LONG-TERM MONITORING OF GALVANIC CURRENTS OF COPPER-STEEL COUPLING IN AN ANOXIC ENVIRONMENT

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The internationally accepted solution for the long-term storage of highly radioactive waste and spent nuclear fuel is a deep geological repository (DGR). The main component is a closed metal container surrounded by an additional barrier, such as a bentonite or cement mixture. In many countries (Sweden, Finland, Canada, Japan, etc.), the inner steel container has an additional external barrier made of copper. Copper is considered an absolute barrier to preventing radionuclide release in the environment, so copper has been studied in various conditions in oxic and anoxic environments. If a copper coating contains undetected defects, the steel container underneath may be exposed to the environment, and galvanic corrosion between copper and steel may occur. The present work focuses on long-term monitoring of copper and steel corrosion currents when steel is galvanically coupled to copper in an anoxic environment. The corrosion currents of 25 electrodes (24 copper and one steel electrode to mimic damage on the container) were monitored using a coupled-multi electrode array (CMEA) for 155 days. Coupled multi-electrode array is a method that allows continuous monitoring of currents in space and time. CMEA samples were exposed to bentonite, saturated with a solution consisting of chloride and sulphide and to solution only in the anoxic environment. After exposure of the CMEA samples to an anoxic environment, various microscopic and spectroscopic investigations of surfaces were employed to investigate corrosion products. A steel electrode galvanically coupled to copper on a CMEA sample exposed to a bentonite mixture has a lower corrosion rate than a CMEA sample exposed only to the solution in an anoxic environment.

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