Experimental characterisation of self-healing in reconstituted Boom Clay

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EXPERIMENTAL CHARACTERISATION OF SELF-HEALING IN RECONSTITUTED BOOM CLAY

TOPIC 04: Hydro-mechanical properties

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Abstract

Disposal of radioactive waste in deep and stable geological formations is considered a feasible approach to isolate these wastes from anthropogenic activities and the environment over a long time period. Argillaceous formations are proposed as one of the suitable host rocks for such infrastructure thanks to their low permeability, high sorption capacity and propensity to plastic rather than brittle deformation. As a result of tunnel excavation, the host rock will experience significant stress redistribution, leading to local failure of the material, the creation of excavation damage zone and a local increase of the host rock permeability. Nevertheless, laboratory and field experiments have shown that these fractures disappear or seal naturally with time (Meier et al., 2000, Bastiaens et al., 2007, Zhang, 2013). This specific behaviour has been attributed to the high plasticity and swelling of clay minerals (hydraulic) and increase in mean stress (mechanical) after the closure of facilities. Studies focusing on sealing of fractures have generally quantified these characteristics in terms of decrease in hydraulic conductivity and increase in fracture volume when it interacts with water. (De La Vaissière et al., 2014, Auvray et al., 2015). However, limited quantitative information is available on mechanical properties of self-healed fractures in preferred host rocks. Therefore, this work focuses on evaluating the recovery of strength along a discontinuity in reconstituted Boom Clay samples under different normal stresses. Normal stress is a crucial parameter affecting shear strength within continuums and the effective contact area between two surfaces of a discontinuity. This work investigates the amount of self-healing in reconstituted Boom Clay under variable normal stresses and testing conditions (direct shear and rotary shear conditions). Further, it aims at supporting the development of models for the post-closure strength recovery of host rock for radioactive waste repositories.

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