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Angular Distribution of Neutrons Around Thick Beryllium Target of Accelerator-Based 9Be(d, n) Neutron Source

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Experimental work and simulations were carried out to determine the angular distributions of neutrons and yields of the 9Be(d, n) reaction overall angular range (360 deg) on a thick beryllium target as an accelerator-based neutron source at incident-deuteron energy 13.6 MeV. The neutron activation method was used in the experimental part using aluminum and iron foils as detectors to calculate the neutron flux. The Monte Carlo neutral-particles code (MCNP5) was used to demonstrate and simulate the neutron distribution, also to understand and compare it with the experimental results. The neutron energy spectrum was computed using the projection angular-momentum coupled evaporation code PACE4 (LISEþþ) and the spectrum was adopted in MCNP5 code. Two experimental ways were used, one with a beryllium target and another one without the beryllium target, to evaluate the neutron flux emitted only by the beryllium target. Typical computational results were presented and are compared with the previous experimental data to evaluate the computing model as well as the characteristics of emitted neutrons produced by the 9Be(d, n) reaction with a thick Be-target. Moreover, the results can be used to optimize the shielding and collimating system for neutron therapy.

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