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Development of a High-Intensity Accelerator-Based D-D/D-T Fusion Neutron Source

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The accelerator-based D-D/D-T fusion neutron source, with mono-energy and high-intensity, is the key equipment to carry out the advanced research of neutron physics and neutron application technology, which provide reliable neutron source for basic research of neutron physics, new nuclear energy utilization system research and development, fusion device research and development, nuclear technology application, etc. A high-intensity accelerator-based D-D/D-T fusion neutron source with a thick adsorption target is developed in Lanzhou university, China. A high-current microwave ion source is used to produce a large current deuteron beam, and neutrons are generated by irradiating the deuteron beam on a deuterium-adsorption target or tritium-adsorption target. The D+ beam spot size is about 20.0 mm. According to the multi-layer computing model, neutron energy spectra, angular distributions and yields for the thick target can be calculated with remarkable precision. The neutron energy spectra are non-mono-energetic neutrons for the developed neutron generator, the neutron angular distributions are anisotropic distributions, and they can provide neutrons with an intensity of 2.8×10^11 n/s (D-D) and 1.4×10^13 n/s (D-T), respectively, with the deuteron of 450 keV/50 mA. In particular, based on the heat conduction theory, the thick adsorption rotating target with water-cooling can withstand the D+ ions beam and ensure that the temperature is less than 200 ℃, which will reduce deuterium or tritium release from adsorption target to ensure neutron beam stability.

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