In-situ Grazing Incidence Small-Angle-Xray-Scattering Studies Using High Brilliance Microfocus Sources

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Grazing Incidence Small Angle Scattering (GISAXS)

Measures diffuse scattering in reflection geometry of grazing incidence (θs) and grazing reflectance (θr) angles

Diffuse scattering contains information about
- surface and subsurface structure
- island dimensions and 3-D arrangements
- roughness
- pore diameter

Advantages:
- non-destructive, allowing inspection of buried clusters and interfaces
- in contrast to microscopy average over sample surface/volume
- working under all conditions (enables in-situ screening/control)
- changing the incidence angle controls the penetration depth

Disadvantages:
- transformation from reciprocal to real space needs an appropriate model
- we always measure statistical averages over ensemble of entities

The potential of our microfocus source IµS in GISAXS studies in the home-lab is demonstrated in an overview of representative experimental setups and results. The studies take advantage of the brilliance and outstanding beam quality of the low-maintenance IµS. It is shown how the IµS can be used to achieve excellent results in the investigation of in-situ thin film deposition in UHV chambers by using GISAXS or of the structure of oriented two-dimensional liquid crystalline samples.

In-situ GISAXS during thin film growth

By using in-situ GISAXS in the home-lab we investigated how multilayers grew during thin film deposition. This kind of experiments is typically done only at synchrotrons. With an IµS it is now possible to perform GISAXS measurements during thin film growth in a home-lab environment.

In-situ GISAXS of Nano-particles on liquid surfaces

GISAXS measurements were performed with the IµS/Dectris system at the Institute of Physics at the Slovak Academy of Science in Bratislava. Silver particles on a langmuir film were analyzed at different surface pressures which were applied by means of a reduction of the surface area.

Upgrading Existing Diffractions with the Incoatec Microfocus Source IµS

You have a Bruker AXS, Marcresearch, Nonius, Rigaku, Huber or some other system? Incoatec offers a unique possibility to upgrade your existing diffractometer by installing the high-performance, air-cooled and low-power microfocus source IµS.

Your upgrade benefits:
- No maintenance, only single phase power and water cooling required
- 3 years warranty
- Maximum installation down time of only 2-4 days
- New safety concept development on request
- Full compliance with European Machinery Directive 2006/42/EC

Your upgrade options:
- Source, optics and scatterer slits
- Single source upgrade for XRD, XRF, CFIDAX and many more applications
- Dual wavelength setup by adding IµS as complementary source
- Cu, Mo, Ag, Co and Cr radiation (others on request)

In-situ GISAXS of metal films on graphene

This method revealed kinetics of Cu cluster growth on graphene.

It allows rapid optimization of metal deposition processes in laboratory conditions.

Further growth studies of Au, Ag,… on graphene surface are in progress.

In-situ Grazing Incidence Small-Angle-Xray-Scattering (GISAXS) setup in Hamburg

The three generations of IµS, IµS 5.0 and IµS 2.0

GISAXS reciprocal space map of the 40 x Mo/Si multilayer mirror with period 0.9 nm

GISAXS plots show the perfect growth of the multilayers. Even thin films with a total thickness in the range of 15 nm could be measured. The time resolved evolution of the specular signal enables the measurement of the Bragg peaks and the Kiessig Fringes dynamically.

In-situ Grazing Incidence Small-Angle-Xray-Scattering (GISAXS) measurements at the Institute of Physics at the Slovak Academy of Science in Bratislava.