Reference data for evaluation of hydrogen and helium accumulation rates for structural materials irradiated with intermediate energy protons

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A study of primary radiation effects and a long term activation of structural material of neutron spallation sources implies the use of a set of reliable data for a calculation of components of gas production rates including proton, deuteron, triton and helium isotope production for a wide range of primary proton energies and target materials. Theoretical models can solve the problem partially, giving in the best case an approximate description of experimental data. An obtaining reliable nuclear data for modern applications requires performing the data evaluation involving an analysis of experimental data and theoretical calculations.

The present work presents a new approach for evaluation of gas production crosssections at intermediate energies. An idea is the evaluation of an atomic mass dependence of cross-sections using the available experimental information and model calculations for a certain number of incident particle energies. The approach gives a possibility to get experimentally based values of cross-sections for targets, if the measured data are absent.

In the present work proton-, deuteron-, triton-, ³He, and α -particle production crosssections were evaluated for proton induced reaction for 278 stable target nuclei from ⁷Li to ²⁰⁹Bi at incident energies from 62 to 1200 MeV using measured data and results of model calculations.

An examples of obtained cross-sections is shown in Fig.1.



Fig.1 Evaluated α -particle production cross-sections for stable target nuclei from ⁷Li to ²⁰⁹Bi at the incident proton energy 800 MeV.