INFRARED SPECTROSCOPIC ELLIPSOMETRY OF SiO_2 TRAPEZOIDS AND BIOHYBRID SiO_2/PROTEIN INTERFACES

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Infrared spectroscopic ellipsometry yields in-situ information about the micrometer-sized surface structure and surface chemistry of components relevant for solar cells, LEDs, biotemplates and biosensors. While ellipsometric scatterometry is already established in the UV/VIS spectral range for the integrated circuit industry, our approach combines the investigation of micrometer-sized periodic structures with the analysis of molecular vibrations [1, 2].

We measured the Mueller matrices of trapezoidal SiO_2 columns on Si with periods from 10 to 20 μm in both lateral directions (Fig. 1.). The modeling by Rigorous Coupled Wave Analysis shows good agreement for two different azimuth angles of sample rotation and geometrical lengths which correspond to SEM results. Moreover, simulations suggest that the off-diagonal Müller matrix elements are especially sensitive to variations of the azimuth angles and the trapezoidal baseline length.

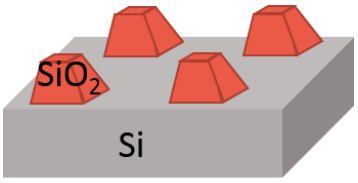

Fig. 1. Sketch of SiO_2 trapezoids

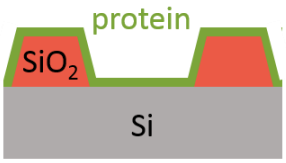

Fig. 2. Cross section of protein coated SiO_2 stripes

To describe a system with a biohybrid interface, micrometer-sized lamellar SiO_2 gratings were produced on Si and coated with a nanometer-thin monolayer of human serum albumin (HSA, protein, Fig. 2.). The infrared ellipsometric spectra were recorded before and after the protein coating. The comparison of the spectra shows geometrical characteristics as well as protein related vibrational peaks which, in principle, can elucidate the secondary protein structure.

Keywords: Infrared Ellipsometry; Scatterometry; Mueller Matrix; Biohybrid Interface

References

[1] H.T. Huang, F.L. Terry, Thin Solid Films 455-456 (2004) 828-836.
[2] C. Walder, M. Zellmeier, J. Rappich, H. Ketelsen, K. Hinrichs, Applied Surface Science 416 (2017) 397-401.