INVESTIGATION OF THE SCATTERING CROSS SECTIONS OF NEUTRONS ON CARBON NUCLEI AT THE REACTOR FILTERED BEAMS

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Natural carbon is well known as reactor structure material and at the same time as one of the most important neutron scattering standards, especially at energies less than 2 MeV, where the neutron total and neutron scattering cross sections are essentially identical. The best neutron total cross section experimental data for natural carbon in the range 1 - 500 keV has uncertainties of 1 - 4 %. However, the difference between these data and those based on R-matrix analysis and used in the ENDF libraries is evident; especially in the energy range 1 - 60 keV. Experimental data for total scattering neutron cross sections for this element in the energy range 1 - 200 keV are scanty. The use of the technique of neutron filtered beams developed at the Kyiv Research Reactor makes it possible to reduce the uncertainty of the experimental data and to measure the neutron scattering cross sections on natural carbon in the energy range 2 - 149 keV with accuracies of 3 - 6 %. Investigations of the neutron scattering cross section on carbon were carried out using 5 filters with energies 2, 3.5, 24, 54 and 133 keV. The neutron scattering cross sections were measured using a detector system covering nearly 2π. The detector consisting of ^{3}He counters (58 units), was located just above the carbon samples. The ^{3}He counters (CHM-37, 7 atm, diameter = 18 mm, L = 50 cm) are placed in five layers (12 or 11 in each layer). To determine the neutron scattering cross section on carbon the relative method of measurement was used. The isotope ^{208}Pb was used as the standard. The normalization factor, which is a function of detector efficiency, thickness of the carbon samples, thickness of the ^{208}Pb sample, geometry, etc., for each sample and for each filter energy has been obtained through Monte Carlo calculations by means of the MCNP4C code. The results of measurements of the neutron scattering cross sections at reactor neutron filtered beams with energies in the range 2 - 133 keV on carbon samples together with the known experimental data from database EXFOR/CSISRS and ENDF libraries are presented.