PO1052

Study on the correlation of process parameters and plasma density in PIAD employing active plasma resonance spectroscopy

Jens Harhausen[1], Moritz Oberberg[2], Sina Malobabic[3], Rüdiger Foest[1], Lars Mechold[3], Peter Awakowicz[2], Ralf Peter Brinkmann[4]

[1]Leibniz INP, Greifswald, Germany [2]AEPT, Ruhr University, Bochum, Germany [3]Laser Components GmbH, Olching, Germany [4]TET, Ruhr University, Bochum, Germany

harhausen@inp-greifswald.de

Most applications in photonics greatly rely on optical components which ensure specific spectral properties. In this context, optical interference coatings (OIC) of high quality are key elements, enabling for the refining of optical components with functional coatings like anti-reflectives, high-reflectives or filters. A versatile method for the manufacturing of OICs is plasma ion assisted deposition (PIAD), which is commonly understood as the combination of electron beam evaporation and the densification of the growing film by means of a plasma ion beam. Present concepts of process control only affect the operating parameters and deposition parameters, while there is no access to gain insight on plasma conditions. Fluctuations and deviation of plasma conditions due to long term drifts cannot be detected with common monitoring techniques of thin film properties but affect the quality, reproducibility and yield of PIAD processes.
A promising diagnostic tool for monitoring of the plasma state is active plasma resonance spectroscopy (APRS). The recent implementation of a multipole resonance probe (MRP) offers a process compatible approach to measure electron density (n_e) during deposition. In this contribution, we present an installation of a pair of MRPs in an industrial box coater, allowing access to both, magnitude and changes in lateral distribution of n_e near the substrate plane. The sensitivity of the MRP has been evaluated and the impact of various operating parameters on n_e has been assessed appropriately. The interdependency of lateral distribution of n_e and homogeneity of layer properties across the radial coordinate of the box coater at nominally constant level of plasma assistance is discussed based on single layer experiments of TiO_2 and Ta_2O_5.
The work is based on funding by the German Federal Ministry of Education and Research (BMBF) under grants 13N13208, 13N13212 and 13N13213.

Keywords
PIAD
APRS