Maintenance of Remote Handling Equipment in ACPF

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1. Introduction

The Korea Atomic Energy Research Institute (KAERI) has decided to demonstrate the electrolytic reduction process of the pyroprocess in the advanced spent fuel conditioning process facility (ACPF), a hot cell facility that has been constructed in the past. The hotcell is being improved for the composition. The existing cell was an air atmosphere hot cell, but an argon compartment was installed to improve some hot cells to argon atmosphere. In an argon atmosphere cell, an electrolytic reduction process device and a remote handling device are installed to perform process operation and maintenance.

Process equipment and cell equipment installed in the argon atmosphere cell should be operated and maintained remotely and remotely operated equipment handling it should be remotely maintained. In this study, we propose the maintenance method of the remote handling equipment remotely from the hot cell to verify the maintenance work so that the remote maintenance can be performed.

2. Maintenance of MSM

2.1 Configuration of ACPF

The existing ACPF facility is an air atmosphere hot cell. The hot cell has two cells, a process cell (M8a) and a maintenance cell (M8b), as shown in Figure 1. The ACPF facility requires an argon atmosphere cell to perform the electrolytic reduction process. Therefore, part of the process cell was modified as shown in Fig. 2, and a part of the cell was constructed with a cell of argon atmosphere. The argon compartment should be able to operate the process unit in an argon atmosphere and should not leak out. Due to the leakage of argon outside and the retrograde of existing remote handling devices (master-Slave Manipulator), existing these devices have been replaced by new ones.

All devices are operated remotely using crane and MSM. As the cell device, there are installed a temperature sensor for measuring the temperature in the cell, a light for illuminating the cell, a camera for observing the operation in the cell, and a material transferring device for transferring the material between cells. A designed crane to ensure maximum operating area in the confined space of the compartment was installed. In addition, a crane operated from the maintenance cell to the process cell was installed.

Fig. 1. Structure of ACPF.

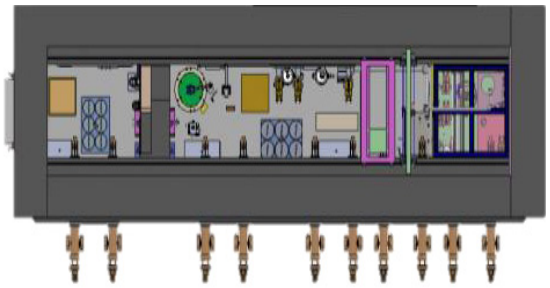

Fig. 2. Improved ACPF.

2.2 Mechanical Master-Slave Manipulator

The mechanical master-slave manipulator installed in the ACPF was a walischmiller A110 model. The MSM has a working area that can reach the rear wall of the hot cell. The MSM consists of three parts: a slave arm, a through tube, and a master arm. The MSM unit has a function of sealing the inside of the hot cell and the outside of the hot cell through a through tube installed on the wall of the hot cell, Argon gas does not leak out.

The MSM installed in the hot cell can be divided

into three parts. If a MSM has malfunctions while operating the hot cell, the corresponding arm can be removed from the hot cell wall and assembled to perform maintenance.

2.3 Maintenance of MSM

The MSM can be repaired by isolating the failed part. Since the master arm is installed outside the cell, it can be easily attached and detached. The master arm can repair the fault.

For maintenance of the slave arm, it must be taken out of the cell. To repair a failed device in a hot cell, there must be room for the decontamination of the device and for the operator to repair the device. At present, there is no room for maintenance in the ACPF. For the repair of the slave arm it was used as a way to replace it with a new slave arm. Corrosion can occur as the salt is used in the process. All materials are carried in and out through the material transport system between cells. The slave arm can't enter the argon cell using the transfer system. In the argon compartment, the spare slave arm is mounted on the wall of the hot cell so that the slave arm can be maintained without carrying it out. Two spare slave arms are installed in the argon compartment. In the process cell, three spare slave arms are installed on the wall.

Replacement of the slave arm uses a remote handling equipment crane. Separation of the through tube and the slave arm is carried out in the operating area. Maintenance work requires securing the operator's view because the slave arm is separated, fastened and transported on the hot cell window. The maintenance work was performed by using a camera to secure the operator's view. It is also important to ensure visibility using a mirror in case a camera malfunctions. In this paper, the procedure for the failure of the left and right slave arms of the work window is established and verified according to the installed position.

3. Conclusion

The maintainability of the MSM, a remote handling device installed in the hot cell, was examined and verified. In order to operate and maintain the process equipment installed in the hot cell, the remote handling device must be able to maintain its integrity. Therefore, a maintenance procedure simulating the faults of MSM was established and maintenance was performed according to the scenario. By performing remote maintenance work on the argon compartment and the MSM in the cell, we have successfully achieved the objective.

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