

Tests experiments will be reviewed, such as the COXINEL one [21].

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L-07

Session B, Tuesday, 14.06., 9⁰⁰ - 9⁴⁰

Structure and long-range-order in colloidal self-assembly

A. V. Petukhov^{1,2*}

¹*van 't Hoff laboratory for physical and colloid chemistry, Debye Institute for nanomaterials science, Utrecht University, the Netherlands*

²*Laboratory of physical chemistry, Eindhoven University of Technology, the Netherlands*

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*e-mail: a.v.petukhov@uu.nl

Colloids are able to self-assemble into various structures with periodicity on the scales ranging from nanometres to about a micron. They are widely recognized as an important model system to study nucleation phenomena in freezing, melting and solid-solid phase transitions, jamming and glass formation. In addition, colloidal crystals are attractive for multiple applications since they can be used as large-scale low-cost templates to fabricate novel materials with unique optical properties such as the full photonic bandgap, 'slow' photons and negative refraction, as well as materials for application in catalysis, biomaterials and sensorics.

Nowadays small-angle X-ray scattering (SAXS) is widely recognised as an indispensable structure characterisation tool at the mesoscopic scales. Recent developments of synchrotron sources and X-ray detectors provide a very fast and effective tool to study colloidal crystals and their real-time development. The high penetration power of X-rays makes SAXS applicable to almost all system types. In addition, the intrinsically low contrast of all materials for X-rays ensures, in the vast majority of cases, a high quality of the scattering data that is free of multiple scattering contributions. SAXS also gives access to a broad range of spatial scales from a nanometre to microns. Moreover, as will be discussed in more detail in the lecture, microradian resolution can be achieved using synchrotron sources and refractive optics [1]. This provides access to periodicities up to several microns. Moreover, positional correlations on distances up to submillimetre can be accessed from the width of diffraction peaks measured with microradian resolution.

The results will be illustrated by a number of examples. In particular, the structure of rhombic crystals spontaneously formed by cubic colloids with rounded corners will be discussed [2,3]. Another example will be the transition to a lower-symmetry body-centred tetragonal structure in a system of magnetic core-shell spherical colloids, which is induced by dipole-dipole interactions between colloids [4]. A short overview of some of our studies of lyotropic colloidal liquid crystals spontaneously formed by highly anisometric colloidal particles [5,6] will be given. Finally, in-situ studies of the self-organization of semiconductor quantum dots of different shape

at a liquid interface [7-9] using grazing-incidence SAXS will be illustrated.

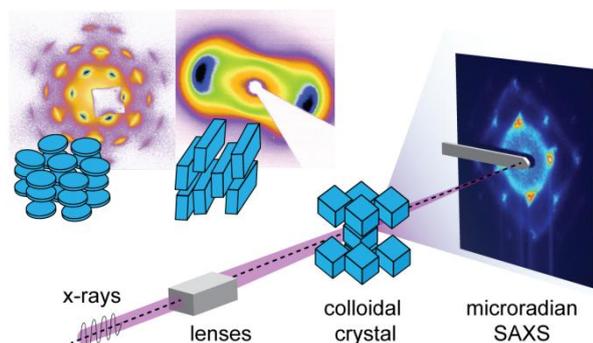


Figure 1. Schematic principle of microradian x-ray diffraction setup and examples of diffraction patterns measured in (from left to right) columnar crystals of colloidal gibbsite platelets, biaxial nematic phase of goethite boards, and crystals of hematite colloidal superballs (=cubes with rounded esges).

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L-08

Session B, Tuesday, 14.06., 9⁴⁰ - 10²⁰

Molecular single-ion magnets: Harnessing molecule-surface interactions

J. Dreiser^{1*}

¹Swiss Light Source, Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland

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*e-mail: jan.dreiser@psi.ch

Single-molecule magnets (SMMs) [1,2] are molecular complexes containing transition metal or lanthanide ions, which exhibit slow relaxation of their magnetization. SMMs and their mononuclear counterparts, molecular single-ion magnets (SIMs) [3,4] are attractive building blocks for potential molecular spintronics and quantum information processing devices. One route toward construction of such devices is the deposition of SMMs and SIMs on flat surfaces [4–6].

In this contribution I will show several examples of such molecule-inorganic hybrid structures studied by low-temperature, high-field x-ray magnetic circular dichroism (XMCD) as well as by scanning tunneling microscopy (STM). I will point out possible caveats that can occur when SMMs and SIMs are removed from their native molecular crystal environment and put into the hostile environment of an inorganic surface. I will highlight the importance of the molecule-surface interaction for the magnetic properties of the surface deposited molecules. Furthermore, I will demonstrate that by careful choice of the surface a significant improvement of the magnetic properties compared to the bulk molecular crystal can be achieved.

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