Preparation of metallic target of ^{100}Mo for production of ^{99m}Tc in cyclotron

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Introduction

Technetium-99m, the daughter of ^{99}Mo is the most commonly used radioisotope in nuclear medicine [1–2]. Current global crisis of ^{99}Mo supply, aging of nuclear reactors and staggering costs force the search for alternative sources of ^{99m}Tc. Radioisotope Centre POLATOM joined the IAEA Coordinated Research Project on "Accelerator-based Alternatives to Non-HEU Production of ^{99}Mo/^{99m}Tc". The planned outcome of this project is development of ^{99m}Tc production method using the reaction of ^{100}Mo(p,2n)^{99m}Tc [3] in Polish cyclotron.

This work presents the results concerning preparation of ^{100}Mo target for irradiation with protons.

Material and Methods

The manufacturing of Mo target was performed using pressing of molybdenum powder into pellets and its sintering in hydrogen atmosphere at 1600 ^{o}C [4]. For this purpose a tantalum and stainless steel plates were used as support. Several pellets using molybdenum powder with particles size of 2 µm in diameter were pressed at different values of pressure.

Results and Conclusion

The optimized parameters of pressing molybdenum pellets with various sizes are given in TABLE 1. It was found that the pellets did not adhere neither to the tantalum nor stainless steel plates but they conducted electricity very well. Pellets prepared with higher pressure were more mechanically resistant, however application, even the highest used pressure did not ensure its satisfactory stability.

diameter (mm)	thickness (mm)	mass of Mo powder (mg)	pressure (MPa)
10	0.45	170	4
12	0.46	245	4
15	0.58	600	15
15	0,65	736	28
15	0,63	730	28

TABLE 1. Parameters of Mo pellets pressing

In order to improve mechanical strength, pressed Mo pellets were sintered in hydrogen atmosphere at temperature of 1600 °C. As a result of this process dimensions of Mo pellets decreased: diameter by 13 %, thickness by 12 %, weight by 1.5 %, volume by 34 % while density increased by 50 %. The changes of these parameters are associated with reduction of molybdenum oxide and removal of oxygen from intermetallic space. It was confirmed by photos of microscopic cross section of pellets before and after sintering. It was observed, that after sintering Mo pellets got a metallic form with very high hardness and mechanical strength.

References

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