ISSRNS 2010: Abstracts / Synchrotron Radiation in Natural Science Vol. 9, No. 1 – 2 (2010)

APPLICATIONS OF SAXS AND GISAXS IN BIONANOTECHNOLOGY

H. Amenitsch *

Institute of Biophysics and Nanosystems Research, Schmiedlstr. 6, A-8042 Graz, Austria

Keywords: small angle scattering, grazing incidence, self-assembly, fast chemical reactions

**) e-mail: amenitsch@elettra.trieste.it*

Small Angle X-ray Scattering (SAXS) has developed as a powerful working horse in almost all synchrotrons in the world. Its fundamental strength is the capability of *in situ* investigations for all states of matter - gas, liquid and solid – as well as probing materials in bulk, surface sensitive (grazing incidence SAXS) or with high local spatial resolution (scanning SAXS).

This presentation should summarize the current state of the art investigating self-assembly processes *i.e*. watching molecules *in situ* to form nano(bio)materials or the *in-situ* response of supramolecular structures to physical/chemical parameter changes as temperature, stretch *etc*. Some highlights of the current research covering the fields of life sciences till nanomaterials will be discussed and will include the above mentioned application areas of the SAXS and GISAXS technique. The examples will range – to name just a few – from self-assembly of nanotubes in form of helical ribbons [1], *in-situ* study of the formation of mesoporous materials on surfaces as well as in solution [2], to self-assembly of nanoparticles [3].

At the same time, for advanced studies on nanomaterials, the integration of *in-situ* chemical and physical perturbation technicques into the experimental set-up is a prerequisite. Some sophisticated instrumental developments like ultrafast mixers with µs-resolution [4,5], *in situ* aerosol reactors [6], or optical tweezers [7] are presented with adequate examples.

References

[1] C.V. Teixeira, *et a*l., "Formfactor of a N-layered helical tape and its application to nanotubeformation of Hexa-peri-hexabenzocoronene based molecules", *J. Appl. Crystallogr*. (2010), accepted.

[2] D. Grosso, *et al*., "Periodically ordered nanoscale islands and mesoporous films composed of nanocrystalline multimetallic oxides", *Nature Mater*. **3** (2004) 787.

[3] R. Viswanatha, *et al*., "Growth mechanism of cadmium sulfide nanocrystals", *J. Phys. Chem. Le*tt. **1** (2010) 308.

[4] B. Marmiroli, *et al*., "Free jet micromixer to study fast chemical reactions by small angle X-ray scattering", *Lab on Chip* **9** (2009) 2063.

[5] W. Schmidt, *et al*., "Accessing ultrashort reaction times in particle formation with SAXS experiments: ZnS precipitation on the microsecond time scale", *JACS* (2010) 10.1021/ja101519z.

[6] I**.** Shyjumon**,** *et al*., "Novel in situ setup to study the formation of nanoparticles in the gas phase by small angle x-ray scattering", *Rev. Sci. Instrum.* **79** (2008) 43905.

[7] D.Cojoc, *et al*., "Scanning x-ray microdiffraction of optically manipulated liposomes", *Appl. Phys. Lett*. **91** (2008) 234107.