

## Electron Probe Micro Analyzer (EPMA) for Radioactive Materials

### Background

More accurate methods to predicting aging changes in structural materials are needed in the face of reoperation and long-term operation of light water reactors. We have established an analysis station for nuclear materials in a radiation controlled area and utilized it for developing the embrittlement correlation code based on

investigation of the irradiation embrittlement mechanism of reactor pressure vessel steels. This facility is able to obtain the chemical composition of materials with a high accuracy in large areas up to an order of centimeter and also broadens the spatial scale able to be analyzed in the analysis station.

### Outline

This facility allows us to analyze the chemical composition in a large observation area of radioactive materials due to the installation of an electron probe micro analyzer (EPMA) equipped with a field emission gun and ultra-soft X-ray detector in the radiation controlled laboratory in the Komae area. The inclusion of a 100nm minimum and the segregation at the grain and other boundary can be sensitively analyzed using the field emission gun, and light elements such as

boron, carbon, and nitrogen can also be sensitively analyzed using the ultra-soft X-ray detector. For example, it is useful to investigate the effect of light elements on mechanical properties due to the fact it can analyze at a level of tens of ppm in boron in steels. It also has the advantage of large scale analysis from nanometer to centimeter by the effective combination of nanometer scale analysis techniques such as atom probe and TEM utilizing an array of equipment in the analysis station.

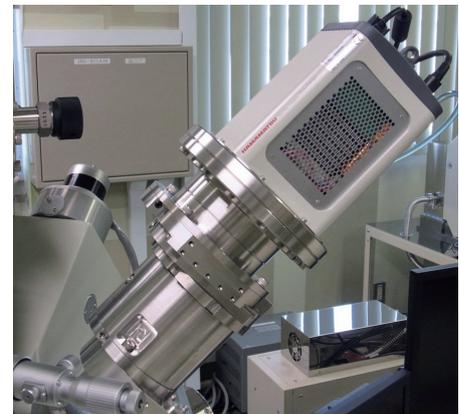
### Specifications

The specifications of this EPMA are summarized as follow.

- Main body: JEOL JXA-8530F  
Electron gun: Schottky field emission gun  
Spatial resolution of secondary electron: < 3nm
- Detectors: Wave dispersive X-ray detector: 5  
Energy dispersive X-ray detector: 1 (silicon drift type)  
Ultra-soft X-ray detector: 1 (diffraction grating and cooled CCD)  
Range of energy spectrum: 50 - 210eV

### [Installed location and date]

Komae area / December, 2012



Ultra-soft X-ray detector

Photos: Electron probe micro analyzer (EPMA) for radioactive materials