Performance of optical devices for energy-selective neutron imaging at NOBORU at J-PARC

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NOBORU [1, 2], Neutron Beam-line for Observation and Research Use, is a day-1 neutron instrument at MLF (Materials and Life Science Experimental Facility) of J-PARC, which can serve a test beam port. Energy-selective neutron imaging at a MW-class pulsed source is one of the important developments performed at NOBORU for several years. In order to enhance the capability as for imaging experiment, a rotary collimator and a neutron filter device were installed on the middle of the beam-line. A revolver-shape shielding equipped with four holes classified as Open (100x100mm²), Large (31.6x31.6mm²), Small (10.0x10.0mm²) and Tiny (3.2x3.2mm²) is remotely rotated to change the so-called collimator ratio (L/D) of pinhole optical system. It was found from the neutron radiography test that neutron transmission images with high spatial resolution (~50μm) could be obtained by selecting Tiny hole. To mitigate exposed neutron and gamma ray from a moderator, a remote-controlled filter device was introduced in front of the rotary collimator. A 6mm-thick acrylic resin plate and a 1mm-thick borosilicate glass are used to attenuate epi-thermal neutrons and cold ones, respectively. Bulk lead and bismuth single crystal plates attenuate the gamma rays. It was confirmed that gamma rays from the source could be suppressed, enabling to measure epi-thermal neutrons (see Fig.). Experiences on imaging techniques accumulated at NOBORU so far are now utilized for designing a forthcoming novel instrument dedicated for neutron imaging at MLF.


Neutron spectral intensities obtained with Bi (bismuth) filter (25, 50 and 75mm thick).