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Plasma assisted deposition of metal fluorides for 193nm applications MARTIN BISCHOFF, MAIK SODE, DIETER GAEBLER, NORBERT KAISER, ANDREAS TUENNERMANN, Fraunhofer IOF Jena — The ArF lithography technology requires a minimization of optical losses due to scattering and absorption. Consequently it is necessary to optimize the coating process of metal fluorides. The properties of metal fluoride thin films are mainly affected by the deposition methods, their parameters, and the vacuum conditions. Until now the best results were achieved by metal boat evaporation with high substrate temperature and without plasma assistance. In fact, it was demonstrated that the plasma assisted deposition process results in optical thin films with high packing density but the losses due to absorption were extremely high for deep and vacuum ultraviolet applications. This paper will demonstrate that most of the common metal fluorides can be deposited by electron beam evaporation with plasma assistance. In comparison to other deposition methods, the prepared thin films show low absorption in the VUV spectral range, high packing density, and less water content. The densification of the thin films was performed by a Leybold LION plasma source. As working gas, a variable mixture of fluorine and argon gas was chosen. To understand the deposition process and the interaction of the plasma with the deposition material, various characterization methods like plasma emission spectroscopy and ion current measurements were implemented.

Martin Bischoff
Fraunhofer IOF Jena

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