Geophysical Research Abstracts
Vol. 16, EGU2014-13248-1, 2014
EGU General Assembly 2014

Reaction induced fractures in 3D

Ole Ivar Ulven and Anders Malthe-Sørenssen
University of Oslo, Physics of Geological Processes, Oslo, Norway (o.i.ulven@fys.uio.no)

The process of fracture formation due to volume changing processes has been studied numerically in a variety of different settings, e.g. fracture initiation in general volume increasing reactions by Ulven et al.[4], weathering of dolerites by Røyne et al.[2], and volume reduction during chemical decomposition prosesses by Malthe-Sørenssen et al.[1]. Common to many previous works is that the simulations were performed in a 2D setting, due to computational limitations.

Fractures observed both in field studies and in experiments are in many cases three dimensional. It remains an open question in what cases the simplification to 2D systems is applicable, and when a full 3D simulation is necessary.

In this study, we use a newly developed 3D code combining elements from the discrete element model (DEM) with elements from Peridynamics[3]. We study fracture formation in fully three dimensional simulations, and compare them with simulation results from 2D DEM, thus gaining insight in both qualitative and quantitative differences between results from 2D and 3D simulations.

References

[1] Malthe-Sørenssen, A., Jamtveit, B., and Meakin, P., "Fracture Patterns Generated by Diffusion Controlled Volume Changing Reactions," Phys. Rev. Lett. **96**, 2006, pp. 245501-1 – 245501-4.

[2] Røyne, A., Jamtveit, B., and Malthe-Sørenssen, A., "Controls on rock weathering rates by reaction-induced hierarchial fracturing," Earth Planet. Sci. Lett. **275**, 2008, pp. 364 – 369.

[3] Silling, S. A., "Reformulation of elasticity theory for discontinuities and long-range forces," J. Mech. Phys. Solids, **48**, Issue 1, 2000, pp. 175 – 209

[4] Ulven, O. I., Storheim, H., Austrheim, H., and Malthe-Sørenssen, A., "Fracture Initiation During Volume Increasing Reactions in Rocks and Applications for CO_2 Sequestration", Earth Planet. Sci. Lett. **389C**, 2014, pp. 132 – 142.