3 - 29 Photonuclear Production of Mo-99 Based on an Electron Accelerator

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^{99m}Tc is a pure beta-decay nuclide and widely used in clinic diagnosis of various diseases. Radiopharmaceuticals based on ^{99m}Tc are used in about 80% of all nuclear imaging procedures worldwide[1]. ^{99m}Tc is mostly obtained from its parent nuclide ^{99}Mo ($T_{1/2} = 65.95$ h) via β^- decay. The most common method for commercial production of ^{99}Mo is based on ^{235}U fission. Typically, solid HEU (highly enriched uranium) or LEU (low enriched uranium) targets are irradiated in a high thermal neutron flux reactor. However, this technology has several drawbacks including a limited number of production sites, nonproliferation issues, and high amounts of radioactive waste. These issues gave rise to the development of alternative technologies for ^{99}Mo production. Therefore, it is of great importance to produce ^{99m}Tc based on accelerators.

Photonuclear approach based on ^{100}Mo (γ, n) ^{99}Mo reaction is one of the most promising alternative methods for ^{99}Mo production. A typical setup for the photonuclear production of ^{99}Mo includes a high energy electron accelerator, an electron-photon converter, and a Mo-100 target. In this work, we carried out the production experiment on the electron accelerator at IMP. In prior of irradiation experiment, simulation was carried out to decide the proper parameters for the ^{99}Mo production. A 2.5 μm Tantalum disk with a diameter of 13 mm was used as the bremsstrahlung converter. 2 g Mo-100 disk with a diameter of 13 mm prepared by Cold isostatic pressing was used as the target After irradiation for 127 hours (Fig. 1), the irradiated target was analyzed by HPGe detector, and the main products was ^{99}Mo, containing a little ^{96}Zr as the impurity (Fig. 2). The irradiated target was then dissolved for the subsequent chemical separation and purification process.

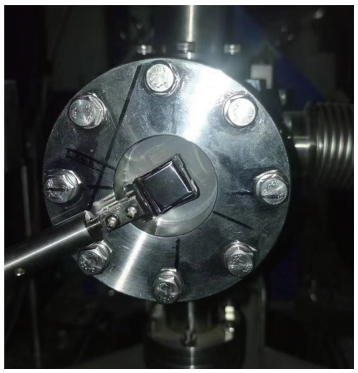

Fig. 1 (color online) Irradiation of Mo-100 target on electron accelerator at IMP.

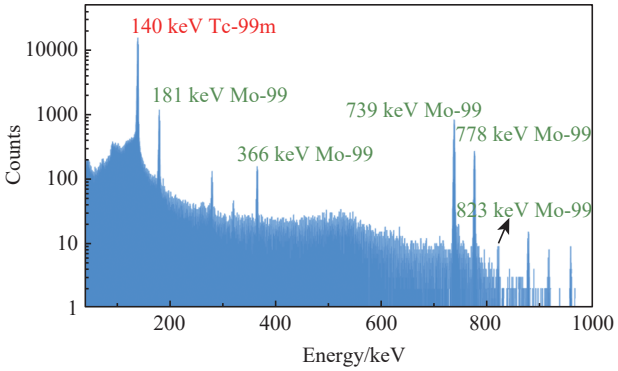

Fig. 2 (color online) HPGe spectrum of the irradiated ^{100}Mo target.

References

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