Determining of Thermal and Resonance Neutron Fluxes Distribution for Research of Nuclear Data of Isotopes at the IREN Facility

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The nuclear data is important values not only for fundamental nuclear physics but also for applications. Nowadays, many physical methods have applied to research one of which is Neutron Activation Analysis (NAA), so the updating demand for these data are always crucial for global nuclear data library. In Frank Laboratory of Neutron Physic JINR, NAA method is carried out at the IREN facility. The IREN facility is the pulsed intensive resonance neutron source, combining of a linear electron accelerator LUE-200, a Wolfram-Ni-Iron alloy target (90% W) and the water moderator. Since the flux of neutrons emitted from the target is uneven, it is necessary to reveal the dependence of flux to the irradiation position on the moderator's surface.

In this work, we used 6 pairs of flux monitors: Cu (in a cadmium shell) – Cu (without the shell) with same size. The monitors were placed at 1, 3, 5, 7, 9 cm top-down from the upper edge of the moderator. Also the same size 11 pairs of Cu flux monitors were placed around of 43 cm perimeter of moderator at 5 cm mark from the top-down. All monitors were irradiated in two phases for 5 hours for each. The IREN control modes were follows: burst frequency – 25 Hz, beam current – 1.6 A, electron energy – 110 MeV and average electron's current – 4.5 μA approximately. Spectrometric data were collected for 2 hours for each sample, using an automatic system, which includes a samples changer and the Canberra GC 4018 HPGe detector with relative efficiency 40%, resolution 1.8 keV at 1.33 MeV. GENIE-2000 software was used for spectra processing. Cadmium-difference method was applied for calculating the neutron fluxes. As a result, the maximal value of the thermal neutron flux is equal to $2 \cdot 10^8$ $n \cdot cm^{-2} \cdot sec^{-1}$ at 5 cm from the top-down. The changes in fluxes distribution around the perimeter of the moderator were minor.

We plan to use obtained data for determination both thermal neutron capture cross-section and resonance integral of some important isotopes, using in different physic fields.