Optical spectroscopy of surfaces, thin films and nanostructures

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Conceptually very simple optical methods, namely Reflectance Difference Spectroscopy (RDS/RAS) and Differential Reflectance Spectroscopy (DRS), can provide valuable insight into the structure and growth of ultrathin films in straight correlation with their electronic, optical and other physical or chemical properties. Notably, these *differential* optical spectroscopies can achieve sub-monolayer sensitivity and are capable of monitoring kinetic processes on surfaces in real time. This will be illustrated in selected examples dealing with the fabrication and optical characterization of functional layers, such as reconstructed surfaces [1], graphene nanoribbons [2] and ultrathin molecular films [3,4]. While the spatial resolution in the UV-VIS range is naturally limited, microscopic information on the structure and electronic properties can be obtained from complementary surface science techniques such as STM and Photoemission Electron Microscopy (PEEM). As an outlook, I will describe how optical spectroscopy and PEEM can be combined into a single experiment, thus enabling truly parallel optical spectroscopy and photoelectron microscopy at a local scale [5,6].

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