Sea Salt Deposition on the Canister Surface of Concrete Cask

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1. Background

Concrete cask storage has been implemented in the world. At a later stage of storage period, the containment of the canister may deteriorate due to stress corrosion cracking (SCC) phenomena in a salty air environment. In Japan, the dry storage of spent nuclear fuels using concrete cask has not been implemented. Interim Storage Facility in Japan is likely installed at coastal sites. It is necessary to evaluate the SCC of the canister.

The SCC occurs when certain conditions of stress, material and environment are satisfied. A design criterion for mitigation of the SCC is necessary to utilize the concrete cask system. The SCC is mitigated if one of the conditions is removed. In this study, the environmental condition is focused on. The sea salt particles come from the sea with wind. The cooling air including the sea salt particles goes into the concrete cask and goes along the canister surface. Some parts of the sea salt particles in the air deposit on the canister surface. In the state of the art, the data of sea salt deposition were obtained but the test condition is different compared from the canister. The characteristics of the deposition on the canister surface are as follows;

(1) The temperature of the canister surface is hot.

(2) The surface of the deposition is vertical.

(3) The cooling air including the sea salt particles goes upward in parallel with the canister surface.

(4) The concrete cask is placed in a building and the canister surface is not exposed to wind and rain.

(5) Because the radiation dose is very high near the canister surface and the gap between the canister surface and the concrete container is very narrow, it is difficult to measure the amount of the deposition and check the surface condition.

The data of the sea salt deposition was obtained using the test equipments in the laboratory and the field condition taking account of the canister surface condition.

2. Test Equipment for the measurement of the sea salt deposition

To measure the sea salt deposition on the metal surface, two kinds of test were performed. One is the laboratory test and another is the field test.

In the laboratory test, a wind tunnel was used. In the wind tunnel, there is a nozzle which produces the artificial salt particles. The diameter of the artificial salt particle is same as the natural one near the seashore. Particle number density in the air of the test is much higher than the natural condition. The position of the wind tunnel is vertical and the air including the artificial salt particles goes upward. The metal test pieces are put on the inner surface of the wind tunnel. The temperature of the test pieces can be controlled by the

heater. The amount of the salt deposition on the test pieces was measured changing the test duration.

In the field test, five vertical wind tunnels were used. The wind tunnels were placed in the test house located in the 4km distance from the seashore. The air includes the natural sea salt particles and goes into the wind tunnels. The metal test pieces are put on the inner surface of the wind tunnel. The temperature of the test pieces can be controlled by the heater. The amount of the salt deposition on the test pieces was measured changing the test duration.

3. Test Results

The data relation between the amount of the deposition on the metal surface and the test duration was obtained. Figure 3 shows the data obtained in the laboratory and field tests.

4. Acknowledgement

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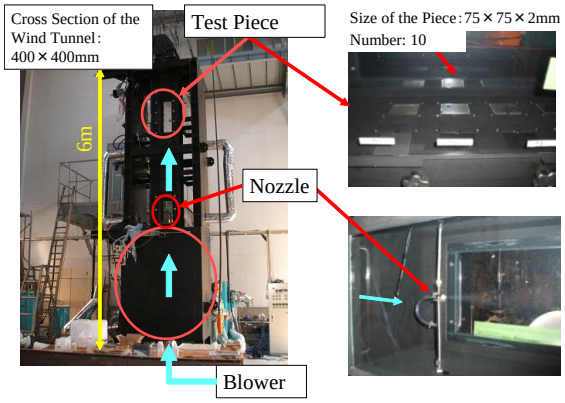

Fig.1 Test Equipment for the Laboratory Test

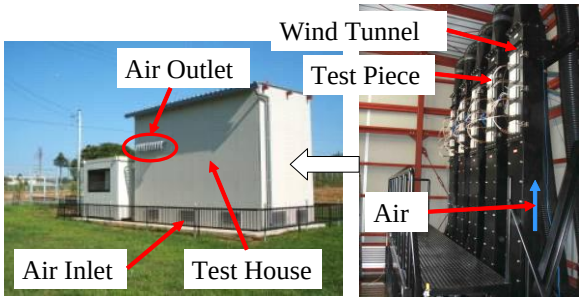

Fig.2 Test Equipment for the Field Test

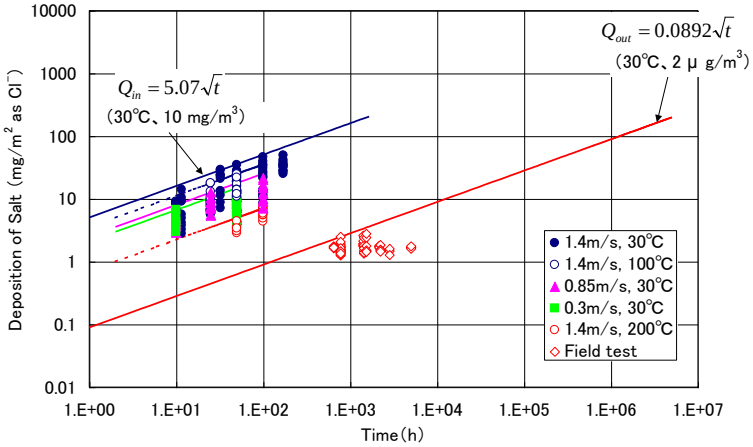

Fig.3 Test Results of the amount of the salt deposition on the metal surface in the laboratory and field tests