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Development of new evaluation technique of long term geomechanical interaction between bedrock and buffer in near-field

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The objective of this paper is to evaluate a long term behavior which is a coupled thermo-hydro-mechanical processes in the near-field of a geological repository for high-level radioactive waste (HLW) disposal by the **centrifugal model test**. To clarify the **long term behavior in the near-field**, the researches by the full-scale test and the numerical analysis have been carried out. The numerical study is able to evaluate the long-term behavior in near-field. For a verification of applicability of numerical model, however, it is difficult to conduct a long-term full-scale test due to a place, time, and economic restraint. If the experiment of the small model of near-field based on the centrifugal scaling law that can supplement these problems becomes possible, a long term reliability of the disposal repository can be improved by acquiring the empirical laboratory data.

The model specimen consists of a cylindrical rock mass (Tage tuff) of 180 mm in a diameter and length, bentonite buffer (Kunigel-V1) and model overpack (SUS). The borehole (disposal pit) of 57 mm in a diameter and 127 mm in a height was drilled at the center of the rock mass. These are the size of 1/30 proposed in the report of *CRIEPI & FEPC (1999)*. The model specimen in the study was enclosed with the pressure vessel, and centrifugal model tests were conducted at 30 G of centrifugal force field in isotropic stress-state conditions with confining pressures of 2 to 10 MPa and injecting water from the bottom of model specimen. The centrifugal tests were conducted up to two months (165 equivalent years in conversion time of full-scale).

As results, a slight settlement due to self-weight in the displacement of the model overpack was measured after injecting water. After that, the model overpack heaved rapidly and a maximal was measured, and then, the overpack tended to a gradual settlement. The value of heave was several times as large as the settlement. The soil pressure of buffer did not occur until the buffer absorbed water and began to swell, and increased rapidly swelling begins. Then, it tended to a gradual decrease after a maximal was measured. In terms of the maximal of displacement of overpack and soil pressure of buffer, these value were obviously different depending on the confining pressure (**confining pressure dependency**). In addition, these measured values after the maximal in this study were not converged even after up to two months in test-time (**time dependency**). These behaviors are distinctly different from the results of previous centrifugal model test *(Nakamura & Tanaka, 2009)* in a strain-state condition using a stainless steel test vessel which the values have converged in about 50 to 70 equivalent years. Thus, we first revealed experimentally that **a long term behavior in the near-field was changed by geomechanical interaction between the deformation of bedrock (disposal hole) and swelling behavior of buffer depending on earth pressure**, and **did not converge even in the long term experiments by the interaction**.

Keywords: High-level radioactive waste disposal repository, Near-field, Centrifugal model test, Long term behavior, Geomechanical interaction