PHOTON AND ELECTRON BEAM ENERGY MEASUREMENT BY THE SELECTED PHOTONUCLEAR REACTIONS AND NEUTRON CAPTURE

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In the broad spectrum of possible applications of bremsstrahlung photon beams in the MeV energy region in science, medicine or industry, the characteristics of the beams should be well known. One of the basic parameters that largely determine the beam quality is the endpoint energy of the bremsstrahlung. Measurement of the maximum energy of photon beams can be performed by photonuclear reaction, and natural indium has the potential to be one of the best activation detectors. The reason for this is the large number of photonuclear reactions that occur when a natural indium is exposed to a high energy photon beam: $^{115}In(\gamma,n)^{114m}In$, $^{115}In(\gamma,2n)^{113m}In$, $^{113}In(\gamma,2n)^{111}In$, $^{115}In(\gamma,\gamma`)^{115m}In$ and $^{113}In(\gamma,\gamma`)^{113m}In$. If the photon energy is high enough, the neutrons will be produced the accelerator target and the $^{115}In(n, \gamma)^{116m}In$ reaction is possible. Due to the differences in the energy dependences of the cross sections of mentioned reactions, the increase of saturation activities of photoactivation and photoneutron production vary in an unequal manner with the change of the energy of the bremsstrahlung beam. As a consequence of that, it may be expected that the ratios of saturation activities of some reactions could be a very sensitive function of the endpoint energy of the photon beam. The Mikrotron photon beam was used to verify the possibilities of natural indium to be a monitor of the maximal energy of the bremsstrahlung in the energy interval from 5 MeV to 25 MeV. An additional advantage is that this technique can be applied to determining the energy of fast electrons. Accurate determination of the energy of LINAC-200 fast electrons was performed

using several photonuclear reactions carried out on natural Indium after conversion of electron energy in bremsstrahlung in thick Tungsten target. Considering that the energy dependence of ratios of saturation activities were determined by using the bremsstrahlung produced by electrons accelerated by Microtron (having a well calibrated output, including reliable data of electron energies), several energies of LINAC-200 accelerator were determined by comparison with Microtron derived ones. Three types of scintillation detectors (LaBr3:Ce, BGO and plastic) were calibrated in electron beams using obtained values of energies.