2 - 16 A Test Study of γ Transitions from ^{42,43}Ti Nuclei

Xu Shiwei, He Jianjun, Hou Suqing, Yu Xiangqing, Zhang Ningtao
Fang Yongde and Liu Minliang

The precise excitation energies of the proton-unbound states for the key nuclides along the rapid-proton process (so called rp-process) path play a very important role in nuclear astrophysics reaction rate calculations. This work reports the preliminary results of a test study of γ transitions from the ^{42,43}Ti nuclei.

The experiment was performed at the HI-13 Tandem Accelerator at China Institute of Atomic Energy (CIAE). A 35 MeV ^{16}O beam bombarded an isotopically enrich ^{28}Si metallic foil with a Pb backing (13.8 mg/cm^2 thick). The excited states in the ^{42,43}Ti nuclei can be populated via the fusion-evaporation reaction of ^{28}Si(^{16}O, 2n)^{42}Ti and ^{28}Si(^{16}O, n)^{43}Ti, respectively. Once the excited states populated, the related γ transitions can be measured and identified by the X-γ-t and γ-γ-t coincidence technique. In the experiment, the γ rays detected with an array consisting of 14 Compton-suppressed HPGe detectors.

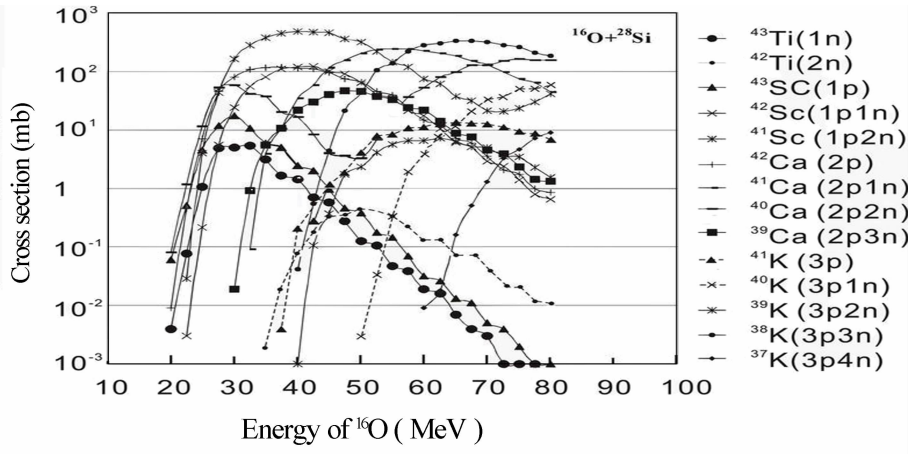

Fig. 1 Reaction cross sections for the ^{16}O+^{28}Si colliding system calculated by an ALICE code[1].

The reaction cross sections for the ^{16}O+^{28}Si colliding system were calculated by an ALICE code[1], as shown in Fig. 1. However, none of γ transition was observed in the experiment because of the low cross sections for the ^{42,43}Ti production. The γ transitions from the excited states in ^{42}Sc, ^{39}K and ^{42}Ca were observed. We found that the cross section of the ^{28}Si(^{16}O, 3p2n)^{39}K reaction was almost equal to that of the ^{28}Si(^{16}O, 2p)^{42}Ca reaction, which is contrary to the theoretical calculations. The data analysis is still in progress.

Reference

[1] M. Blann, H. K. Vonach, Phys. Rev., C28(1983)1475.