THE NEUTRON FACILITY AT NCSR "DEMOKRITOS" AND NEUTRON ACTIVATION RESEARCH ACTIVITIES OF NTUA

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Studies of neutron induced reactions are of considerable interest, not only for their importance to fundamental research in Nuclear Physics and Astrophysics, but also for practical applications in nuclear technology, dosimetry, medicine and industry. These tasks require improved nuclear data and higher precision cross sections for neutron induced reactions on various isotopes.

At the 5.5 MV Tandem T11/25 Accelerator Laboratory of NCSR "Demokritos" quasi-monoenergetic neutron beams can be produced in the energy ranges ~ 15-21 MeV by means of the $^{3}H(d,n)^{4}He$ reaction, ~ 4-11 MeV via the $^{2}H(d,n)^{3}He$ reaction and ~ 2.0-5.3 MeV using the $^{3}H(p,n)$ reaction. The maximum flux has been determined to be of the order of 10^{5}-10^{6} n/cm^{2}s, implementing reference reactions (such as $^{27}Al(n,\alpha)^{24}Na$, $^{197}Au(n,2n)^{196}Au$ and $^{93}Nb(n,2n)^{92m}Nb$), while the flux variation of the neutron beam is monitored by using a BF_3 detector. The neutron beam has been characterized using the multiple foil activation technique as well as extensive simulations [1,2].

The neutron beam has been extensively used over the past 15 years by the NTUA group, for the measurement of (n,2n) and occasionally (n,3n), (n,p), (n,α) reaction cross sections on several isotopes of Am, Hf, Ir, Ge and Au, with the activation technique [3-14]. All these isotopes are important for several medical and industrial applications, including reactor technology, cancer treatment, radiochemical detectors etc. After the end of the irradiation the induced γ-ray activity of the samples and the reference targets are measured off- line by HPGe detectors of 100%, 80% and 16% relative efficiency. The absolute efficiency of the detectors is obtained using a calibrated ^{152}Eu source, placed at the same distance as that of the sample. Additionally, the experimental set up is always simulated with the use of the MCNP (Monte Carlo N-Particle) code, for the estimation of the neutron flux, the self-absorption of the γ-rays in the sample, the effect of parasitic neutrons which accompany the beam etc.

Furthermore, statistical model calculations using the codes EMPIRE and TALYS are usually performed on a wide energy range for the measured data measured as well as for the data reported in literature.

An overview of the neutron activation campaign at this facility will be presented.

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