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Corrosion of Cast Iron for High-Level Nuclear Waste Containers in the Presence of Bentonite or the SRB *Desulfosporosinus burensis*

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Cast iron containers are currently used for the temporary storage of nuclear waste. At the current stage of research, it is not clear whether cast iron, together with coating materials, also is an option for long-time storage. In this study, we want to investigate its potential as a container material for the disposal of high-level nuclear waste in deep geological repositories (DGR) in claystone bedrock. The dynamic corrosion process depends on the conditions present in the DGR which are influenced and/or controlled by geochemical parameters (e.g., redox potential, pH, the ionic composition of the pore-water), physical parameters (e.g., pressure), and the influence of metabolically active microorganisms. Corrosion of cast iron will occur at the interface of the container surface and the bentonite backfill material, which contains natural microbial populations. In the investigated worst-case scenario, water would reach the container and introduce microorganisms inherent in the bedrock, such as sulfate-reducing bacteria (SRB).

The conditions in a DGR were simulated in microcosm experiments to investigate the impact of microbiologically influenced corrosion (MIC) on cast iron. The anaerobic microcosms contained artificial Opalinus Clay pore water, N_2, cast iron coupons, as well as a Wyoming bentonite or the SRB *Desulfosporosinus burensis* (DSM 24089) (isolated at the Andra Underground Research Laboratory in Buré, France).

After incubation at 25°C for 50 days, the microcosms were analysed for bio- and geochemical parameters, i.e., pH, Fe(II):Fe(III), changes in their microbial populations, as well as SEM-EDX and Raman spectroscopy to identify secondary iron phases and corrosion products. The coupons showed surface corrosion and various mineral phases on their surfaces. Additionally, the coupons from the *D. burensis* microcosms showed an increased concentration of carbon on their surface, i.e., an indication of a biofilm.

Furthermore, the interaction of technetium-99 with the corroded coupons was investigated to assess the immobilisation of Tc by exposed and corroded cast iron.