Preparation of Laser Plasma Carbon Stripper Foils in a new designed UHV System

P. Maier-Komor, G. Dollinger, A. Kastenmüller [a], M.K. Nacke, and W. Heimkes
[a] FRM 2 - ZWE

Laser plasma ablation of spectroscopically pure graphite under UHV conditions is the only established method for the preparation of carbon stripper foils for heavy ions. Such foils with their structure of randomly oriented nanocrystallites can best withstand ion irradiation damage. The procedure was developed at our laboratory in 1990 [1] and the required ultrahigh vacuum box coater and the high power pulsed Nd:YAG laser were funded by the Deutsche Forschungsgemeinschaft DFG in 1992. Since then the preparation procedure was continuously improved Ref. [1] and references therein and such foils were installed in the terminal of our tandem accelerator. Thus the ion beam quality was improved, the limitation in ion beam current could be abandoned and the stripper foil exchange intervals could be drastically prolonged, which not only reduced the required manpower but also improved the voltage stability and thus the reliability of our tandem accelerator. The about 12 years of operation of the laser plasma plant showed some weak points of the construction but also some commercial components had exceeded their lifespan. Due to the repeated annealing the cubic UHV recipient had developed leaks on some welding joints which no longer could be repaired with acceptable effort. Therefore a new box coater was developed and built which is better matched for the repeated annealing processes. In addition a new gate valve (DN 320 ISO) , sealed with gold wire rings to the vacuum chamber and to the cryopump, was required. The bottleneck for the preparation of these carbon stripper foils was the laser entrance window which becomes increasingly opaque during carbon deposition. The carbon source to window distance was enlarged in the new setup. Due to this and a better laser light transmission, caused by slightly changed laser plasma conditions, the life of the laser entrance window before exchange could be prolonged by a factor of five [2]. The source to window distance could be further enlarged if the plant would be moved in a room with greater headroom or if the intermediate ceiling could be removed in this laboratory. A 100 mm diameter dielectric mirror reflects the horizontal laser beam into its vertical direction. With it the focused laser beam can be wobbled by means of two dc motors, which drive micrometer screws. The motion of this mirror is computer controlled (PC DX486) via a two-axis dc motor controller in such a way that the focused laser beam spirally sweeps over the graphite disk with constant velocity. With the return to service of the laser plasma plant it became apparent that both dc motors had developed too much internal friction that they could not follow the control command. Thus it became evident also that there was still an error in the computer program for the spiral motion. After exchange of the dc motors and fixing the program error the laser plasma plant is in operation again.

References

[1] G. Dollinger, Ph.D. thesis, TU München, 1990
[2] P. Maier-Komor *et al.*, Nucl.Instr. and Meth. **A...** (2004) in press