# Long-Term Corrosion Behavior of Canister Materials in KURT Environment


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## 1. Introduction

Main purpose of these corrosion tests was to know the corrosion rate of the candidate materials for an engineered barrier system in underground environment. The long term corrosion test cells have been launched since Oct. 2010 at KURT site in KAERI. The corrosion cell was designed simulating the EBS suggested in A-KRS as depicted in Fig. 1 [1].

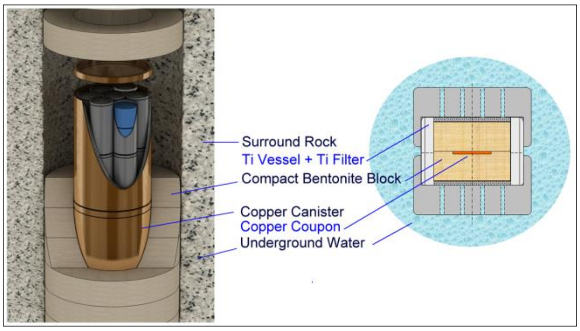


Fig. 1. Schematic diagram of corrosion cell.

In this study, cold spray coating copper, compressed copper, STS 304, cast nodular iron, and Ti(Gr.2) have been kept in KURT environment. Recently lots of 3 and 6 year old test cells were dismantled and analyzed, and the test results were disclosed in this article.

## 2. Experiment

### *2.1 Environmental corrosion test*

A test specimen (D 15.0 × t 1.0 mm) was surrounded by two compact bentonite blocks (D 30.0 mm × t 10.0 mm) similar to the actual disposal system, and then the blocks were stored in a small titanium vessel. The titanium vessel was composed of a hollow body, two titanium filters (D30.0 mm × t 1.5 mm) of 10 ㎛ pore size and two caps blocking the both ends of the body by screwing them.

In the KURT field test, the lots of corrosion cells were kept in several environmental chambers sustained at 70 °C in KURT. Fresh underground water was flowing through the chamber continuously at 10~20 cc/min.

After the test, corrosion rate was determined by weight loss measurement. And the corrosion product was analyzed by XRD and SEM-EDX. The used bentonite was also analyzed by XRD and ICP-OES.

## 3. Result

### *3.1 Dismantling of corrosion cells*

The corrosion cells of 3.2 and 6.5 year old were dismantled as in Fig. 2. The corrosion products in compressed copper, coating copper, and cast nodular iron were combined with bentonite strongly. But STS304 and Ti showed clear surface without any kind of corrosion product.

Fig. 2. The 3.2 year old test specimens with compact bentonite right after dismantling.

### 3.2 Analysis

There were white precipitations on copper specimens and cast iron, which were analyzed by XRD. The white precipitation on copper specimen was presumed to be anorthite (Ca type feldspar), which can be formed by the reaction of dissolved feldspar with $Ca^{2+}$ [2]. And the white on cast iron was presumed to be Aragonite, which was known to be formed by the reaction of carbonate ($CaCO_3$) with $Ca^{2+}$.

But the Albite was also detected by XRD in 6.5 year old Copper specimen.

### 3.3 Corrosion depth

The corrosion product on copper specimen was removed with weak HCl solution, but the removal process was not smooth since some black CuO spots on the surface were hard to remove with weak HCl, which caused severe dissolusion of pure copper and produced a thicker corrosion depth. Ti and STS304 did not showed any increase in corrosion depth though they experienced 6.5 year corrosion test. The cast iron showed continuous increase of corrosion depth with test time

## 4. Conclusion

There were considerable increases of corrosion depth in cast iron and copper specimens. And the compact bentonite exhibited some change in its mineral composition after 3.2 and 6.5 years.

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