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Stellar nucleosynthesis: experimental yields of the112Sn(gamma,n)111Sn and 112Sn(gamma,p)111m,g In reactions for p-nuclei production simulation

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The nuclei of the overwhelming majority of the occurring in nature stable isotopes of medium and heavy chemical elements were synthesized in hot stars during the scenarios of rapid and slow neutron capture, that is (n,gamma)-reactions, and following beta-decays. However, in the formation of a so-called {p-nuclei} group including the 112Sn nuclide, simple photonuclear reactions of the (gamma,n), (gamma,p), and (gamma,alpha) type play a key role, and that is why this scenario was named the gamma-process. There is a need to know the rates of a large array of low energy nuclear reactions to simulate the current natural abundances of the p-nuclei.
In the present work using the thin tantalum converter bremsstrahlung of the NSC KIPT (Kharkiv) electron linac for the target irradiations and high energy resolution gamma spectrometry for the induced radioactivity measurements we determined the integral yields of the 12Sn(gamma,p)111m,gIn(T_1/2=7.7m,J^{\pi}*{m}=1/2^{-}, T*g{1/2}=2.8 d,J{pi}_{g}=9/2^+) and 112Sn(gamma,n)111Sn(T_1/2=35.3m)
reactions in the relevant to astrophysical interest energy range between the threshold and 15 MeV. The results of the measurements are compared with the available data obtained by counting the neutrons and protons to be emitted, and with the calculations of the statistical theory of nuclear reactions implemented by the widely used for astrophysical calculations computer codes with different models of nuclear level density and radiation strength function.
As an additional result, the branching coefficients of the strongest gamma-transitions between the 111In excited states
populated at the 111Sn nucleus decay have been determined.
They differ from the currently accepted values.

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