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Initiation and propagation of fissures of claystone under gas pressure: numerical and experimental investigations

Abstract:

The current decision is to store nuclear waste in an impermeable layer of clay to prevent any leakage. The waste will be cased and stacked in sealed tunnel. Over the tens of years, the water and nuclear products will oxidize the casing and build up hydrogen gas pressure. In the worst scenario, the pressure will rise enough to start fissuring the claystone and modifying the permeability. Little work has been carried out on the topic of gas fracturing so an experimental protocol was designed to create stable fractures under oil or gas pressures. The investigations aim to compare breakdown pressures and fissure shapes. The results will help validate the numerical model used to mimic the phenomenon at the size of a sample and then of a tunnel.

Further steps:

In near future, I hope to complete the set-up of the experimental apparatus and start fissuring the first batch of samples. In parallel, the numerical work aims to combine the Biot's poro-elastic model and the Fichant's damage model that was used by Hui WANG during his PhD thesis.

Reference:

ALPERN, J., MARONE, C., ELSWORTH, Derek, et al. Exploring the physicochemical processes that govern hydraulic fracture through laboratory experiments. In: 46th US Rock Mechanics/Geomechanics Symposium. OnePetro, 2012.

Publication (not related to PhD topic):

Rodrigues, R. & Orense, Rolando & Pardo, Gislaine & Sarmah, Ajit & Yan, R.. (2020). Liquefaction Resistance of Sand Amended with Biochar. *Géotechnique Letters*. 10. 1-20. 10.1680/jgele.19.00029.