Technological Laboratory of the TUM

P. Maier-Komor, M. K. Nacke, and W. Heimkes

1. Improvement of the Preparation of Carbon Stripper Foils from the Laser Plasma Ablation Deposition Process

in cooperation with G. Dollinger, C. M. Frey, and H.-J. Körner

One quality criterion of the carbon stripper foils prepared by laser plasma ablation deposition (lpa) is their nearly constant ion transmission during their life-time. Unexpectedly a decrease in ion transmission was observed during long term measurements in 1995. The method of foil preparation was not changed, therefore only carbon built up could have been the reason for this effect. Normally carbon built up on stripper foils in the terminal could be excluded, because there should be a hydrocarbon-free vacuum of $\leq 10^{-5}$ Pa. The installation of the gas stripper, however, needed differential pumping through the tight tubes of the gas channel. In order to guarantee a good vacuum in the terminal a 900 l/s ion pump was installed in its centre. This ion pump was not working. Due to the poor conductance of the gas stripper channel the two 110 l/s ion pumps at both ends of the terminal could only maintain a vacuum of $\approx 10^{-3}$ Pa. All used lpa stripper foils had a thin collodion or formvar backing which evaporates when penetrated by the ion beam. Without this backing the slackening procedure was not possible for the lpa foils whereas standard carbon stripper foils, which were still the majority, could be slackened and thus installed in the terminal without any plastic support. These plastic backings of the lpa foils must have been the source for a hydrocarbon pollution in the terminal vacuum. A 1 % hydrocarbon partial pressure which is $\approx 10^{-5}$ Pa can be guessed. Thus 2.5 hours of ion beam on a stripper foil, which was the average life-time for high current operation, result in an impingement of $\approx 8\,\mu$g/cm^2 of hydrocarbons, which are nearly completely deposited on the hot surface in the beam spot area. This means a 50 % transmission reduction for a ^{127}I beam. In this way the life-time of a lpa stripper foil is ended by carbon built up and not by irradiation damage. In order to avoid this, the 900 l/s terminal ion pump was repaired and investgations were pushed for lpa foils without plastic support.

Due to the texture of carbon foils prepared by thermal evaporation their tensile strength is better than the one of lpa foils with their random orientation of nano crystallites. The tensile strength is in most cases larger for higher density materials. The density of thermally evaporated carbon cannot be enlarged by any process parameters and it is generally lower than for the bulk material (graphite). We measured, however, that the density of lpa carbon films depends on the laser power density [1,2] at the graphite source and reaches values above graphite at power densities ≥ 16 GW/cm^2. In order to save valuable laser beam time all carbon stripper foils of this kind were prepared at 2 GW/cm^2 so far, which is sufficient for the random orientation and thus the long life-time. Now lpa carbon stripper foils were prepared with a laser power density of 8 GW/cm^2. These foils were sufficient rigid to be floated and slackened with good efficiency without a plastic support.

The status of this plant for laser plasma ablation-deposition has been improved that routinely all carbon stripper foils to be used in the terminal can be prepared by this method without any collodion backing. The ion transmission is nearly constant during the life-time and is reproducible constant with each new foil due to the good homogeneity as well of the individual foil as of the whole deposition charge. Nevertheless the development is not completely finished. The problems with back focussed laser light are still not completely solved. Investigations are on the way in order to prepare in addition thicker carbon stripper foils for dead section

2. New Setups for Investigations of Process Parameters for CsI Photocathode Films

in cooperation with B. B. Bauer, J. Friese, R. Gernhäuser, and A. Kastenmüller

When we noticed that quantum efficiency values are generally smaller for CsI than deduced from a questionable calibration of the reference detectors, we decided to investigate process parameters isolated from athmospheric influences. The penetration depth of VUV light in CsI [3] is only 5 to 11 μg/cm^2 depending on the wavelength, and the electron escape length seems to be even smaller. This means that only the top thin layer of a CsI film is responsible for the quantum efficiency and this thin layer is attacked especially by humidity in the air.

For this purpose a bellows-sealed vacuum interlock was constructed, in which a substrate mount with three samples (size 20 × 20 mm^2) could be moved as well in the position for evaporation in the evaporator as later on in the vacuum chamber for quantum efficiency measurements. For substrate heating before and during CsI deposition halide lamps were mounted above the substrate position and the temperature is controlled by a spring loaded thermocouple which touches the substrate mount at the position for evaporation.

We wanted to try the laser plasma ablation process also for the preparation of CsI films to improve the quantum efficiency. The motivation for this was driven by some features of the laser plasma ablation process as experienced