Performance Evaluation of Novel Emplacement Device

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1. Introduction

DBD (Deep borehole disposal) of high level radioactive waste at the depth of 3~5 km is under discussion nowadays [1]. The one of key devices in DBD operations is the joint device between a disposal canister and emplacement rig. J-slot joint is well known device for this purpose [2], and has been used in oil & gas industry. But J-slot joint can be connected only to drill pipe, and the recombining is impossible after disconnecting.

In this study, a new joint concept was suggested to overcome the problems of the existing joint device for DBD process. New joint device can be applied to various emplacement rigs such as drill pipe, wireline, coiled tubing, and etc. And it also makes the emplacement rig to be connected or disconnected to the disposal canister only by the mechanical operations.

For demonstration of the new joint concept, a joint device, a twin canister string, and a test water tube were manufactured through the detailed designs of them in 1/3 scale. And the deployment mud was prepared in two forms of Ca-type and Na-type bentonite.

2. Design

The novel joint device was designed to seize the wedge on top of a canister string, and move down through a borehole. When it arrives at the bottom of a borehole, the joint releases the wedge by compressive action. The novel device can recombine with the canister string by placing it onto the settled canister string. This recombination can be achieved by the movable sliding hook box in the joint device. If the joint device lifting is faster than the falling speed of the hook box, disconnection occurs. And if it is slower, the wedge on the canister string is seized by the hooks again. The joint device can be equipped to various emplacement jigs.

3. Manufacturing

The novel joint device(Φ110 mm, H148 mm), the twin canister string (Φ140 mm, H1,105 mm), and the water tube (Φ150 mm, H1,500 mm) as a substitute for the borehole were manufactured in 1/3 scale through the detailed designs. And the deployment muds were prepared to fill in the water tube with Na-type bentonite (MX-80) and Ca-type bentonite (GJ-II) respectively.

4. Experiment

The joint device was equipped in a crane hoist, and a twin canister string was dipped in the water tube filled with deployment mud. The connecting, lifting, going down, and releasing tests were performed. The novel joint device exhibited good operations in Na and Ca-type muds with a moving speed of 10 m/min of a crane hoist.

5. Conclusion

The novel joint device was designed for the emplacement & retrieval of a disposal canister in DBD process. And the novel device showed good performance in the simulation test. Therefore, it was concluded that the novel joint device can be used for the emplacement & retrieval of a disposal canister in DBD process.

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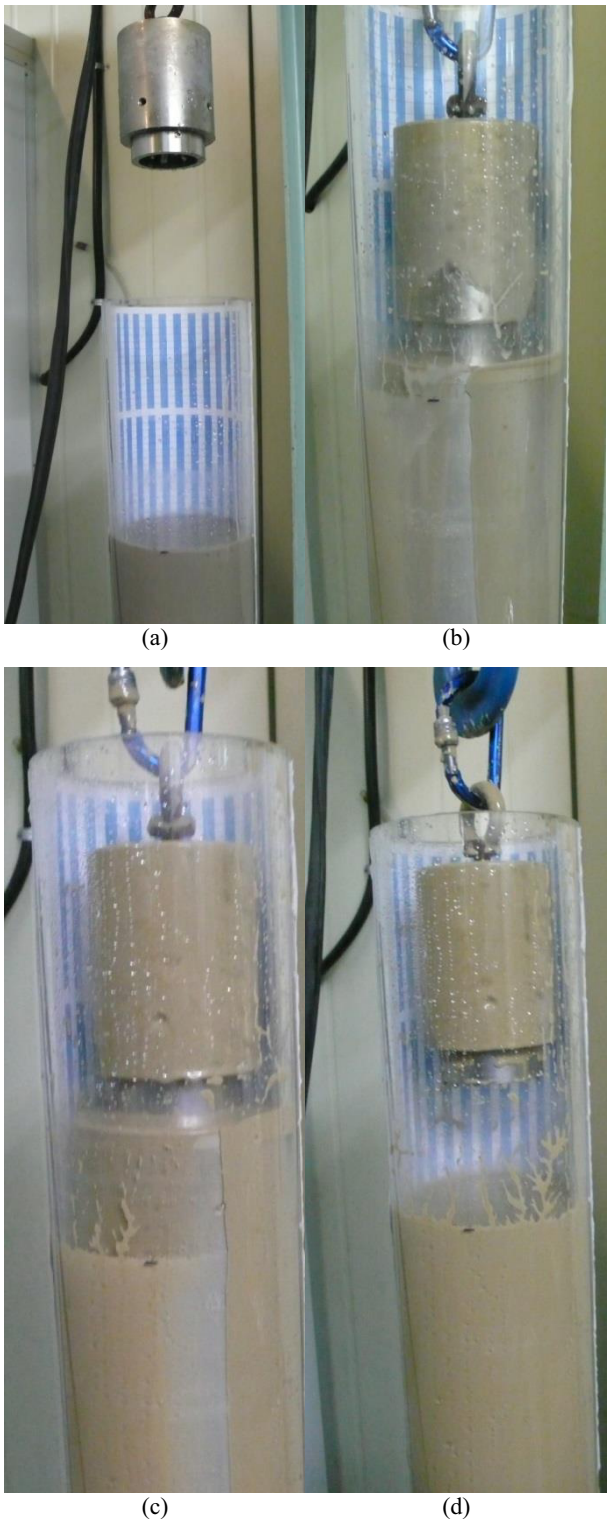

(a) (b)

(c) (d)

Fig. 1. Performance testing of the novel emplacement joint in Na & Ca bentonite mud; (a) setting for the test, (b) lifting a canister in Na bentonite mud, (c) lifting a canister in Ca bentonite mud, and (d) releasing a canister in Ca bentonite mud.