility of multidimensional imaging to a larger number of users and applications in geology.