Neutron induced cross sections of 14.1 MeV tagged neutron reactions leading to activation products

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Fast neutron activation is a selective method complementary to thermal and epithermal neutron activation analysis. In the fast neutron induced reaction of type (n,p), (n,α), (n,xn), (n,np), etc, better gamma emitters than in the case of incident slow neutrons can be obtained. These reactions are of interest for sciences and technology due to the nuclides production. One typical example is the ^{56}Fe(n,p)^{56}Mn reaction.

Furthermore, these nuclei are component part of vessels and walls of different devices and facilities in nuclear reactors and the emission of protons and alphas leads to the accumulation of Hydrogen and Helium, which will influence in time the physical resistance of the walls.

Nuclear reactions induced by tagged fast neutrons with emission of alpha particles on isotopes of light to heavy elements were analyzed [1]. In Fig. 1 the differential cross section of ^{147}Sm(n,α)^{144}Nd for 5 MeV incident neutrons energy is represented.

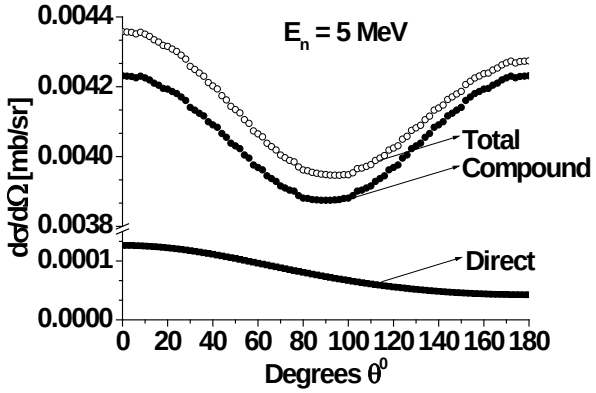

Figure 1: Differential cross section of ^{147}Sm(n,α)^{144}Nd reaction. Contribution of compound and direct processes.

The cross sections of fast neutron induced reactions, up to 20 MeV, where evaluated by using computer codes realized by authors [2] and Talys codes [3]. The contributions of different reaction mechanisms were obtained for every reaction. Then, the production of nuclides and isomer cross section were obtained and compared with experimental data from literature [4]. The cross section data will be used for a computer simulated fast neutron activation experiment.

The present results on cross section and simulation are necessary for tagged fast neutrons activation experiments proposed to the 14.1 MeV tagged neutron facility TANGRA [5] from the Frank Laboratory of Neutron Physics from JINR Dubna.

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