DEMONSTRATION OF THE ADVANCED SPENT FUEL CONDITIONING PROCESS IN A HOT CELL

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Abstract

The Advanced spent fuel Conditioning Process(ACP) was proposed and developed for an effective management of the PWR spent fuel in Korea. The decay heat, radioactivity and volume of the spent fuel can be reduced to about a quarter by the ACP technology, which became the motivation for this R. & D. project. The ACP is a pyroprocess that reduce a metal oxide form of spent fuel to a form of metal, and it consists of several unit processes such as a disassembling & cutting, slitting & voloxidation, metallization, smelting, salt treatment. For a laboratory scale demonstration of the ACP, an alpha-gamma type hot cell facility(ACPF) has been constructed by remodeling a beta-gamma type hot cell which was installed for future usage on the basement of the Irradiated Materials Experiment Facility(IMEF) at the KAERI site. The hot cell line at the ACPF includes two hot cells(the process cell and the maintenance cell) with a total of five working station. The inside dimensions of these hot cells are as follows:
- The process cell : Width 8.1 m, depth 2 m, height 4.3 m
- The maintenance cell : Width 2.2 m, depth 2 m, height 4.3 m.
- The shielding walls were made of 90 cm – thick heavy concrete lined with stainless steel, rated 37500–Ci γ–emitter. Plug-in doors at the back allow for access to each cell. Manipulation of the ACP equipments is provided by five pairs of master slave manipulators and an electronically controlled servo-manipulator of a KAERI design. An isolation room is located at the rear of the process cell, separate from the gamma shielding, and a continuity of the alpha sealing inside the cells is provided inside the cells by a steel lining. The spent fuel rodcuts for a demonstration of the ACP are prepared in the Post Irradiation Examination Facility(PIEF), while the ACP processing from a rodcut slitting to a metal ingot casting are carried out in the ACPF as shown in the following process flow chart(Fig.1).

![Fig. 1. A process block diagram of the ACP process.](image-url)

The construction of the ACPF was completed at end of Oct. 2005, and an inactive test with natural uranium was implemented. This paper introduces the ACPF, and it presents the results of the inactive test of the ACP in a hot cell.