ANCHORS -HYDRAULIC MECHANICAL CHEMICAL EVOLUTION OF BENTONITE FOR BARRIERS OPTIMISATION

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The knowledge of long-term Thermo Hydro Mechanical Chemical (THMC) behaviour of bentonite-based components contributes, as a main factor, to the safety improvement, design, and optimisation of Engineered Barrier Systems (EBS) for all Deep Geological Repository (DGR) concepts. Whereas several bentonites are well studied and their sealing and retention properties have been investigated, a rising number of alternative bentonites and bentonite-based mixtures are under consideration across Europe that are not well investigated yet. Potential disruptions to the global bentonite supply chain (e.g., geopolitical issues, costs etc.) could severely restrict the supply of the well-studied bentonite. To mitigate this problem, a wide range of alternative bentonites and bentonite-based materials that can be used to seal a DGR without compromising its safety need to be characterised. In response to these challenges, the ANCHORS Work Package (WP), part of the European partnership on Radioactive Waste Management (EURAD2), has been specifically designed to address these issues. ANCHORS' main objective is to increase the optimisation potential of bentonite barrier systems and the robustness of the safety case 1) by qualifying the Hydro Mechanical (HM) behaviour of various kind of bentonite types and mixtures through laboratory experimental program focused on heterogeneity, chemical effects and friction at different scales and 2) by improving the numerical tools that are necessary to carry out performance assessment of bentonite barriers in a THMC repository environment. Additionally, this work package involves the establishment of a comprehensive database containing THMC material properties and representative numerical results for various kinds of bentonites and mixtures. These efforts ultimately contribute to the optimisation of DGR designs. To achieve those objectives, the WP is divided into four tasks. The laboratory testing task focuses on multiscale experimental characterization of various bentonite types and mixtures, emphasizing chemical loadings, heterogeneity, friction, and mixture optimization. It also includes analyzing aged bentonites from in situ tests. The modeling task focuses on improving constitutive models and numerical tools for bentonite barrier performance assessment, with particular attention to heterogeneity, temperature and chemical effects. Additionally, it aims to provide insights which can be used for confidence building in safety case applications by examining parameter sensitivity, long-term evolution and uncertainty propagation in large-scale bentonite barriers. The first two tasks focus on WP coordination and Knowledge Management (KM) specifically aiming to capture knowledge relevant to the WP's Strategy Research Agenda topic and support its transfer to the EURAD-2 community and beyond through the KM program.

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