ACCELERATOR BASED NEUTRON SOURCE FOR THE NEUTRON CAPTURE THERAPY AT HOSPITAL

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Recently, the ever increasing interest in curing malignant tumors has been in using boron neutron capture therapy (BNCT). The idea of BNCT is simple and elegant. A tumor-seeking compound containing stable isotope ^{10}B is introduced into blood and given time to be accumulated in the tumor. The tumor is then irradiated with epithermal neutrons, which are captured by ^{10}B isotope. Capturing neutrons causes the boron nuclei to break apart, resulting in the emission of α-radiation and recoiling ^{7}Li nuclei. Both α-particles and lithium are high in energy but short in range, which means that they destroy the malignant cells in which boron is embedded without hurting the adjacent healthy cells.

In this paper, accelerator source of neutrons for the hospital-based boron neutron capture therapy is proposed and discussed. Kinematically collimated epithermal neutrons are produced via near-threshold $^{7}Li(p,n)^{7}Be$ reaction at proton energies of 1.883÷1.9 MeV. At proton energy of 2.5 MeV, the neutron beam is produced for fast neutron therapy and for BNCT usage after moderation. DC proton current of tens of milliampers allows to provide therapeutically useful beams with treatment times of tens of minutes. The basic components of the facility are: a hydrogen negative ion source, an electrostatic tandem accelerator with vacuum insulation, a charge-exchange target, a sectioned rectifier, and a thin lithium neutron production target on the surface of tungsten disk cooled by liquid metal heat carrier. Design features of facility components are discussed.

Project № 1484 "Accelerator based neutron source for the neutron-capture and fast neutron therapy" was supported by International Science and Technology Center. Work on the project is accomplished in accordance with the Agreement now. 2.5 MeV tandem accelerator is under construction. A set of experiments on study of high voltage durability of vacuum gap with large square electrodes is realized on available 1 MeV tandem-accelerator. A 5 mA 25 keV DC H^- ion beam with required emittance was obtained. The first specimen of neutron production target with liquid metal heat-carrier was made. In this paper, current results are presented.

Investigations of elements of the whole accelerator-based neutron source are expected to be carried out by the close of the project (May 2002). As a result of the project, a conception of accelerator based neutron source for the neutron-capture and fast neutron therapy at hospital appropriate for commercial use will be presented.

Then the work is assumed to be continued on construction an experimental neutron source basing on the tandem accelerator produced, and usage of neutron beam will be started. The extended project is proposed. Financial support needs prolongation.