TECHNOLOGY AND IMPLEMENTATION OF THE DUPIC CONCEPT FOR SPENT NUCLEAR FUEL IN THE ROK

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ABSTRACT

In order to maintain continuous g rowth of the nuclear power industry in Korea, several issues such as spent nuclear fuel management, safety of nuclear reactor and non-proliferation concerns, etc. should be kept in mind. Taking advantage of the Korean nuclear reactor strategy of having both light water reactors(PWR) and heavy water reactors(CANDU) for electricity generation, DUPIC(Direct Use of spent PWR fuel in CANDU reactors) nuclear fuel cycle concept has been suggested as one of the solutions of PWR spent fuel management, while improving the utilization of uranium resources in a proliferation-resistant way.

The DUPIC fuels for CANDU reactors can be refabricated by only mechanical and thermal processes without any separation of sensitive nuclear materials, even fission products, because the remnant fissile contents in the PWR spent fuel is high enough to be reused in CANDU reactors.

Major challenges for the DUPIC fuel fabrication are the development of the manufacturing technology to produce pellets with high density, the development of remote fabrication equipment to be used in highly shielded hot cells and the handling of radioactive materials during processing. The powder treatment process, called OREOX, of PWR spent fuel material has been developed to manufacture the DUPIC pellets in accordance with current CANDU fuel specifications. Based on the pelletizing technology developed using simulated spent fuel and the developed fabrication equipment, the experimental fabrication of DUPIC fuels has been performed at KAERI from January 2000.

A series of irradiation tests using the HANARO research reactor at KAERI are planned to be carried out to verify the performance of DUPIC fuels. In addition, theoretical analysis of DUPIC fuel behaviors in the commercial CANDU reactors is under way to check the compatibility of DUPIC fuels in terms of reactor physics, safety and handling.