

## Neutron induced reactions at the tandem accelerator of NCSR “Demokritos”

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The neutron facility at “Demokritos” can deliver monoenergetic neutron beams in the energy range 120-650 keV, 4-11.5 MeV and 16-20.5 MeV via the  ${}^7\text{Li}(p,n)$ ,  $d(d,n)$  and  $t(d,n)$  reactions, respectively. The corresponding beam energies delivered by the accelerator are 1.92-2.37 MeV protons, 0.8-9.6 MeV deuterons and 0.8-3.7 MeV deuterons, for the three reactions, respectively. Neutron beam flux measurements for the low energy region have been performed utilizing a new NE213 liquid scintillator detector, while for the medium energy region, the beam flux has been investigated by means of the multi-foil method of  ${}^{93}\text{Nb}(n,2n){}^{92\text{m}}\text{Nb}$ ,  ${}^{115}\text{In}(n,n'){}^{115\text{m}}\text{In}$ ,  ${}^{56}\text{Fe}(n,p){}^{56}\text{Mn}$ ,  ${}^{197}\text{Au}(n,2n){}^{196}\text{Au}$  and  ${}^{27}\text{Al}(n,\alpha){}^{24}\text{Na}$  reference reactions.

Two areas of investigation of neutron induced reactions will be presented.

a) Cross section measurements for reactions relevant to nuclear energy applications, such as  ${}^{232}\text{Th}(n,2n){}^{231}\text{Th}$  and  ${}^{241}\text{Am}(n,2n){}^{240}\text{Am}$ . On the context of the CERN n-TOF collaboration, the cross sections of these reactions have been measured at several energies, relative to the  ${}^{93}\text{Nb}(n,2n){}^{92\text{m}}\text{Nb}$ ,  ${}^{197}\text{Au}(n,2n){}^{196}\text{Au}$  and  ${}^{27}\text{Al}(n,\alpha){}^{24}\text{Na}$  reaction cross sections, by using the activation method. In addition, (n,f) reactions on  ${}^{232}\text{Th}$  relative to natural U have been carried out utilizing track etch detectors (lexan). Theoretical statistical model calculations have been performed using the computer code STAPRE/F and compared to the experimental data of (n,2n) and (n,f) reactions.

b) In addition, cross section measurements for (n,2n), (n,p) and (n, $\alpha$ ) reactions on high purity natural Ge and Hf have been performed in the energy range 7-11.7 MeV, by using the activation method. In the cases where it was found possible, isomeric to ground state cross section ratios have been determined, which have attracted considerable interest due to the fact that calculations on the isomeric states are strongly dependent on the level scheme and the spin distribution of the level density of the product nucleus. Theoretical statistical model calculations are currently being carried out by using the code STAPRE and EMPIRE.