MM 15: Topical Session Nanoporous Functional Materials IV

Time: Tuesday 10:15–11:15 Location: IFW B

Topical Talk MM 15.1 Tue 10:15 IFW B

Fluidics with Nanoporous Solid-State Membranes: From Fundamental Physics to Applied Biology — •Patrick Huber — Faculty of Physics and Mechatronics Engineering, Saarland University, D-66041 Saarbrücken, Germany

Transport of fluids across nanopores plays a crucial role in phenomena ranging from clay swelling, frost heave, oil recovery and catalysis, to colloidal stability, protein folding and transport in cells and tissues. The advent of tailorable nano- and mesoporous membranes, most prominently arrays of carbon nanotube bundles, of silicon, silica and alumina channels, has led to a growing interest in fundamental and applied questions with regard to the transport phenomenology across this kind of nanostructures. After a short introduction into this sub-field of nanofluidics, I will present experiments on pressure-driven and self-propelled (capillarity-driven) transport of fluids in nanochannels and will highlight differences between nanoscopic and macroscopic transport principles. Finally, I will elucidate how protein translocation experiments across artificial nanochannel arrays may allow the exploration of the transport machinery at biomembranes.

MM 15.2 Tue 10:45 IFW B

Crystallization Kinetics Dictate the Molecular Arrangement in Nanochannels — •Anke Henschel, Klaus Knorr, and Patrick Huber — Saarland University, Saarbruecken, Germany

We present an x-ray diffraction study on the crystallization of chain-like molecules (medium length n-alkanes and n-alcohols) in arrays of lined up, tubular silicon and silica channels (mean channel diameters of 10 nm)$^{1-2}$.

The samples, prepared by capillary condensation or filling in the liquid state and subsequent cooling below the pore freezing point, exhibit diffraction patterns typical of significant, anisotropic orientation distributions of the pore crystals. The architectural principle common to all observed textures originates in a nano-scale version of the mechanism underlying the Bridgman technique of single crystal growth: Upon solidification of completely filled nanochannels the fastest, and hence dominant growth direction, propagates along the long axes of the channels and thereby dictates a distinct orientational arrangement of the molecular crystals.

(1) A. Henschel, T. Hofmann, P. Huber, K. Knorr, Phys. Rev. E 75, 021607 (2007).

(2) A. Henschel, P. Huber and K. Knorr, Phys. Rev. E 77, 042602 (2008).

MM 15.3 Tue 11:00 IFW B

Electrostatic Doping of Strongly Correlated Systems — •Ajay Kumar Mishra, Azad Darbandi, Robert Kruk, and Horst Hahn — Institute for Nanotechnology, Forschungszentrum Karlsruhe GmbH, P.O. Box 3640, D-76021 Karlsruhe, Germany

We present a study on the tuneable magnetic transitions using electrostatic doping (electrostatic modulation of the carrier density upon surface charging). In strongly correlated materials, like colossal magnetoresistance compounds (CMR), electrostatic doping can alter fundamental properties of the electronic system by inducing phase transitions.

Since the electrostatic doping is a surface effect a large surface-to-volume ratio is desired to get an appreciable modification of the physical properties. In order to obtain such nanostructures, La1-xSrxMnO3 (LSMO) nanoparticles were synthesized by spray pyrolysis. The microstructure of the as synthesized nanoparticles consists of porous, shell-like structures with a particle size of about 8 nm. The magnetic measurements of nanoparticles show superparamagnetic behavior at room temperature. A controlled post annealing was carried out to bring the ferromagnetic transition slightly above room temperature. The sharp transition and favorable surface-to-volume ratio is reached at annealing temperatures between 800-1100 0C, resulting in grain sizes ranging from 30 to 80 nm. A reversible change of 2 % in magnetization is observed when the charge is applied at the solid-electrolyte interface. The magnetization modulation upon charging is discussed in terms of the reversible electrostatic hole doping.