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VITA ACCELERATOR NEUTRON SOURCE FOR APPLIED AND FUNDAMENTAL RESEARCH IN THE FIELD OF FUSION POWER *)

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At the Budker Institute of Nuclear Physics, a tandem electrostatic accelerator of charged particles with vacuum insulation (VITA) was proposed, created and is currently in operation [1]. The accelerator generates stable beams of protons or deuterons of direct current with an energy from 0.2 to 2.3 MeV and a current of up to 10 mA. Initially, VITA was created to generate epithermal neutrons in the reaction 7Li(p,n), for boron neutron capture therapy (BNCT). At present, the accelerator is actively used for a number of applied and fundamental studies.

A high degree of beam monochromaticity in energy (0.1%), in combination with the technology of manufacturing thin, impurity-free lithium and boron targets, allows us to study the mechanisms and cross sections of nuclear reactions. The setup was used to measure the differential cross section of the 11B(p,α)αα reaction, the main candidate for aneutron fusion [3]. It was shown that in the vast majority of cases, the reaction proceeds through sequential decay: at the first stage, a high-energy alpha particle is emitted and an 8Be nucleus is formed in the ground or excited state, and at the second stage, the beryllium nucleus decays into two alpha particles.

In a joint study with researchers from the ITER project center, the neutron cross sections and spectra were measured in various channels of the ^{7}Li(d,n)^{8}Be reaction [4]. This reaction is characterized by a high yield and energy of neutrons. It was shown that with a deuteron beam energy of 1.5 MeV and a beam current of 1 mA, the accelerator achieved a neutron yield of 2 10^{12} s^{-1}. The obtained fast neutron fields were used to conduct radiation tests of materials and equipment used in the first wall of a thermonuclear reactor [5], as well as to conduct research on fast neutron therapy [6].

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