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## Optical monitoring of sputtered ultrathin TiN films

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The plasmonic applications require search for novel materials with metal-like optical properties and low optical losses. Transition metal nitrides exhibit metallic properties depending on a concentration of free-carriers of charge. Their plasmonic properties can be controlled by the film structure and the stoichiometry. In this work, we deal with the study of the growth process of TiN films. The films are grown by RF magnetron sputtering on fused silica, silicon and MgO substrates at a substrate temperature ranging from 20°C to 500°C. The growth process is monitored using in-situ spectral ellipsometer in a spectral range from 245 to 1690 nm. The ellipsometric data are analysed using mathematical models based on Drude-Lorentz oscillators describing the interband transitions and free-electron behaviour. The number of physical parameters such as free-electron concentration, Drude relaxation time and electrical conductivity is estimated at each stage of the deposition process by analysis of dielectric functions. Special attention is devoted to the initial nucleation stage when the free-electron behaviour is significantly influenced by the interface between the substrate and the TiN film. The prepared TiN coatings are analyzed using infrared ellipsometer operating in the spectral range from 1.7μm to 30μm where the optical functions are the most significantly influenced by free-electron behaviour. The obtained results are compared with those obtained by Van der Pauw and Hall effect measurement. The TiN film structure, chemical bonding and composition are analysed by X-ray Photoemission Spectroscopy and Energy Dispersive Spectroscopy, respectively. The surface morphology is studied using Atomic Force Microscopy and Scanning Electron Microscopy.

**Keywords**
titanium nitride
spectral ellipsometry
optical monitoring