

Conceptual Design of Pyroprocess Mock-up Facility

Gil-Sung You, Won-Myung Choung, Jeong-Hoe Ku, il-Je Cho, Dong-Hak Kook,
Kie-Chan Kwon, Eun-Pyo Lee, Won-Kyung Lee, Dong-Hee Hong

*Korea Atomic Energy Research Institute: 1045 Daedeok-daero, Yuseong-gu, Daejeon, 305-353, Korea,
yougil@kaeri.re.kr*

1. Introduction

KAERI has been developing a pyroprocess for a LWR spent fuel conditioning and a future reutilization in the Generation IV reactors. From 2001 to 2005, the ACP facility for an electrolytic reduction of a LWR spent fuel had been developed as shown in the figure 1 and 2. The ACP facility has been using for demonstration of the Advanced spent fuel Conditioning Process (ACP) from 2006. The ACP facility has two air-sealed type hot cells, one is for main processes and the other is for the maintenance of process equipment. The ACPF hot cells were designed to have an air environment. From 2007, a mock-up facility for an engineering scale demonstration to cover a full pyroprocess has been developing. The conceptual design works of this mock-up facility had been performed by the end of 2007. Basic and detailed design works will be taken in 2008 and a construction license proposal will be submitted to the government in the same year. By the end of 2009, the construction works of the mock-up facility will have been finished. After 2 year operation (2010 and 2011) of the engineering scale mock-up facility, the development of the Engineering Scale Pyroprocess Facility (ESPF), having a capacity of 10 ton HM/year, starts in 2012 and the

construction works will have been finished until the end of 2016. If the ESPF demonstrates a full pyroprocess by using LWR spent fuels successfully, the Korea Advanced Pyroprocess Facility (KAPF) could be developed and demonstrated to verify the final commercialization of a pyroprocess treatment of LWR spent fuels. The KAPF could have a treatment capacity with 100 ton HM/year. In parallel with a series of developments of pyroprocess facilities, safety analysis works will be also performed to confirm the integrated safeties of these several pyroprocess facilities.



Fig. 1. The working area view of the ACPF



Fig. 2. Inside View of the ACPF Process Cell

2. Conceptual Design of the Pyroprocess Mock-up Facility

For the development of engineering scale facility covering a full pyroprocess, KAERI needs a facility which can be tested with non-irradiated fuels. In order to fulfill this necessity, a mock-up facility has been developed. Table 1 shows the specifications of the pyro mock-up facility. This conceptual designed mock-up facility as shown in the figure 3 will have two sealed cells, one is for pre-treatment processes such as a decladding, voloxidation and a salt waste treatment process and the other is for the main processes such as an electrolytic reduction, electro-refining, electro-winning and cathode processing, etc. The pre-treatment and main processes cells will be maintained with air and argon environments, respectively. For maintaining a pure argon environment in the main processes cell, an argon purification and humidity control system will be equipped.

Table 1. Specifications of the PMF

Capacity	10 tHM/y
Plant type	Mock-up facility with an argon inert atmosphere cell and an air cell
Availability	70 % (in consideration of O&M outage) = 256 equivalent full operating calendar days
Design life	30 years
Input	PWR simulated spent fuels
Output	U metal as LLW, U-TRU-RE metal simulated ingot for SFR fuel
	Wastes (ceramic, metal, vitrified)
Main function	Temporary material storages (PWR simulated SF, simulated metal ingot, wastes)
	PWR simulated SF disassembling, Simulated rod chopping
	Decladding/voloxidation, Electrolytic reduction, Electro-refining /Electro-winning, Cd distillation, Cathode processing
	U and simulated TRU metal ingot fabrication
	Salt waste recycling, Wastes treatment

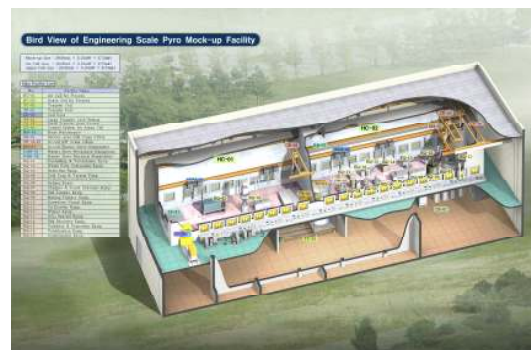


Fig. 3. Conceptual Design View of the Pyro Mock-up Facility