Examination on PIE Working Conditions in IMEF for Irradiated Capsule (07M-21K) at HANARO OR Irradiation Hole

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1. Introduction

Total of seventeen irradiated non-instrumented and instrumented capsules, which are normally irradiated at HANARO CT/IR irradiation holes, have been transported and examined for PIE activities at hot cell in IMEF since 1998[1,2,3].

The 07M-21K capsule is the first instrumented material capsule, irradiated at a HANARO OR irradiation hole with a 3.5E19 n/㎠ neutron fluence during twenty days. It has three different conditions, which are about a 4 mm smaller outer diameter than before 60 mm, a little higher irradiation temperature, and a little longer irradiation duration.

In this paper, the working conditions as well as the possibility of Instrumented Material Capsule (07M-21K) at hot cells in IMEF were studied and discussed for not only transportation but also a cutting and dismantling of the irradiated instrumented material capsule irradiated at the HANARO OR irradiation hole.

2. Experimental

2.1 Transportation

In general, an instrumented capsule is transported from the HANARO pool site to IMEF cask receiving area by using a 10 ton shipping cask and a truck. The shipping cask is unloaded from a truck and loaded at the transferring cart by a 30 ton fixed hoist. As the loaded shipping cask is moved to the service area, the upper shock absorber is removed and the bolts are unbolted. By handling it with an overhead crane, it is loaded into a water pool and positioned vertically at the bottom of the pool. Using a bucket elevator, the capsule is transported into the M1 hot cell and placed on the working table of hot cell with a cell crane and a pair of master-slave manipulators.

The dimension of the 07M-21K is only different in outer diameter, so it will be possible to transport it from HANARO to IMEF by the same shipping cask without meeting a serious problem. In the case of transferring it from the pool to the M1 hot cell, it is also possible to use the same bucket elevator. But it is recommended to deliver the capsule on the same day in order to avoid the possibility for producing a kind of debris, which is considered a chemical reaction with a specimen holder and a specimen together, finally much time and man power are expected to be invested.

2.2 Cutting and Dismantling

The previous capsule was transferred for a cutting and dismantling from the M1 hot cell to the M2 hot cell. The previous shape of the capsule was cylindrical with a 60 mm outer diameter, 3 mm thickness and approximately 1,000 mm in length as shown in Tab. 1[4]. The material for the outer capsule is STS316 and it consists of five(5) specimen holders with many kinds of specimens, five(5) insulating materials, five(5) neutron fluence monitors etc., and each specimen holder is combined with heater lines and thermo-couples. The top and the bottom parts of the capsule were cut by a capsule cutting machine as shown in Fig 1, specially designed for cutting the HANARO fuel assembly and a capsule irradiated at HANARO. The revolution of the wheel and the moving speed was 200 rpm and 0.15 mm/min respectively. It took about one(1) hour to completely cut the top and bottom parts of the capsule also as summarized in Tab 1.

The capsule cutting machine has a flexible mounting chuck range from 40 ~ 100 mm in diameter, so it is available to adapt to a new capsule which is manufactured with a 56 mm in outer diameter. It is assumed that some different operational conditions will be found faster than the previous conditions shown as in Tab 1 concerning the revolution of the chuck and wheel as well as the feeding speed of the wheel assembly.

Table 1. Operational conditions of capsule cutting machine with previous capsule

Items	Values	Remarks
Material of outer	STS316	
Diameter(mm)	60	
Length(mm)	≈ 1,000	
Chuck(rpm)	2.5 ~ 3.0	
Wheel(rpm)	200	
Feed speed(mm/min)	0.15	
Working time(hr)	1.0	

In order to dismantle the specimens from the specimen holder, the specimen press machine as shown in Fig 2 is used. The dimension of the irradiated specimens is the same as before and it is designed to handle a load up to 100 kg by an electrical motor, therefore, it is also possible to use this machine again

for the 02M-21K capsule without worries about a serious problem.

Figure 1. Capsule cutting machine installed in M2 Hot cell.

Figure 2. Specimen disassembling from specimen holder by specimen press machine installed in M5a hot cell.

But it is also strongly recommended to cut the bottom of the capsule on the same day as quickly as possible in order to drain the water, which could have occurred during a transportation both to the HANARO storage pool and the IMEF pool, from the inside of outer pipe, therefore, it could avoid the possibility of producing a kind of debris, which will require much time and man power for dismantling a specimen from the specimen holder.

3. Summary

The working conditions as well as the possibility of an Instrumented Material Capsule (07M-21K) at a hot cell in the IMEF, which is irradiated a at HANARO OR irradiation hole were studied and discussed not only for a transportation but also a cutting and dismantling as follows.

1) The dimension of 07M-21K is reduced from 60 mm to 56 mm in outer diameter, but it will be possible to transport it from HANARO to the hot cell of the IMEF by a shipping cask and a bucket elevator which were all used before without meeting a serious problem.

2) The capsule cutting machine has a flexible mounting chuck range from 40 ~ 100 mm in diameter, therefore, it is assumed that some faster operational conditions could be found than the previous ones shown in Tab 1 concerning the revolution of the chuck and wheel as well as the feeding speed of the wheel assembly, but it is no problem.

3) However it is also strongly recommended to cut the bottom of the capsule on the same day as quickly as possible in order to drain the water, which could have occurred during a transportation both the HANARO storage pool and the IMEF pool, from the inside of outer pipe, therefore, it could avoid the possibility of producing a kind of debris, which will require much time and man power for dismantling a specimen from the specimen holder.

An irradiated Instrumented Material Capsule (07M-21K) will be carried out PIE from the beginning of May 2008 during about 4 months in IMEF.

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