Excitation functions of ^{3}He- induced nuclear reactions on natural copper up to 55 MeV

Mayeen Uddin Khandaker[a,*], Kotaro Nagatsu[b], Katsuyuki Minegishi[b], Ming-Rong Zhang[b], Samer K. I. Ali[a], Naohiko Otuka[c]

[a] *Center for Applied Physics and Radiation Technologies, School of Engineering and Technology, Sunway University, 47500 Bandar Sunway, Selangor, Malaysia*
[b] *National Institutes for Quantum and Radiological Sciences and Technology, 4-9-1 Anagawa, Inage, Chiba 263-8555, Japan*
[c] *Nuclear Data Section, Division of Physical and Chemical Sciences, Department of Nuclear Sciences and Applications, International Atomic Energy Agency, A-1400 Vienna, Austria*

Abstract

Excitation functions for the ^{nat}Cu(^{3}He,x)^{66,67}Ga,^{62,65}Zn,^{61,64}Cu and ^{56,57,58,60}Co nuclear reactions were measured from the respective threshold up to 55 MeV incident energy by using the conventional stacked foil activation technique combined with HPGe γ-ray spectrometry. Measured data were critically compared with the relevant earlier experimental data and also with the theoretical data obtained from the model calculations. Present results confirmed some of the previous experimental data, whereas only a partial agreement was found with the evaluated data in the TENDL-2019 library. Independent cross-sections for the ^{nat}Cu(^{3}He,x)^{56}Co,^{62}Zn and ^{61,64}Cu reactions are reported here for the first time. From the measured cross-section data integral production yields were calculated. The measured data are useful for reducing the existing discrepancies in the literature, to improve the nuclear reaction model codes, and to enrich the experimental database for various applications. The application of the deduced data in the field of beam monitoring and thin layer activation is discussed.

Keywords: ^{nat}Cu(^{3}He,x) reactions; γ-ray spectrometry; Medical radionuclides; Validation of monitor reactions; Improvement of model codes.

*Corresponding author: E-mail: mu_khandaker@yahoo.com; Phone: +601115402880