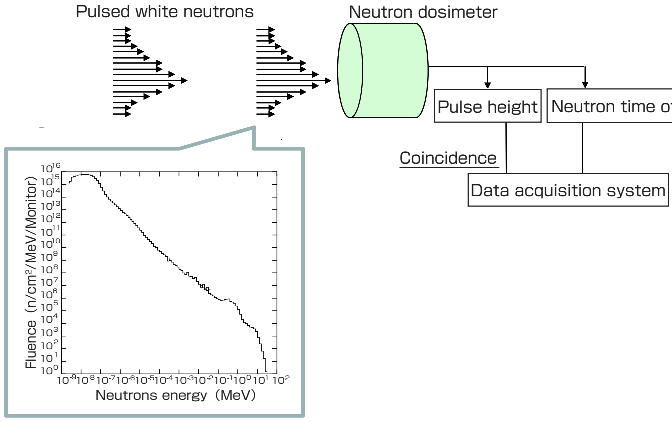
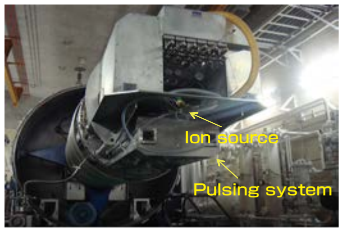
Calibration technique for neutron dosimeters using pulsed white neutron sources

Open the door to obtaining the energy response curve of neutron dosimeters experimentally

Neutron dosimeters are important in various industrial applications such as at nuclear plants. The responses of neutron dosimeters are usually calibrated using monoenergetic neutrons of discretely limited energy points. We have developed a new calibration method to obtain a continuous response curve of a neutron dosimeter using pulsed white neutrons from 1 meV to 20 MeV all at once. The pulsed white neutrons are produced from the ^{7}Li (d,n) reaction or Ta (γ,n) reaction with a thick target. In the calibration method, the response curve is determined by two-dimensional measurements of pulse height and neutron time of flight. It is expected that the calibration method will broaden application to more precise neutron dose evaluation in various fields such as work places with inherent spectra.





Ion beam pulsing system on the 4 MV Pelletron accelerator of AIST

Schematic view of the concept of the calibration method with pulsed white neutron sources
The calibration is performed by two-dimensional measurements using pulse height and neutron time of flight outputs obtained from the neutron dosimeter. The graph shows the white neutron spectrum produced by the Ta (γ,n) reaction and water moderation.

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X-ray absorption fine structure spectroscopy of light elements for green chemistry

Opening a new era of materials analysis utilizing superconducting tunnel junction detector

X-ray absorption spectroscopy (XAS) in the soft X-ray region is important for materials analysis of compound semiconductors or catalysts, for which light elements are important to improve their performances. Superconducting tunnel junction (STJ) detector is promising for XAS in the soft X-ray region, because of its high sensitivity and high element selectivity compared to conventional spectrometers using semiconductor detectors or gratings. We constructed a soft X-ray spectrometer using a 100-pixel STJ array detector (Fig. 1, Fig. 2) . To demonstrate the high sensitivity and high element selectivity of the STJ spectrometer, we observed the fluorescence of nitrogen from an SiC sample with nitrogen density of 300 ppm, for which it was impossible to detect the N-Kα line separating from the C-Kα line using conventional spectrometers. We successively observed the N-K edge XAS of the sample, separating the weak N-Kα line from the prominent C-Kα line (Fig. 3) . The STJ spectrometer may be a powerful tool to improve performances of materials which require a low density light element dopant.

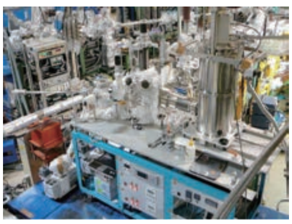

Fig.1 X-ray absorption fine structure spectrometer using 100-pixel superconducting tunnel junction array detector

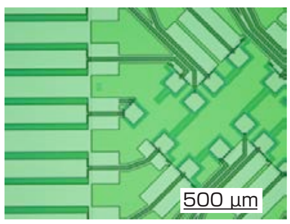

Fig.2 Microphotograph of superconducting tunnel junction array detector

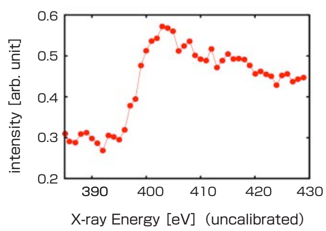

Fig.3 Nitrogen K edge spectrum in a silicon carbide sample with nitrogen density of 300 ppm

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