



1. Title:	In situ XANES Analysis for EUVL Projection Optics Contamination
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3. Abstract body:

To investigate EUVL projection optics contamination, surface analysis is an important technique in addition to high flux EUV irradiation source and precise reflectometry. In particular, in situ observation technique provides very important information for understanding contamination phenomena. An in situ X-ray absorption near edge structure (XANES) spectrometry technique was developed and used in our contamination study in which surface state analysis and element concentration mapping were carried out.

A contamination evaluation system was installed at the end-station of the long-undulator beamline (BL9) in the NewSUBARU SR facility. In the BL9, a high-resolution soft-X-ray monochromator has been equipped, and monochromated radiation beam has been utilized at the end-station. Total electron yield (TEY) spectrum of photoemission by X-ray absorption was obtained with scanning the photon energy. The size of the monochromated beam was 0.7(h) x 0.4(v) (mm²) at the sample surface. By scanning the sample two-dimensionally and collecting the TEY data, an elemental concentration map was obtained around the irradiated area.

EUV irradiations on Si-capped and Ru-capped Mo/Si multilayer mirrors were carried out with EUV dose of up to about 2000 (J/mm²) under various water vapor pressure conditions. XANES spectra of carbon (C) and oxygen (O) K-edges were measured after the irradiations. It is found for a sample that O concentration increased at the irradiation center, which indicates oxidation occurred at the irradiated area. On the other hand, C concentration decreased at the irradiated area, which indicates C cleaning occurred.

The in situ XANES analysis is a simple and useful technique to understand the optics contamination phenomena.