



Corrosion evaluation for engineered barriers in crystalline host rock – challenges for container development in the German site selection process

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Abstract. Crystalline rock is being considered as a potential host rock for a deep geological disposal facility for high-level radioactive waste in the ongoing site selection process in Germany. As crystalline rock is commonly highly fractured, the designation of a containment-providing rock zone is potentially not possible. In this case, according to German law (§ 23 (1) and (4) StandAG), the safe containment of the nuclear waste for 1 million years must be guaranteed by engineered and geo-engineered barriers. Therefore, it is of great importance to evaluate and understand processes that might lead to corrosion of the canister from the outside or from the inside. The long-term integrity of the waste canister depends on various parameters such as the material, microstructure, and coating of the canister; the properties of the geo-engineered barriers; the local pore water composition; the radiolysis on the inside of the container; and the tectonic strain.

In a recent project (Long-Term Integrity of Canisters in Crystalline Host Rock – LaKris), the challenges of determining the durability of waste canisters in crystalline host rock have been addressed by comparing and evaluating different international concepts for canister design and discussing their applicability to the requirements in Germany. Further focus lies on the evaluation of predominant corrosion mechanisms while also considering the geochemical environment of the crystalline host rock in Germany that the canisters might be subjected to.

This contribution will highlight the activities within the project with regard to evaluating the corrosion properties of different potential canister materials such as copper, cast iron, and stainless steel. The aim is to deepen the understanding of individual processes and their combined effects as well as their classification into favourable or unfavourable processes and conditions for the derivation or justification of requirements. It also includes a review of the existing requirements on canister integrity according to the regulatory framework as well as a discussion about important hydrogeochemical parameters, which could influence the corrosion of the canister, including the limited availability and uncertainty of such data.