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## Real-Time GISAXS Analysis for Functional Film Development

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Responsive nanostructured films from amphiphilic lipids hold significant potential for applications in food, pharmaceutical, and biotechnological sciences. For instance, the amphiphilic lipid glycerol monooleate can be used to form antimicrobial coatings [1,2]. Lyotropic liquid crystalline films based on glycerol monooleate are also interesting as nanoreaction environments, drug delivery platforms, and biosensors. However, the nanoscale structural changes and orientations that such films undergo on surfaces during changes in composition or chemical reactions are not yet fully understood.

This presentation discusses the creation and analysis of mesostructured lipid films. We utilize in situ time-resolved grazing incidence small-angle X-ray scattering (GISAXS) to investigate the formation and transformation of film structure, orientation on the surface, and dynamics upon variation in composition and during chemical reactions. We demonstrate the formation of food-grade glycerol monooleate/triolein coatings on glass and silicon wafers without prior surface modification, employing ethanol as a coating solvent to achieve ultra-low contact angles [3]. Using a GISAXS sample platform, we examine the effects of composition, humidity, drug loading, and chemical reactions on the coating nanostructure. Our latest results, combining in-situ GISAXS with ellipsometry and confocal Raman microscopy studies, show the enzymatic hydrolysis of glycerol-lipids in aqueous enzymatic solutions, leading to swelling of the internal film nanostructure and eventual structural transformations [4]. Additionally, we analyze novel enzyme-responsive coatings and nanoreaction platforms to study polymerization reactions [5]. These findings highlight the role and application of lipid self-assembly in thin films for the functional modification of various substrates.

### References:

- [1] Stefan Salentinig, Mahsa Zabara, Pietro Parisse, and Heinz Amenitsch, *Phys. Chem. Chem. Phys.*, 2018, 20, 21903-21909
- [2] Mahsa Zabara, Qun Ren, Heinz Amenitsch, and Stefan Salentinig, *ACS Applied Bio Materials*, 2021, 4, 5295-5303
- [3] Stefan Salentinig, Mahsa Zabara, WO/2020/035483 - ANTIMICROBIAL COATINGS
- [4] Rafael Freire et al., manuscript in preparation, status 2024.
- [5] Meron Debas et al., manuscript in preparation, status 2024.

### Please select the related topic from the list below

Instrumentation and methods

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