Systematics studies of (n,p) reaction cross sections at 14.5 MeV neutron energy

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Abstract:

In order to calculate unmeasured data, a new semi-empirical formula for the calculation of the (n,p) cross section at 14.5 MeV neutron energy is obtained. It is based on the pre-equilibrium exciton and evaporation models and uses the Droplet model of Myers and Swiatecki to express the reaction energy $Q_{(n,p)}$. The behavior of the different terms of the Droplet model involved in $Q_{(n,p)}$ was checked individually before choosing the pertinent terms and setting up the formula. Fitting this formula to the existing cross section data on 161 nuclei with $40 \leq A \leq 209$, the adjustable parameters have been determined and the systematics of the (n,p) reaction have been studied. The predictions of this formula are compared with those of the existing formulae and with the experimental data. In this work an important improvement in description of the (n,p) reaction cross section has been obtained. This improvement is due to the simultaneous introduction of the pre-equilibrium process and the effective reaction energy deduced from the droplet model. The new formula has been tested for 161 nuclei with $40 \leq A \leq 209$. It shows an improvement in describing the (n,p) data compared with the existing relations.

Keywords: neutrons induced reactions, systematics cross sections, pre-equilibrium exciton model, evaporation model, droplet model.

References

[1] A.Yu. Konobeyev and Yu.A.Korovin, Semi-empirical systematics of (n,p) reaction cross sections at the energy of 14.5 MeV, Nucl. Instr. and Meth.B 103, 15(1995).

[2] A.Yu. Konobeyev,V.P.Lunev and Yu.N.Shubin, Semi-empirical systematics of (n,□) reaction cross sections at the energy of 14.5 MeV, Nucl. Instr. and Meth.B 108, 233(1996).

[3] M.Belgaid and M.Asghar, Semi-empirical systematics of (n,p) cross sections for 14.5 MeV neutrons, Nucl. Instr. and Meth.B 142, 463(1998).

[4] M.Belgaid and M.Asghar, Semi-empirical systematics of (n,□) cross sections for 14.5 MeV neutrons, Nucl. Instr. and Meth.B 149, 383(1999).

[5] M.Belgaid, T.Segueni, F.Kadem and M.Asghar, Semi-empirical systematics of (n,t) cross sections for 14.5 MeV neutrons, Nucl. Instr. and Meth.B 201, 545 (2003).