A compact, fully automated solid target irradiation, handling and transfer system was developed for the $^{100}\text{Mo}^{pm}$ Tc production; however, it can be used for any solid target material. All the target handling is fully automated. The target is pneumatically transferred to the irradiation station where it is removed from the carrier, placed in the irradiation chamber and the cooling water connected. At the end of irradiation the target is returned to the carrier and transferred to the processing hot cell where it is automatically placed in a distillation unit.

$^{100}\text{Mo}$ targets are prepared by plasma spraying or laser cladding of the copper target substrate.

The target, placed in an aluminium carrier, is transferred pneumatically between the irradiation station and the hot cell processing unit. The target’s active face is completely sealed by the carrier.

The pneumatic transfer is using two vacuum producers (vacuum-cleaner motors) placed close to each end of the 2” (50mm) PVC transfer pipe. The small diameter of the pipe makes the installation of the transfer line much simpler. The progress of the carrier along the line is monitored by magnetic sensors triggered by a magnet in the base of the carrier.

The target irradiation station consists of the target holder, the collimator, the pneumatic transfer terminal and a manipulator. The entire unit is contained in a modular aluminium frame 35x25x24 cm.

On landing in the transfer terminal, the carrier with the target are magnetically oriented to the correct position and the terminal’s sliding cover opened. The manipulator advances to target releasing the carrier’s locks and removes the target by suction. Once the target is out of the carrier, the manipulator rotates 135° and places the target in the irradiation position in the target holder. Cooling water tubes are attached to the manipulator and connect with the target once it is in place.

The target assembly consists of a copper substrate, an elastomer seal, and seal frame. The copper substrate carries the $^{100}\text{Mo}$ layer and is provided with cooling channels on the opposite face. The target is designed to handle 5KW with surface temperature of 350°C. It is placed at 15° to the beam. A collimator in front of the target collimates the 13mm diameter beam to 10mm diameter. The irradiated area on the target face forms a 10x38 mm ellipse.

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Two successful processes were developed for the coating with $^{100}\text{Mo}$: plasma spraying and laser cladding. Both provide thick, adherent coats.

High temperature plasma is created by electric arc in argon or helium. Mo slurry is injected into the plasma and the flow of the gas carries the molten droplets to the substrate to be coated. The low concentration of the slurry allows for precise control of small quantities of material. The slurry is fed coaxially with the gas flow. Shielding gas (argon) is injected simultaneously around the plasma to prevent molybdenum oxidation.

Large numbers of targets can be sprayed simultaneously. The targets are placed on a 200mm diameter drum rotating at 350 RPM and sprayed from a distance of 150mm. It takes about two minutes to obtain 60μ thick coat. The material deposited on the masks is removed and reused.

High-power laser beam can melt and fuse the powder to the substrate in a single operation. This technique has the advantage of 100% efficiency, very good adhesion and high turnover.

The target face is coated with 100μ thick layer of nickel. The molybdenum powder is mixed with polyvinyl alcohol to create liquid slurry, and the correct volume dispensed with a syringe into an elliptical recess on the target face. The target is baked in a vacuum oven at 200°C. The dry molybdenum layer is scanned with 500W laser beam. The beam spot is 0.4 mm and the scans overlap 20%. Scanning speed is 40 cm/sec. To prevent oxidation, the target face is shielded by an argon flow during the cladding.

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