Contribution ID: **65** Type: **ORAL**

CRIEPI's studies on the SCC of the canister for spent nuclear fuel

To put the concrete cask in practical use in Japan, stress corrosion cracking (SCC) of canister must be coped with. It is required to take measures for one or two of the three factors, i.e. welding residual stress, material, and environment, to cope with the SCC that may result in loss of the containment function of the canister. Prevention of loss of containment due to SCC of a canister was evaluated either by a method of comparing the amount of salt on the canister surface during storage with the minimum amount of salt to initiate rust and SCC or by a method of comparing the wetting time of the canister surface under salty-air field environment with the lifetime of the SCC fracture of the canister material. We examine an application of the zirconia shot peening as the residual stress improvement processing that is considered for prevention of SCC occurrence of the canister weld effectively. For the inspection of the canister integrity during storage, there are several candidate methods. We develop a technique to measure chlorine deposited on the surface of canisters by laser-induced breakdown spectroscopy. Furthermore, we propose the monitoring system using the temperature deference between the top and the bottom of the canister as a helium leak sensor for the canister in storage. In order to analytically evaluate the change of the temperature deference between the top and the bottom of the canister during the leakage of helium gas from the canister, the unsteady state thermal hydraulics model which takes the change of density of helium gas into consideration has been developed.

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