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Determination of Electron and Ion Energy Distribution Functions in a Plasma Ion Assisted Deposition (PIAD) Process[1] J. HARHAUSEN, R. FOEST, A. OHL, Leibniz Institute for Plasma Science and Technology — High performance optical coatings are commonly produced by PIAD in order to achieve comparably high deposition rates. Here, the plasma source is a hot cathode direct current discharge with an auxiliary magnetic field (APS). Its design is such to generate a population of fast ions to be released into the deposition chamber. A detailed understanding of the plasma properties in the chamber is mandatory to increase the level of uniformity and reproducibility of the deposition process. In order to determine the electron and ion energy distribution functions (EEDF,IEDF) the concepts of the Langmuir probe, the retarding field energy analyzer and optical emission spectroscopy are employed. Fundamental findings are that the EEDF can be described in the framework of the non-local approximation and that the degree of ionization inside the APS is close to unity. The shape of the IEDF and its evolution along the beam path can be described consistently by considering charge exchange reactions with the background neutral gas and the profile of the plasma potential.

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