Investigation of the cross section for the reaction $^{241}Am\,(n,2n)^{240}\,Am$

G. Perdikakis [a b] C. T. Papadopoulos [a] R. Vlastou [a]
A. Lagoyannis [b] A. Spyrou [b] M. Kokkoris [a] E. Gerodimou [a]
N. Patronis [c] D. Karamanis [c] Ch. Zarkadas [b] G. Kalyva [b]
and S. Kossionides [b]

[a] *School of Applied Mathematics and Natural Sciences, National Technical University of Athens*

[b] *Institute of Nuclear Physics, NCSR "Demokritos, Athens*

[c] *Department of Physics, School of Natural Sciences, University of Ioannina*

Abstract

The experimental and theoretical investigation of the $^{241}Am\,(n,2n)^{240}\,Am$ reaction cross section has been performed, for the first time at the energy region from 8.8 to 17MeV, by the activation method. The reaction $^{241}Am(n,2n)$, is of particular importance to nuclear energy applications for "clean"energy production, and for nuclear waste transmutation, like the Accelerator Driven Systems (ADS). The monoenergetic neutron beam for the activation measurement, was produced at the 5.5MV TANDEM accelerator of NCSR 'Demokritos', by means of the $^{2}H\,(d,n)^{3}\,He$ and $^{3}H(d,n)^{4}He$ reactions. During the 5-day long irradiation, the neutron flux was monitored by a BF_3 counter. The neutron yield as well as the beam current was recorded in 100 sec intervals by two multiscaling units. The radioactive target consisted of a 37GBq ^{241}Am source enclosed in a Pb container. Three foils, one of natural gold, one of ^{27}Al and one of ^{93}Nb, were used as reference materials for the neutron flux determination. After the end of the irradiation, the activity induced by the neutron beam to the target and the reference foils, was measured off-line by a 50 % relative efficiency, HPGe detector.

Statistical model calculations using the code STAPRE have been performed, and the first results are presented. A phenomenological model taking into account collective, superfluid and shell effects in the determination of the level density, was employed for the investigation, in the framework of the statistical model of Hauser and Feshbach. Furthermore, experimental data on the neutron induced fission cross section of ^{241}Am, have been used as a constraint for the calculations. The results of the investigation are presented in comparison with experimental data and previous theoretical evaluations.

Preprint submitted to Elsevier Science