InterPore2018 New Orleans



Contribution ID: 362 Type: Poster

Reactive Transport Modelling on the Drill Core Scale, Parameterized by GeoPET/µCT Process Tomography

Tuesday, 15 May 2018 18:00 (15 minutes)

In-situ leaching of ores is considered as an economic and environmentally friendly production method. However, the leaching process is complicated by its dependence on the material's heterogeneity and by retroactive effects over large scales. We developed an experimental procedure which is based on positron emission tomography (PET) during transport experiments with radiotracers (Kulenkampff et al. 2016), supported by μ CT, to derive flow and diffusion parameters with molecular sensitivity (picomolar) and with reasonable resolution (1 mm) on samples with drill core dimensions. The procedure directly yields the spatial distributions of flow velocity and effective volume from flow experiments, the diffusion coefficient, and the real geometry of the sample. This approach is validated by using a core sample (L = 10 cm, D= 6 cm) with an induced fracture, obtained from Permian Kupferschiefer sandstone. After the tomographic measurements the core sample was leached stepwise with (1) fresh water to remove salt minerals, (2) acidic solution (H2SO4, pH 1.5) to reduce the carbonate content, and (3) acidic solution with added ferric iron to dissolve the Cu-sulfidic ore.

The measured hydrodynamic and structural parameters from PET and μ CT were then directly imported into a reactive transport model using interface Comsol Multiphysics with Phreeqc (iCP, Nardi et al. 2014) to simulate core sample leaching. The geochemical conditions of the simulation were considered consistent to the laboratory leaching experiment. The reactive transport simulation is based on the real geometry of the sample and the observed flow fields on the continuum scale and does not require a high performance computation of flow simulations on pore scale. The results of these economical simulations are compared to the results of the laboratory leaching experiments.

References

J. Kulenkampff, M. Gründig, A. Zakhnini and J. Lippmann-Pipke. Geoscientific process monitoring with positron emission tomography (GeoPET), Solid Earth, 7, 1217-1231, (2016).

A. Nardi, A. Idiart, P. Trinchero, L.M. de Vries and J. Molinero. Interface COMSOL-PHREEQC (iCP), an efficient numerical framework for the solution of coupled multiphysics and geochemistry. Computers & Geosciences 69, 10-21, (2014)

References

Acceptance of Terms and Conditions

Click here to agree

Primary authors: KULENKAMPFF, Johannes (HZDR); KARIMZADEH, Lotfollah (HZDR); SCHYMURA, Stefan (HZDR); EICHELBAUM, Sebastian (nemtics); LIPPMANN-PIPKE, Johanna (BGR); FISCHER, Cornelius (HZDR)

Presenter: FISCHER, Cornelius (HZDR)

Session Classification: Poster 2

Track Classification: MS 1.27: Pore Scale Processes and Upscaling of Flow and (Reactive) Transport

in Porous Media