OPTOFLUIDIK PLATFORM FOR ENHANCED IR MICROSCOPIC SENSING

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An optofluidic platform for in situ enhanced infrared (IR) microscopic biosensing is presented enabling structural and chemical analysis of biomolecules in nanoliter samples. The platform combines enhancement substrates and microfluidic chips of arbitrary material and is designed for applications in conventional IR microscopes. [1] Metallic island film covered templates for Surface Enhanced IR Absorption (SEIRA) exhibit a specific enhancement behaviour. For quantitative evaluation the surfaces were characterized by UV-VIS ellipsometry, IR Ellipsometry/Microscopy and AFM-IR.

Potential applications for the developed optofluidic platform are lab-on-chip, organ-on-chip, cell analytics, bio-analytics or diagnostics. In situ IR spectroscopy enables label free and non-destructive molecular identification and can provide detailed information on interactions and reactions *e.g.* changes in protein folding or receptor-ligand interactions. The presented optofluidic platform circumvents the challenge of strong IR absorption of common polymeric materials used for microfluidic chips employing a single-reflection geometry under non-ATR (attenuated total internal reflection) conditions. This development allows for the usage of commercially available chips facilitating the application of the method. Utilization of optimized enhancement substrates of metal island films [2] offers a signal enhancement by a factor of 10-100.[3]

Submonolayer sensitivity of the developed platform is demonstrated by studying the formation of 1.2 nm thin monolayer of the tripeptide glutathione (GSH) in an aqueous environment. The potential to study interactions and reactions at the solid–liquid interface is shown by monitoring chemical changes in the monolayer as response to changes in environmental pH. Time-resolved (2.5 min) measurements of GSH monolayer formation show that dynamic processes can be monitored in situ. The determined detection limit of 0.03 nmol/cm^2 emphasize the potential of the platform in biosensing applications as well as in the study of dynamic processes *e.g.* enzymatic reactions, receptor–ligand interactions or conformational changes of molecules due to environmental stimuli with sub-monolayer sensitivity under in situ conditions.

Keywords: metal island films, infrared ellipsometry/microscopy, submonolayer, nanoliter, sensing

References

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