CPP 42: New Instruments and Methods

Time: Thursday 11:30–13:00 Location: H39

CPP 42.1 Thu 11:30 H39

Design of neutron spin-echo spectrometers for ESS — •Stefano Pasini[1], Michael Monkenbusch[1], and Melissa Sharp[2] — [1]Jülich Center for Neutron Science, FZJ, Germany — [2]ESS AB, Lund, Sweden

Neutron spin echo (NSE) is the technique with the highest energy resolution for probing the dynamics of materials. Within the German European Spallation Source design update project, the Research Centre Jülich is optimizing a high-resolution (HRNSE) and a wide-angle neutron spin-echo (WANSE) spectrometer. The specifications of the polarization system will be analogous for both instruments: A straight, 8cmx8cm neutron guide with a comparatively short (~2.6m) polarizing bender or eventually a single polarizing mirror inducing a kink in the guide. A potential beam extension and focusing in horizontal direction for the WANSE is still under investigation. For the design of the magnetic layout of the HRNSE, we combined the active stray field compensation techniques used at the SNS-NSE, enabled by superconducting coils, and a coil-geometry optimization versus minimization of field-integral inhomogeneity, depolarization and stray-field. We found a solution with 3 times reduced intrinsic inhomogeneity of field integrals and low stray fields allowing for a working configuration up to 2Tm field integral. The limitations of the correction elements will be partly resolved by the increased field homogeneity. The strategy of low intrinsic inhomogeneity has been pursued also for the WANSE. This should allow us to reach a resolution comparable with that of the current high resolution J-NSE@FRM-II.

CPP 42.2 Thu 11:45 H39

Combining advanced sputter deposition and GISAXS - new avenues for in-situ experiments — Ralph Doehrmann[1], Gunthard Benecke[1,2], Sebastian Bommel[1], Stephan Botta[1], Berit Heidmann[1], Gerd Herzog[1], Roman Mannweiler[1], Johannes Risch[1], Matthias Schwartzkopf[1], Gonzalo Santoro[1], Shun Yu[1], and •Stephan Volkher Roth[1] — [1]Deutsches Elektronen-Synchrotron (DESY), Notkestraße 85, D-22607 Hamburg, Germany — [2]MPI Colloids and Interfaces Golm, Abt. Biomat., Wissenschaftspark Potsdam-Golm, D-14424 Potsdam, Germany

Nanocomposite structures play an important role in organic photovoltaics. To elucidate their structure-function relationship and to tailor them on the nanoscale, in-situ investigations following their formation are mandatory. These investigations have to cover the nano/molecular level to the mesoscale domain. This necessitates the use of scattering techniques like small- and wide angle x-ray scattering. Sputter deposition often is the final step in producing an electric contact in organic photovoltaic devices. We present a novel in-situ sputter deposition chamber for grazing incidence small- and wide-angle x-ray scattering investigations using microfocused x-ray beams [1,2]. We present first results of in-situ metal sputter deposition on inorganic and polymeric surfaces, using its unique high-temperature annealing and high-throughput capacities. This allows for the first time combinatorial in-situ microbeam GISAXS investigations to scan the parameter range during sputter deposition. [1] Roth et al., J. Phys: Cond. Matter 23, 254208 (2011) [2] Buffet et al., J. Synchr. Radiation 19, 647 (2012)

CPP 42.3 Thu 12:00 H39

Nanocharacterization of Organic Semiconductors using NanoXAS, a Combined Scanning Transmission X-ray Microscopy/Scanning Probe Microscopy instrument — Peter Warnicke[1], Nicolas Pilet[1], Benjamin Watts[1], Rainer Fink[2], Christoph Quitmann[1], and •Jörg Raabe[1] — [1]Paul Scherrer Institut, 5232 Villigen, Switzerland — [2]Univ. Erlangen-Nürnberg, 91058 Erlangen, Germany

Properties of organic semiconducting materials are strongly linked to the interplay between chemical composition and microstructure. As techniques providing simultaneous information on these characteristics are lacking there is a great need for more complete characterization tools. Here we present a novel instrument (NanoXAS) which combines two powerful techniques, scanning probe microscopy (SPM) and x-ray absorption spectroscopy (XAS), in order to fully characterize organic semiconducting materials and devices. SPM can measure physical properties such as sample topography, elasticity, adhesion, or friction on lateral scales down to nanometers. XAS gives direct access to the local chemical composition, electronic structure, molecular orientation, order, and absolute density. The instrument consists of a SPM and a scanning transmission x-ray microscope (STXM) in a coaxial arrangement. A semi-transparent sample is scanned through the x-ray beam and the transmitted x-rays are detected by a photodiode or by a SPM tip thus enabling high-resolution imaging with element sensitivity. To demonstrate the function of the instrument we present measurements on polymers and polymer blends.

CPP 42.4 Thu 12:15 H39

Confocal and polarized μ-RAMAN Imaging-Spectroscopy as a tool for the estimation of crystallinity and orientation of iPP films and Pirouette rings — •Krisztina Vincze-Minya[1], Sabine Hild[1], Sibylle Jilg[2], and Reinhard Forstner[2] — [1]Institute of Polymer Science, Johannes Kepler University, Linz, Austria — [2]TCKT - Transfer Center for Polymer Technology GmbH, Wels, Austria

The morphology of iPP polypropylenes strongly depends on conditions of sample preparation. While stretching and temperature induced changes in polymer microstructure are widely explored the influence of shear stress is only sparsely investigated. Pirouette-dilatometer enable to prepare samples at defined temperature, pressure and cooling conditions may show local variations in crystallinity and orientation. Polarized confocal Raman microscopy (pCRM) will be used to investigate local variation crystallinity and orientation of iPP samples sheared by Pirouette-dilatometer. Therefore, pCRM imaging was applied on iPP cast and MDO films, which have an orientation measured via WAXS revealing the suitability of the method for the investigation of crystallinity and orientation with high spatial resolution. The Hermans orientation function was as well estimated and found to be also in good correlation with the WAXS data. Cast films: high depolarization ratio, low orientation, higher crystallinity degree. MDO films: low depolarization ratio, high orientation, lower crystallinity degree. The slow cooled Pirouette-samples have a lower crystallinity then the fast cooled samples, and the differences between the stretch and unstretched samples are also presented.

CPP 42.5 Thu 12:30 H39

Larmor precession in ultralow magnetic fields detected by Field Cycling NMR — •Benjamin Kresse — Institut für Festkörperphysik, TU Darmstadt, Hochschulstr. 6, 64289 Darmstadt

Field Cycling (FC) relaxometry is a powerful tool to measure the microscopic dynamics at a wide range of Larmor frequencies. Typically, the highest accessible magnetic field of about 1 Tesla is limited by the power of the magnet, while the low frequency limit is the noise of the current source. The present work deals with experiments in the low frequency range.

For reaching low magnetic fields in an FC experiment it is important to (i) compensate the earth field, (ii) avoid a zero field overshoot during the fast field switch from high to low field, (iii) stabilize the low field and (iv) measure the low field at the sample position.

Our way to solve these problems is to implement a set of five independently controlled coils into our home built FC magnet. This setup allows us to perform non-adiabatic field switch down to a low evolution field which is controlled by an active fluctuation compensation. In a series of test experiments the lowest stable magnetic field we reached and measured directly by Larmor precession of protons in a water sample was about 0.3 microTesla corresponding to $\nu_0(^1H) = 12$ Hz [B. Kresse, A. Privalov, F. Fujara / Solid State Nuclear Magnetic Resonance 40 (2011) 134-137]. With this setup it is also possible to measure T_1 and the evolution field combined in one and the same measurement.

CPP 42.6 Thu 12:45 H39

Pseudo-critical behavior of the static and the dynamic expansion coefficient at the volume phase transition of PNIPAM solutions as seen by Temperature Modulated Optical Refractometry — •Ralitsa Aleksandrova[1], Martine Philipp[1,2], Ulrich Müller[1], Roland Sanctuary[1], Peter-Müller Buschbaum[2], and Jan K. Krüger[1] — [1]Université du Luxembourg, LPM, Luxembourg, Luxembourg — [2]TU München, Physik-Department, LS Funktionelle Materialien, Garching, Germany

The volume phase transitions of aqueous PNIPAM solutions are in-

vestigated by the novel technique of Temperature Modulated Optical Refractometry (TMOR) as a function of temperature and time. In addition to the refractive index, TMOR yields information about the static and dynamic thermo-optical coefficient and eventually the static and dynamic volume coefficient of thermal expansion [1]. The observed pseudo-critical behavior of these physical quantities evidences a rather direct coupling to the order parameter associated with the collapse of the polymer coils. A preliminary interpretation with regard to the involved structural changes on mesoscopic and macroscopic scales is given based on these findings.

[1] M. Philipp, U. Müller, R. Aleksandrova et al., Soft Matter 8, 11387 (2012)