Contribution ID: **64** Type: **Poster**

P2.61: Feasibility Study of One-Dimensional Imaging with an Optical Fiber for Radiation Dose-Rate Monitoring System in the Decommissioning Process

Wednesday, 28 June 2023 17:45 (1 minute)

For the decommissioning of Fukushima Daiichi Nuclear Plants, a real-time dose-rate monitor under the high dose-rate situation is required to remove the debris remaining inside the plants. We have proposed a dose-rate monitor consisting of a scintillator, optical fiber, and CCD spectrometer. Since an over 100-m long optical fiber is used, some noises ("fiber noise") such as scintillation photons generating from the fiber itself and Cherenkov photons with a dominant emission band of below 550 nm must be separated from the signal from the scintillator. Therefore, longer emission wavelength (over 650 nm) and high light output are required for the scintillator.

We focused on a Cr-doped Gd3Ga5O12 (Cr:GGG) scintillator as such applications. In addition, we focused on noise region in emission spectra that has some information originating from fiber noise. This noise is expected to show the dose rate information through the fiber. Thus, we report the radiation dose-rate monitoring system and the analysis of the noise data that we describe as "one-dimensional dose-rate distribution". Cr:GGG single crystal was grown with micro-pulling method and its optical properties were evaluated.

One-dimensional dose-rate distribution was also evaluated with the fiber noise. Using this noise information, we can evaluate the integrated dose through the fiber. Moreover, emission spectra of the fiber noise are expected to be changed due to the absorption in the fiber, and the shapes of the spectra are expected to have position information for source of fiber noise. To evaluate the one-dimensional dose-rate distribution, demonstration of the monitoring system coupled with 20 m-long optical fiber and CCD spectrometer was operated. Optical fiber was placed around the 60Co source (approximately 60 TBq), and emission spectra of the fiber was acquired at each irradiated fiber length under high dose rate conditions (approx. 10-700 Gy/h).

We grew Cr:GGG single crystal with Its emission wavelength was approx. 730 nm. As results of the demonstration, the noise intensities were well fitted with power function as a function of the product of fiber length and dose rate (integrated dose), and the fiber noise information can be used as dose rate information as one-dimensional imaging. In this paper, we discussed the evaluation of the relation of the intensity ratio of Cr:GGG and optical fiber noise and irradiated length of the fiber.

Primary author: MATSUKURA, Daisuke (Tohoku University)

Co-authors: KUROSAWA, Shunsuke (Tohoku University); FUJIWARA, Chihaya (Tohoku University); YAMAJI, Akihiro (Tohoku University); OHASHI, Yuji (Tohoku University); YOKOTA, Yuii (Tohoku University); KAMADA, Kei (Tohoku University); SATO, Hiroki (Tohoku University); YOSHINO, Masao (Tohoku University); HANADA, Takashi (Tohoku University); MURAKAMI, Rikito (Tohoku University); HORIAI, Takahiko (Tohoku University); YOSHIKAWA, Akira (Tohoku University); TAKATA, Takushi (Kyoto University); TANAKA, Hiroki (Kyoto University)

Presenter: MATSUKURA, Daisuke (Tohoku University)

Session Classification: Poster (incl. coffee)