# Real-time manipulation of Ag thin film growth studied by GISAXS

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Silver thin films are used in a number of applications (e.g., transparent and conductive electrodes and plasmonic devices) which require a continuous layer with thickness of a few nanometers. However, Ag films grown by magnetron sputtering have the tendency to form 3D-structures on weakly interacting substrates, what prevents their application as transparent and conductive layers. It is reported that the use of gas additives (particularly N2 [1]) allows for obtaining a continuous layer at earlier deposition stage.

Using a combination of real-time techniques (grazing incidence small-angle x-ray scattering (GISAXS), grazing incidence diffraction (GID), and substrate curvature measurements) [2, 3] we can access the continuous changes in dynamics of the thin film structure formation. It was reported that application of gaseous N2 at the early stages of the growth suffices to achieve faster continuity [1]. We get a deeper insight into the impact of N2 on the growth mechanisms by investigating the growth with N2 flux varying during the deposition and determining a time-dependent evolution of the nano-clusters size and distribution. We supplement these findings by the results provided by laboratory diagnostic tools. For example, x-ray photoelectron spectroscopy (XPS) gives additional information on the chemistry of the substrate (nitradation) and as-grown layer. We will discuss the impact of nitrogen additive on all growth stages (from initial stages of island nucleation, growth, and coalescence, up to formation of percolated and continuous films).Acknowledgements: The work is performed within the frame of the ANR-DFG project IRMA (491224986).

**References**

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