Proceedings of the XIV International Conference on Small-Angle Scattering, SAS-2009



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# Editorial

## Proceedings of the XIV International Conference on Small-Angle Scattering, SAS-2009

There are 52 papers in these Proceedings. The papers are divided into 10 thematic sections and a section for invited papers and reviews. The sections and the respective section editors are given below.

| *Section* | *Editor(s)* |
|---|---|
| Invited Papers and Reviews | Peter Griffiths, Wim Bras, Rudolf Winter |
| Beamlines and Instrumentation | Elliot Gilbert, Wim Bras, Nigel Rhodes |
| Theory, Data processing and Modelling | Jan Skov Pedersen, Carlo Knupp |
| Biological Systems and Membranes | Richard Heenan, Cameron Neylon |
| Ceramics, Glasses and Porous Materials | Rudolf Winter |
| Colloids and Solutions | Peter Griffiths |
| Hierarchical Structures and Fibres | Steve Eichhorn, Karen Edler |
| Metallic and Magnetic Systems | Armin Hoell |
| Polymers | Patrick Fairclough |
| Time resolved Diffraction, Kinetic and Dynamical Studies | João Cabral, Christoph Rau |

We are grateful to all section editors and the many anonymous referees for their invaluable effort which made the publication of the Proceedings possible. The refereeing process was strict and thorough, some papers were rejected and most were improved. The resulting compendium gives a good overview of recent developments in small-angle X-ray and neutron scattering theory, application, methods of analysis and instrumentation. Thus it should be a useful source of reference for a number of years to come. The papers are a good reflection of the material presented at the meeting. Because of the general high quality of the articles, it was difficult to decide which to highlight and be fair to all contributors. The following in particular have caught the attention of the editors.

### Highlighted papers

A statistical survey of **publications** reporting the application of SAXS and SANS by Aldo Craievich (paper 012003) is recommended reading for anyone needing convincing about the vibrancy of this scientific field and the ever expanding use of these techniques. Two aspects of **coherent X-ray scattering**, made available by the advent of the 3$^{rd}$ generation synchrotron sources, are discussed in the papers by Felisa Berenguer and the Diamond/UCL team (012004) and by Birgit Fischer and the DESY/Rostock team (012026). The former describe their effort to reconstruct the image of wet collagen tissue from the speckled pattern of a narrow transmitted beam and complement the results of imaging by scanning SAXS. Fischer et al. utilize the coherence of the X-ray beam in the photon correlation spectroscopy mode to determine the dynamic structure factor, from which the $q$-dependence of the relaxation times was determined for solutions of charged colloidal particles. The nature of particle motion was thus determined, i.e. ballistic at lower concentrations vs. restricted by "caging" at higher concentrations. The use of scanning **microbeam**

 

**diffraction** was also described in the paper by the group of Peter Fratzl (012031), who combined it with tilting the sample in order to obtain what is referred to as 3D SAXS. In this way the orientation distribution of crystallites in callus tissue during bone fracture healing can be explored. Naoto Yagi et al. (012024) used microbeam SAXS and WAXS to study dental enamel crystals in a caries lesion.

**Anomalous**, or resonant, X-ray scattering at low angles (ASAXS) was employed by Guenter Goerigk and Norbert Mattern (Jülich / Dresden) (012022) to study phase separation in the ternary alloy Ni-Nb-Y. Experiments were performed near the K-absorption edges of the three elements and the authors describe how they determined quantitatively the chemical composition of the different separate phases as well as short-range concentration fluctuations during spinodal decomposition. For organic materials, where heavy atoms are not present, typically sulphur would be replaced by Se, so ASAXS could be performed near the Se K-edge. However, Masashi Handa et al. from the University of Tokyo report in paper 012006 a feasibility study of using sulphur itself as the label. They deal with the challenging task of using low-energy X-rays at the sulphur K-edge.

Alexandra Vasilieva and teams from St Petersburg and Moscow describe in paper 012029 a study of a FCC/HCP photonic crystal with a unit cell of 650 nm using the DUBBLE beamline at ESRF, where the incident beam is focused with a compound Berilium lens to give divergence in the **microradian** range. Defects, correlation lengths, mosaic spread and twinning could be studied in a thin film. The use of grazing incidence small- and intermediate-angle X-ray scattering (**GISAXS**) was illustrated on several examples of complex liquid crystal phases and nanoparticle systems by Xiangbing Zeng and the team from Sheffield in paper 012032. Apart from the intrinsic interest in the structure of thin films of these materials, the close proximity of the surface imposes usually a very high degree of preferred orientation, facilitating structural analysis.

From the papers describing the use of neutron scattering, we highlight the study by Léon van Heijkamp and the Delft group, paper 012016, which describes proof-of-principle experiments using **spin-echo SANS** (SESANS) for the study of $D_2O$-labeled liposomes and their destruction with a view of providing a nondestructive technique for monitoring targeted drug delivery for the destruction of tumor tissue. This technique is based on monitoring the decay of spin polarization of scattered neutrons, and it can probe correlation lengths from nanometres to tens of microns.

In paper 012002 Thomas Zemb discusses the various ways in which **SAXS and SANS** data can be combined to investigate microemulsions of surfactants lacking long-range order. Thus, for example, it is described how form and structure factors can be separated, or how the degree of connectivity can be determined between rod-like entities forming “molten cubic” or “sponge” phases.

In the **Theory, Data Processing and Modelling** section we highlight two papers. Paper 0122012, by Carlos Cabrillo and co-workers from Madrid, presents a real-space model for powder samples of relatively highly ordered colloidal particles based on the radial pair distance distribution function. The model takes account of different types of disorder, i.e. of both 1$^{st}$ (“thermal”) and 2$^{nd}$ (“paracrystalline”) kind, as well as finite size, stacking and orientational disorder. In paper 012014 Salvino Ciccariello works out the 3D correlation function of plane objects, specifically a triangle of a general shape. This paves the way to analysing morphologies that can be approximated by cylinders of different cross-sections.

Papers 012051 (Polte et al.) and 012047 report the use of SAS in combination with **X-ray spectroscopy**. Ristic et al. describe a real-time study of **crystal nucleation** induced by ultrasound (012049), while Marianne Imperor-Clerc et al. present an investigation of lyotropic **liquid crystals under shear** (012052). In the **Polymers** section Geoff Mitchell describes modelling of SANS data on electrospun fibres (012042), while Cabral et al. describes a study of nanoparticle aggregation in bulk and thin polymer films (012046). Work on **phospholipid membranes** was reported by Spinozzi et al. and by Onai et al. in papers 012019 and 012018, respectively. The latter deals with the effect of osmotic pressure on model "lipid rafts", these being considered as having an important role in the function of the mammalian cell membrane. Readers interested in **biological** systems will find a number of other interesting papers describing the use of either SAXS or SANS in the **Biological Systems and Membranes** section. A number of descriptions of recent designs of SAXS (synchrotron) and SANS beamlines, as well as detector developments can be found in the section on **Beamlines and Instrumentation**.

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