MAFF Fission Target Development

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1. Doping of graphite with uranium

As reported previously [1], the fission target of MAFF is designed to consist of a cylindrical graphite matrix containing approximately 5 weight% of ^{235}U in form of UC_2. Currently, a procedure of doping graphite with UC_2 is under development, using ^{nat}U as a test material. As outlined in fig. 1, a graphite sample is brought into a pyrex reaction vessel. After degassing at 10^{-5} mbar, a concentrated aqueous solution of $UO_2(NO_3)_2$ is added to the sample and allowed to react on it until saturation is achieved. Then the sample is removed from the liquid and dried in ambient atmosphere by an IR radiator, resulting in solid $UO_2(NO_3)_2$ crystals dispersed in the graphite matrix. Conversion into UC_2 requires heating under vacuum to 2000 °C. For the present, only small samples can be processed inside a resistively heated small Mo box in a cryopumped vacuum chamber.

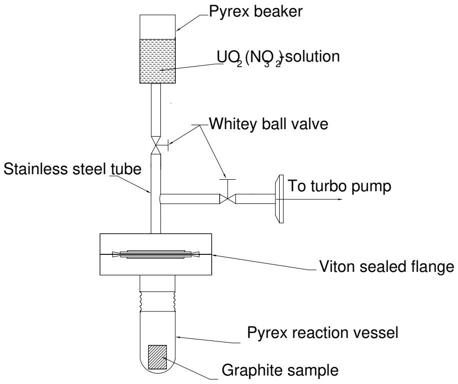

Fig. 1: Setup for absorption of $UO_2(NO_3)_2$ in graphite

In this way, a total of 6 graphite disks of approximately 30–40 mg have been doped reproducibly with 5–7% of ^{nat}U. The production of MAFF targets, however, requires doping of graphite cylinders of 15–20 mm diam. and 40–60 mm length. The extension of the procedure to such geometries is in progress. Heat treatment of the large samples will become possible using the high temperature furnace described below.

2. Status of the high temperature furnace

The development program for the ^{235}U fission target of MAFF includes, among others, extensive long term tests of the target assembly at simulated operational conditions, i.e. at temperatures up to 2500 °C and a pressure range between 10^{-5} and 10^{-6} mbar [1]. For this purpose, a resistively heated high vacuum furnace has been set up, which is capable to provide the required temperatures for a period of at least 1000 hours. Details of the design are given in [2]. A photographic view of the vacuum chamber with the built-in hot zone is shown in fig. 2. The furnace will be brought into service shortly. Extensive safety precautions have been taken to prevent damage of the device and the sample in case of detrimental events like loss of cooling water or vacuum, or failure of a thermocouple or the pyrometer. Likewise, after a short term failure of power, i.e. during a thunderstorm, the interrupted process is resumed automatically by the control system. This prevents the break-down of a running test in case of absence of an operator.

References

[1] H. J. Maier *et al.*, Jahresbericht 1997, p. 100
[2] H. J. Maier *et al.*, Nucl. Instr. Methods. **A438** (1999) 185

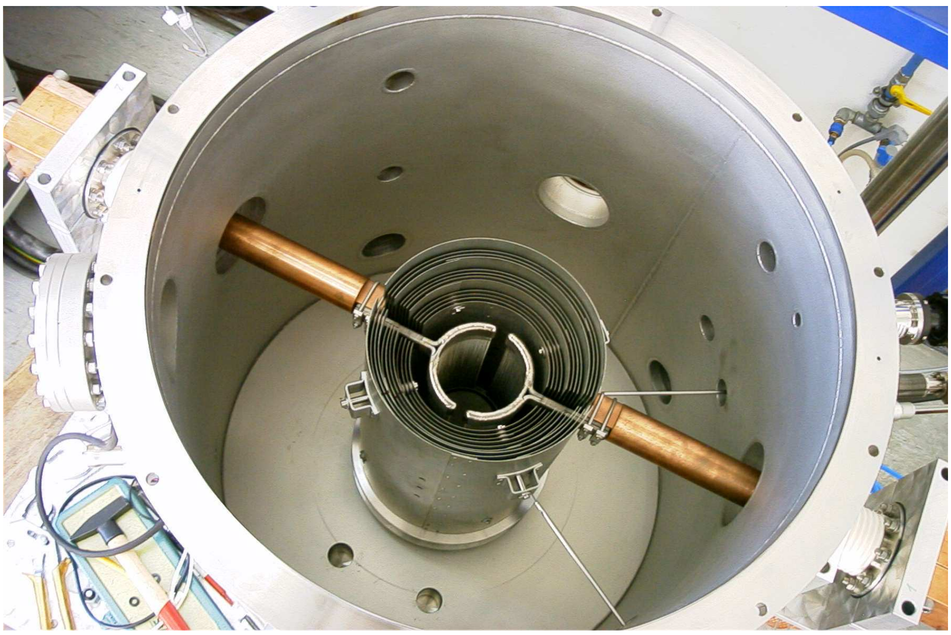

Fig. 2: Photographic view of the furnace, featuring the hot zone with the radiation heat shields inside the vacuum chamber