MLF Experimental Report

提出日 Date of report

実験装置名／BL番号 Name of Instrument

BL10 Neutron beam-line for observation and research use (NOBORU)

実験装置責任者 Name of the person responsible for the instrument:

Kenichi Oikawa

所属 Affiliation: Japan Atomic Energy Agency

1. 研究成果概要 (a)装置グループ内の成果、(b)ユーザー課題実装時における特筆すべきサポート、(c)ユーザー課題の執行状況について、まとめてください。A4 サイズ用紙使用のこと。

Outline of your activities. Following results at your instrument should be reported in A4 size papers: (a) results of your instrument goup, (b) significant user support works, and (c) statistical summary of user experiments.

(a) Results of our instrument group

[Epicadmium neutron spectrum measurement and imaging experiment using filters]

This year, we added two filters for resonance absorption experiment to the present filter exchanger; one is a 2-mm thick cadmium (Cd) plate and the other one is a 50-μm thick tantalum (Ta) and indium (In) foils sandwiched by a couple of 1-mm thick copper (Cu) plates. Figure 1 shows installed filters on the exchanger at around 7.4 m position of the beamline.

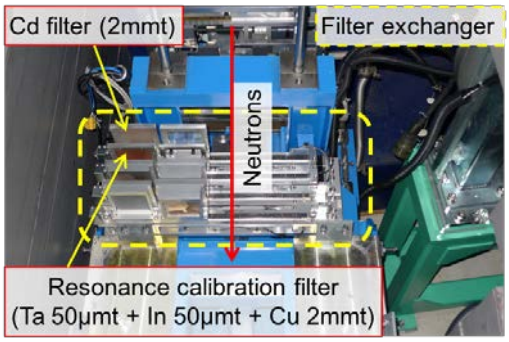

Figure 1. Two newly installed filters for resonance ab-sorption experiment.

Epicadmium neutrons, neutrons of kinetic energy higher than the effective cadmium cut-off energy 0.5 eV, are useful not only for radiograph of thick objects due to its high-penetration power but also elementary analysis using resonance absorption of nucleus. Resonance absorption imaging, being used to visualize a spatial distribution of elements and/or temperature within a sample, is one of the important applications of an intense short-pulse neutron source. To perform resonance absorption imaging, however, efficiency of the epicadmium neutrons for existing counting type two-dimensional (2D) detector is insufficient. The 2012 model lithium-6 time-analyzer neutron detector (LiTA12) system, based on a lithium glass scintillator and multi-anode photomultiplier tube, has the highest neutron efficiency among the detectors for pulsed neutron imaging. The LiTa12 system provides high count rate up to 10M cps as shown in Fig. 2, which shows measured spectra of the resonance calibration filter with the Cd filter.

1. 研究成果概要（つづき） Outline of experimental results (continued).

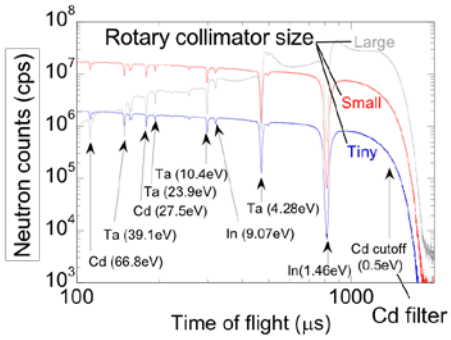

Figure 2. Measured resonance absorption spectra of Ta and In with Cd filter using LiTA12 system.

Neutron transmission images of the test targets made by gadolinium (Gd) and gold (Au) are shown in left and right of Fig. 3, respectively. The image of the Gd was obtained by 10-minutes irradiations with and without the target, then the former image was divided by the latter. The transmission image of the Au target was obtained as well by irradiations of 17 hours with the target and 15 hours without. Detailed experimental procedures are written in the original paper. Although the image of the Au target was not as clear as the Gd target due to lower statistics caused by the narrow energy range, the improvement of the spatial resolution was also attractive in the resonance energy region. The original spatial resolution of 3 mm (by pixel) is drastically improved by the center-of-gravity calculation using event-recorded data of neutron detection. The estimated spatial resolution of the LiTA12 system with the center-of-gravity calculation was 0.7 mm for the energy at 4.9 eV.

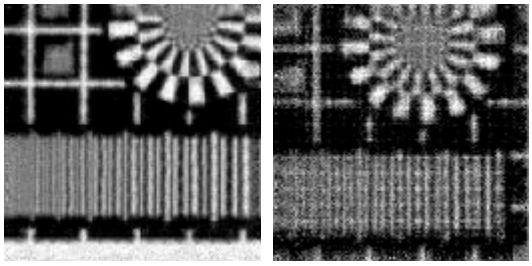

Figure 3. Neutron transmission images of Gd (left) and Au (right) targets. Neutron energy rang-es were less than 0.1 eV for Gd and 4.79 – 5.01 eV for Au.

(b) Significant user support works

In the fall of 2016, a servo motor driver problem of the chopper system of BL 10 occurred, however, the user program was not affected by the quick recovery. Novel neutron holography experiment by the user was strongly supported by instrument member of BL10 and computing team of MLF.

(c) Statistical summary of user experiments

In JFY 2016, in addition to the postponed proposals from JFY 2015, 13 general use and 1 proprietary use proposals were carried out at NOBORU. There was no intrinsic failure of the instrument components of BL10.

28.5 days and 30.5 days were assigned to the general use program of 2016A and 2016B, respectively. A proposal of international user was postponed to 2017A, because of the inevitable adjustment of the experimental schedule.

必要に応じて、A4 サイズの用紙に続きを記入して下さい。