# Improvement of Atom Probe Systems by Addition of Short Wavelength Laser Equipment

## 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 improvement by adding short wavelength laser equipment to the existing atom probe allows us to analyze the place of interest difficult to observe in the past such as the analysis of extra small amounts of elements at the grain boundary.

## Outline

The existing high resolution atom probe system located in the radiation controlled laboratory in the Komae area was upgraded to the high resolution laser-assisted three dimensional atom probe system with the highest quality level of mass resolution and spatial resolution in the world by the addition of short wavelength laser equipment. The improved system allows us to easily observe samples with the oxidization film difficult to observe with the former laser equipment and has the advantage of improved analysis efficiency due to the shorter time taken for data acquisition. In addition, the system allows us to analyze ultra-fine precipitates and grain boundary segregation as well as extra small amounts of elements better than the former equipment since it can minimize the effect of laser power deposition on the microstructure in the target material and also has a detector with high mass resolution. This is the first installation of an atom probe system with similar laser equipment in a radiation controlled area.

## Specifications

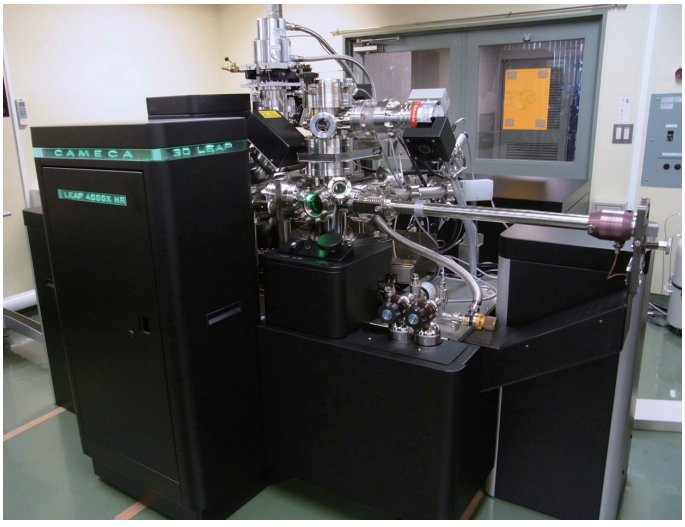
The improved atom probe system has the following advantages.

- The ultraviolet (355nm) laser and widely variable laser power (several fJ – 1.0nJ) enable analysis of a wide variety of materials with a high success rate.
- The minimization of the spot size of a laser beam less than 3$\mu$m makes it possible to obtain a mass-to-charge spectrum with very high resolution.
- The laser pulse rate of 250kHz in maximum makes it possible to acquire data in a shorter length of time. data acquisition.

**[Installed location and date]**

Komae area / March, 2013

Short wavelength laser oscillator (left side view)




Appearance of three dimensional atom probe (front view)

**Photos: Three dimensional atom probe system equipped with a short wavelength laser**