OR2203

APS Ion Source Characterization and Modelling

Diana Tonova[1]

[1]Carl Zeiss Jena GmbH, Oberkochen, Germany

tonova@zeiss.de

The APS-Source (Advanced Plasma Source) has been developed by the company Leybold Optics as plasma source for the PIAD (Plasma and Ion Assisted Deposition) technology. The accelerated ions, produced from the APS, increase the packing density of the growing film and allow the production of dense stoichiometric optical coatings with low absorption. It is known, that the main parameters, which determine the film properties by an ion assisted coating process, are the space and the energy distribution of the ion current density. In order to optimize the coating properties, it is necessary to know the relationship between the ion flux parameters and the operational parameters of the APS source. In the present study, the Design of Experiments (DOE) methodology is applied for the development of an empirical model for the calculation the ion flux parameters as a function of the space coordinates, of the bias voltage, of the discharge current, of the argon fluxes of the APS source and of the oxygen flux in the case of a reactive deposition. The space distribution of the ion current density is represented as a $\cos^n/R^2$ - function, where R is the distance between the point of the measurement and the APS source. The power coefficient n is a function of the APS operational parameters, which results from the fitting of the measured data to a polynomial model. The ion energy distribution, measured with a Faraday-Cup, exhibit two distinct peaks: one at the energy, approximately equal to the bias voltage, and one at the energy of about 10 eV. The measured ion energy spectra are parameterized through a sum of three Gauss-Functions. The Gauss-Functions parameter dependence on the APS operational parameters is obtained from their fitting to polynomial models. The developed characterization and modeling procedure allows the prediction of the ion current density and the ion energy for different APS-process parameters and could be applied for the better understanding, modeling and optimization of different coating properties (density, absorption, stress, homogeneity etc.).

Keywords
plasma and ion assisted deposition
advanced plasma source
ion current profile
ion energy distribution
DOE modeling