

GISAXS with S3-MICRO

Solid-Supported Aligned Nanostructures Probed by Laboratory GISAXS.

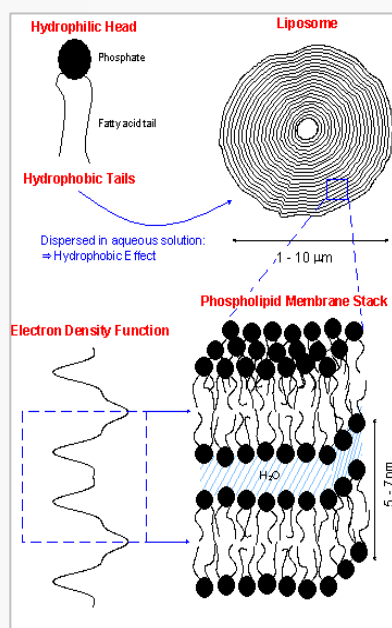
Supramolecular self-assemblies of amphiphilic molecules or surfactant mediated mesoporous materials can be deposited as ordered nanostructure films on planar solid surfaces (e.g. Si-wafers).

GISAXS enables

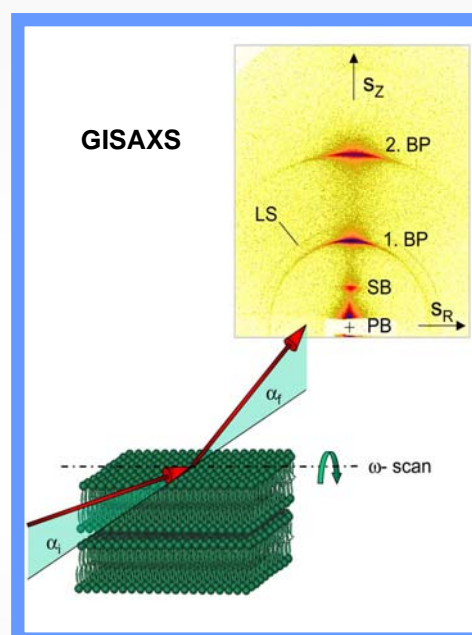
- Routine assessment of quality and regularity of solid-supported nanostructures
- Assessment of structural phase-transitions at changing temperature, pressure or hydration
- Assessment of the preservation of nanostructures' orientational order with respect to solid surface it is attached to, after phase transitions

Recently we also succeeded in performing GI-SAXS experiments with a compact laboratory based SAXS camera (Hecus S3-MICRO) equipped with a dedicated sample holder and a 2D CCD-detector.

The Principle



When membrane lipids are dispersed in water they form multilamellar liposomes (in bulk solutions) or oriented stacks when deposited on solid supports (Si-wafer).



PB: Primary beam (blocked)

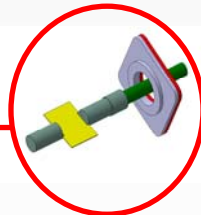
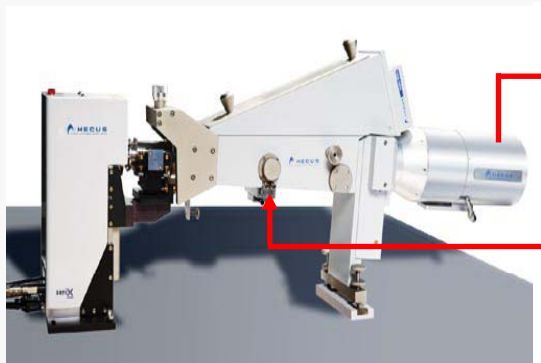
SP: Specular Peak ($2\alpha_i$ with respect to the incident beam)

BP: Bragg Peak (from oriented multilayer stacks)

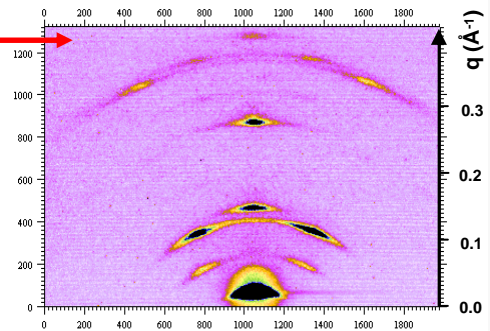
LS: Liposome scattering (from unoriented liposomes)

A monochromatic X-ray beam is directed on a planar surface with a very small incident angle α_i with respect to the surface. The surface can be rotated in small angular increments normal to the incident beam (ω -scan). The scattered intensities are recorded in the s_z and s_r direction (in-plane and out-of plane scattering).

S3-MICRO & GISAXS-Measurements



GISAXS-sample holder



The compact **S3 MICRO System** is based upon:

- based upon point-focus beam delivery system
- working at a max. power of 50W
- working with S3-camera architecture and with
- 2D SAXS- and 1D WAXS detectors

With monochromatized Cu-radiation ($\lambda = 1.54 \text{ \AA}$) a resolution of $d = 2000 \text{ \AA}$ can be achieved.

2D-GISAXS diffraction pattern of the surface-aligned lipid (DOPC, dioleoyl-PC) deposited on a Si-wafer ($12 \times 3 \text{ mm}$) and placed with the sample holder in the focused X-ray beam. The GISAXS pattern of the lipid (in the dry state under vacuum) was obtained with the Hecus S3-MICRO system equipped with a 2D SAXeye CCD-detector. Exposure time was 10 min, X-ray power: 50 W.

A Wide Range of Sample Environments

- ⇒ **RheoCap: Flow-through capillary cell**
- ⇒ **SpinCap: powder or liquid sample rotation**
- ⇒ **Window cell for pastes and powders**
- ⇒ **GISAXS attachment for grazing-incidence SAXS**
- ⇒ **High pressure cell up to 1 Kbar (100 Mpa), optional**