neutron source

Transportation and storage of the lithium neutron-generating target

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The principal parts of the accelerator based neutron source VITA are the ion source for producing the primary H^- beam, the tandem accelerator with vacuum insulation for obtaining the accelerated proton beam, the lithium neutron-generating target for neutron generation and the beam shaping assembly for obtaining an epithermal neutron beam. Neutrons are produced as a result of the threshold reaction $Li^7(p,n)Be^7$ which occurs when protons with the energy more than 1.882 MeV hit the lithium neutron-generating target. The lithium neutron-generating target consists of a thick copper disk with cooling channels and a thin lithium layer thermally sputtered on it.

As lithium on the target rapidly interacts with air and it leads to the decrease in the efficiency of the neutron generation, the lithium target has to be made and used under high vacuum conditions. However, it is possible to store the lithium target in an inert gas (argon) atmosphere. Both vacuum and argon atmosphere options were considered to prevent damage to the lithium target during transport to clinics where VITA is installed.

After neutron generation, the lithium target becomes radioactive due to Be^7, a product of the neutron generating reaction with the half-life of 53 days. According to the sanitary standards and precautions when working with a source of ionizing radiation, especially in clinics, it has to be sealed. For the safe removal of the activated lithium target after neutron generation the method of sealing of the activated layer on the target was proposed.

The report discusses in detail methods of transportation the lithium neutron-generating target to the clinic and its storage after use.

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