MI 10: Crystallography in Nanoscience (KR jointly with MI)

Time: Thursday 11:00–11:45 Location: CHE 184

MI 10.1 Thu 11:00 CHE 184

Structure and dynamics of functional guest complexes in porous matrices — •Dominik Schaniel[1], Kuan-Ying Hsieh[1], El-Eulmi Bendeif[1], Axel Gansmuller[1], Sebastien Pillet[1], and Theo Woike[2] — [1]Université de Lorraine, CRM2, UMR 7036, Vandoeuvre-les-Nancy — [2]Institut für Strukturphysik, TU Dresden

The inclusion of functional molecules in nanostructured matrices is a very active field of research due to the potential applications of such hybrid materials, e.g. in optics, catalysis, or even medicine [1-4]. As a key to the understanding of the properties the structure of the host-guest system must be known. We have synthesised such nanohybrids by encapsulation of photoswitchable complexes ($Na_2[(Fe(CN)_5NO]2H_2O$, SNP) into porous silica matrices with different pore sizes from 1 nm to 20 nm. The structural study has been performed using total scattering methods coupled to pair distribution function analysis (PDF) and nuclear magnetic resonance (NMR). The PDF analysis allows for the determination of the structural arrangement of the isolated SNP complexes (cation- anion) as well as the size of the embedded cluster/nanoparticle. NMR reveals a dynamical behaviour of the guest complexes which depends on the hydration level of the matrix.
[1] Sanchez et al., Adv. Mater. 2003, 15, 1669 ; Vinu et al., J. Nanosci. Nanotec. 2005, 5, 347. [2] Deniz et al., Chem. Eur. J. 2012, 18, 15782. [3] Blecher et al., Nanomedicine : Nanotechnology, Biology, and Medicine 2012, 8, 1364. [4] T.-W. Sung, Y.-L. Lo, Sensors and Actuators B : Chemical 2012, 173, 406.

MI 10.2 Thu 11:15 CHE 184

Crystallization behaviors of n-octadecanol on the surface of silica nanosphere — •Yunlan Su[1,2], Xia Gao[1], Dujin Wang[1], and Patrick Huber[2] — [1]Key Laboratory of Engineering Plastics, Institute of Chemistry, Chinese Academy of Sciences, Beijing, China — [2]Materials Physics and Technology, Hamburg University of Technology, Hamburg, Germany

Geometrical confinement of materials on the nm-scale is known to have an impact on many physical properties. For example, phase transitions can be entirely suppressed or significantly altered in comparison to their bulk counterparts and the molecular dynamics can be affected markedly, especially in the vicinity of glass transitions. In the work, we designed n-octadecanol/SiO2 nanosphere (d = 90 nm) composites and studied the crystallization behaviors of C18H37OH in nanosized space formed by SiO2 nanospheres by DSC and variable-temperature X-ray diffraction (VT-XRD). The transition temperatures for confined C18H37OH are lower than for bulk C18H37OH; In addition, under confinement, the low temperature ordered phase has changed, probably due to the suppression of mobility of molecular chain. While bulk C18H37OH exhibits a crystalline phase of γ form, geometrical confinement favors a mixture of γ and β phases. Geometrical confinement favors a phase closely related to the β form, in which the crystallites with an orthorhombic subcell and chain axes are parallel to the bilayer normal are formed. A reason for this might be the confinement effect, into which the crystallites have to fit, favoring the formation of the geometrically more simple and less bulky form.

MI 10.3 Thu 11:30 CHE 184

Mapping the velocity field around a micro-oscillator in water — •Spas Nedev[1], Sol Carretero-Palacios[1], Silke R. Kirchner[1], Frank Jäckel[1,2], and Jochen Feldmann[1] — [1]Photonics and Optoelectronics Group, Physics Department and Center for NanoScience (CeNS), Ludwig-Maximilians-Universität München, Amalienstr. 54, 80799 Munich, Germany — [2]Department of Physics and Stephenson Institute for Renewable Energy, University of Liverpool, Chadwick Building, Peach Street, Liverpool, L69 7ZF, United Kingdom

Optical trapping in combination with microfluidics provides novel analytical and sensing capabilities. Here we show an experimental and theoretical approach to detect and map the velocity field around a micro-oscillator in water. Fluidic vibrations created by a micro-source, an optically trapped silica particle set to oscillate in a dipole-type mode, lead to displacement of another twin silica particle independently trapped in its vicinity acting as a detector. Fourier analysis of the motion of the detecting particle at different points in space and time provides the velocity map around the oscillating microsphere. The combination of measured velocity field and microfluidic theoretical models reveals that the measured fields are dominated by microfluidic contributions, with a significant acoustic contribution. The concept introduced here allows for the study of the fluidic and acoustic near fields close to micro-source in water. Furthermore it serves a basis for nano-positioning system for location and recognition of moving sources that may be applied to artificial micro-objects and living organisms.