

## Light Water Reactor Materials Analysis Station (Second Period)

### Purpose:

This analysis station has been equipped in order to reinforce and evolve microstructural analysis techniques of radioactive materials of light water reactors in CRIEPI and also to apply to research activities in the prediction of irradiated embrittlement of reactor pressure vessel steels and aging management of light water reactors. Apparatuses of the second period have been installed in succession of the first period.

### Outline:

A high resolution scanning electron microscope equipped with a field emission gun and a vacuum furnace have been joined at the analysis station for the first period installed in our radiation control area. An atom probe, transmission electron microscope, positron annihilation measurement system, and hardness test machines have also been included at the analysis station. Therefore, microstructural characterization of radioactive materials can be performed uniquely in combination of each technique.

### Specifications:

#### (1) High resolution scanning electron microscope

The spatial resolution of this microscope is the highest level in the world and has a wide range of accelerated voltages. The microscope is also equipped with EDS, EPSP, FIB, and many other options.

##### a) Scanning electron microscope (SEM)

- Schottky-type field emission gun

Resolution: <1.1nm (20kV) <2.5nm (1kV)

- Detectors

Secondary electron, reflection electron, and STEM detectors

##### b) Energy dispersive X-ray analysis (EDS)

- Silicon-drifted detector

X-ray count rate: >200,000 counts/sec

##### c) Electron backscattering pattern (EBSP)

- EBSP detector: 120 index/sec

##### d) Focused ion beam (FIB)

- Ga ion gun

Acceleration voltage: 1 – 30 kV

Resolution: < 4nm (30kV)

- Gas and low energy argon ion guns

- Microprobing system

#### (2) Vacuum furnace

Extended thermal aging (more than a week) is possible in order to investigate the mechanism of recovery of radiation damage.

##### a) Vacuum furnace

- Electric furnace: <900°C in common

- Vacuum system: < 5 x 10<sup>-4</sup>Pa

##### b) Monitor and control system

- Recording of temperature and PID control system

### Location and Date of Installation:

Komae Area, March 2010



**Photo 1** High resolution scanning electron microscope equipped with field emission gun



**Photo 2** Vacuum furnace (right) and temperature monitoring system for vacuum furnace (left)