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Novosibirsk accelerator neutron source for BNCT

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Epitheral neutron source for BNCT is currently operating in Novosibirsk, Russia. The source consists of a vacuum insulation tandem accelerator and a lithium target. A proton beam with an energy of 2 MeV and a current of up to 5 mA is used for neutron generation and study of blistering. During the last year, joint research with Novosibirsk Institute of Cytology and Genetics, Novosibirsk Institute of Cell and Molecular Biology, Clinic of the University of Tsukuba, Okinawa Institute of Science and Technology was carried out. As a result of the modernization of the accelerator, including means applied in accelerator technology for the first time, a significant reduction in the parasitic flux of charged particles was achieved, thus improving the stability of the accelerator to breakdowns and increasing several times the proton beam current – up to 5 mA. The effect of space charge on the negative hydrogen ion beam size and profile was studied. The emittance of the beam was measured, and the effect of spherical aberrations of the magnetic lens was revealed. The heating of the diaphragm of the accelerator electrode was detected, and the temperature was measured. The accelerator was modernized to further increase the current. The high quality of the neutron flux generated was confirmed by the results of the successful *in vitro* and *in vivo* studies. The viability of U251human glioma cells and T98G human glioblastoma cells preincubated in boron medium irradiated with neutrons was significantly inhibited. The irradiation of mice grafted with human glioblastoma led to a complete cure. New drugs for targeted delivery of boron based on carbon nanotubes were tested. A new method of measurement of absorbed dose was proposed and tested. Appearance of blisters at irradiation by 2 MeV protons at the samples of copper of various purity and tantalum was observed *in-situ* at a temperature of the order of 150 °C. The thresholds of blister formation were determined. A new neutron generating target with a substrate made in the form of thin tantalum tubes soldered to the copper body was manufactured. The optimized neutron beam shaping assembly was manufactured, which used magnesium fluoride crystals in the moderator and the composite reflector - graphite in the front hemisphere and lead in the back. A new compact sectioned high-voltage source has been created and tested. In contrast to the existing voltage source, it was possible to specify the potential at the accelerating electrodes directly from the rectifier sections, as well as to decrease the accelerator height. The report presents and discusses the results of the research and declares further plans.

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