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## LARGE AREA PRECISION OPTICAL COATINGS BY PULSE MAGNETRON SPUTTERING

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Pulse magnetron sputtering is very well suited for the deposition of optical coatings. Due to energetic activation during film growth, sputtered films are dense, smooth and show an excellent environmental stability. Films of materials like SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Nb<sub>2</sub>O<sub>5</sub> or Ta<sub>2</sub>O<sub>5</sub> can be produced with very little absorption and scattering losses. Therefore they are well suited for precision optics.

In this paper, FEP's coating plant PreSensLine, a deposition machine dedicated for the development and deposition of precision optical layer systems will be presented. The coating machine (VON ARDENNE GmbH) is equipped with dual magnetron systems (type RM by FEP). Concepts regarding machine design, process technology and process control as well as in situ monitoring are presented to realize the high demands on uniformity, accuracy and reproducibility. Results of gradient and multilayer type precision optical coatings are presented.

Examples of application are edge filters and special antireflective coatings for the backlight of 3D displays with substrate size up to 300x400mm. X-ray amorphous Si layers were deposited as polishing layers for EUV lithography. Moreover, the machine allows deposition of rugate type gradient layers by rotating a rotary table with substrates between two sources of the dual magnetron system.

By combination of the precision drive (by LSA) for the substrate movement and a special pulse parameter variation during the deposition process (available with the pulse unit UBS-C2 of FEP), it is possible to adjust the deposition rate as a function of the substrate position exactly. Based on this, the aim of a current development is a technology for the uniform coating of 3D-substrates and aspheres as well as laterally graded layers.

### Keywords

pulse magnetron sputtering  
precision optics  
multilayers  
gradient layers