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Cross-sections from proton irradiation of thorium at energy 200 and 400 MeV

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The residual nuclei yields are of great importance for the estimation of basic radiation-technology characteristics (like a total target activity, production of long-lived nuclides etc.) of accelerator driven systems planned for transmutation of spent nuclear fuel and for a design of radioisotopes production facilities. Experimental data are also essential for validation of nuclear codes describing various stages of a spallation reaction. Therefore, products of proton induced spallation reaction of 232 Th are studied by means of activation measurement and gamma spectroscopy methods. The samples made of thin natural thorium foils were irradiated at JINR Phasotron accelerator with a direct proton beam. Two experiments were performed with 200 MeV and 400 MeV beam energies. Experimental cumulative and independent cross-sections were determined for more than 80 isotopes including meta-stable isomers. Non-symmetrical mass yield fission curve was reconstructed. The results were compared with previously measured values in the case of 200 MeV experiment to validate used data processing methodology. Cross-sections were also compared with MCNP6 Monte-Carlo code predictions. Several different combinations of high-energy event generators and nuclear models were used (CEM.03.03, Bertini and INCL). Generally, experimental and calculated cross-sections are in a reasonably good agreement for both proton beam energies, with the exception of a few isotopes. Similarly, agreement between new and previously measured data for 200 MeV is good, providing an adequate credibility for the new 400 MeV results.

Primary author: VESPALEC, Radek (Czech Technical University in Prague / Joint Institute for Nuclear Research)

Co-authors: Dr SOLNYSHKIN, Alexander Alexandrovich (Joint Institute for Nuclear Research); Dr KARAVAINOV, Dmitry Veselinov (Joint Institue for Nuclear Research); Dr FILOSOFOV, Dmitry Vladimirovich (Joint Institute for Nuclear Research); Dr ADAM, Jindrich (Joint Institute for Nuclear Reserach / Nuclear Physics Institute Rez near Prague); VRZALOVA, Jitka (Joint Institute for Nuclear Research / Nuclear Physics Institute Rez near Prague); ZHURABEK, Khushvaktov (Joint Institute for Nuclear Research); ZAVORKA, Lukas (Joint Institute for Nuclear Research / Czech Technical University in Prague); ZEMAN, Miroslav (Joint Institute for Nuclear Research / Brno University of Technology); Dr HUML, Ondrej (Czech Technical University in Prague); Prof. TSOUPKO-SITNIKOV, Vsevolod Mikhailovich (Joint Institute for Nuclear Research); KISH, Yuri (Joint Institute for Nuclear Research)

Presenter: VESPALEC, Radek (Czech Technical University in Prague / Joint Institute for Nuclear Research)

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