Accelerator based neutron source VITA for measuring nuclear reaction cross sections and for irradiating advanced materials

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A compact accelerator-based neutron source has been proposed and created at the Budker Institute of Nuclear Physics in Novosibirsk, Russia [1]. An original vacuum insulated tandem accelerator (VITA) is used to provide a dc proton/deuteron beam. The ion beam energy can be varied within a range of 0.3–2.3 MeV, keeping a high-energy stability of 0.1 %. The beam current can also be varied in a wide range (from 1 nA to 10 mA) with high current stability (0.4 %). VITA is used to generate a neutron flux via the ^{7}Li(p,n)^{7}Be or ^{7}Li(d,n) reactions, α-particles through ^{7}Li(p,α)α and ^{11}B(p,α)αα reactions, 478 keV photons through ^{7}Li(p,p'γ)^{7}Li reaction, and positrons through ^{19}F(p,αe^{+}e^{-})^{16}O reaction. The facility provides a neutron beam of almost any energy range: cold, thermal, epithermal, monoenergetic, and fast. The facility is used to study radiation blistering of metals during ion implantation [2,3], for the development of boron neutron capture therapy [4-16] including use in clinics [17], for radiation testing of steel and boron carbide for ITER [18] and fibers for CERN, for studying the composition of films by back-scattered protons, for in-depth investigation of the ^{11}B(p,α)αα neutronless fusion reaction, for measuring nuclear reaction cross sections [19-21], *etc*. The report will describe the VITA, present and discuss the results obtained, and declare plans.

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