DS 2: Nanoengineered thin films

Time: Monday 12:30–13:30 Location: H 0111

DS 2.1 Mon 12:30 H 0111

Growth of strained, ferroelectric NaNbO3 thin films by pulsed laser deposition — •Jan Sellmann, Jutta Schwarzkopf, Andreas Duk, Albert Kwasniewski, Martin Schmidbauer, and Roberto Fornari — IKZ, Berlin, Deutschland

Due to its promising ferro-/piezoelectric properties and high Curie temperature NaNbO3 has attracted much attention. In contrast to bulk crystals, thin epitaxial films may incorporate and maintain a certain compressive or tensile lattice strain, depending on the used substrate/film combination. This deformation of the crystal lattice is known to strongly influence the ferroelectric properties of perovskites. In the case of NaNbO3 compressive strain is achieved in films deposited on NdGaO3 and SrTiO3 substrates while deposition on DyScO3 and TbScO3 leads to tensile in-plane strain. In order to characterize and practically apply the ferroelectric films, it is necessary to embed them in a capacitor structure for which we use pseudomorphically grown SrRuO3 as bottom electrodes. We report on the deposition of SrRuO3 and NaNbO3 single layers on SrTiO3, DyScO3, TbScO3 and NbGaO3 substrates by means of pulsed laser deposition. By adjusting the substrate temperature, the oxygen partial pressure and the laser frequency we have successfully deposited smooth, strained, single phase NaNbO3 thin films. Investigations of the films by atomic force microscopy and high resolution X-ray diffraction reveal the dependence of the surface morphology and the incorporated lattice strain on the deposition parameters and the lattice mismatch, respectively. All films exhibit piezoelectric properties, as proven by piezoresponse force microscopy.

DS 2.2 Mon 12:45 H 0111

Local control of molecular glass wrinkling by designed magnetic stray fields — •Henning Huckfeldt, Holger Klein, Florian Ahrend, Thomas Fuhrmann-Lieker, and Arno Ehresmann — Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), University of Kassel, Heinrich-Plett-Str. 40, D-34132 Kassel

An IrMn/CoFe exchange bias substrate has been patterned into artificial parallel stripe magnetic domains by ion bombardment induced magnetic patterning without topographic elevations. PMMA and CoFe were subsequently deposited on top of the exchange bias layer system. Thermal treatment induced internal stress in the viscoelastic/metallic layer combination, which relaxes by wrinkling.

The interaction of the local stray fields emerging from the domain walls between the artificial domains with the CoFe layer on top of the organic PMMA layer, leads to a directional wrinkling parallel and perpendicular to the magnetic domain walls of the substrate. A qualitative model has been developed to explain the observed local alignment of the wrinkles.

DS 2.3 Mon 13:00 H 0111

Guiding block copolymers into sequenced patterns via inverted terrace formation — •Sungjune Park[1], Larisa Tsarkova[1], Stephanie Hiltl[1], Stefan Roitsch[2], Joachim Mayer[2], and Alexander Böker[1] — [1]DWI an der RWTH Aachen e. V., Lehrstuhl für Makromolekulare Materialien und Oberflächen, RWTH Aachen University, D-52056 Aachen, Germany. — [2]Gemeinschaftslabor für Elektronenmikroskopie, RWTH Aachen University, Ahornstr. 55, D-52074 Aachen, Germany.

We present a facile one-step route to achieve sequenced patterns from microphase separated structures in asymmetric polystyrene-b-polybutadiene (PS-b-PB) diblock copolymer films. For the guided block copolymer assembly we used topographically corrugated SiCN ceramic substrates which were fabricated by a facile replication process using non-lithographic PDMS masters. Homogeneous block copolymer films have been floated onto the corrugated substrate without significant changes to the corrugations topography. During thermal annealing of PS-b-PB diblock copolymer, the material transport was guided by a wrinkled substrate to form regular modulations in the film thickness. As a consequence of the thickness-dependent morphological behavior, the film surface appears as sequenced patterns of alternative microphase separated structures. The ordering process is attributed to a newly observed phenomenon of inverted terrace formation which is induced by the corrugations on substrate, so that the resulting surface patterns are free from the surface relief structures within macroscopically large areas.

DS 2.4 Mon 13:15 H 0111

Ultraschall unterstützte Deposition von kolloidalen Kristallen — •Sabine Wollmann, Hubert Krenner, and Achim Wixforth — Universität Augsburg, Universitätsstraße 1, 86159 Augsburg

Colloidal crystals are a versatile system to realize templates and masks for etching and deposition processes or to realize photonic band gap materials. We present investigations on ultrasonic assisted deposition of colloidal crystals employing surface acoustic waves. For this, droplets of an aqueous solution of polystyrene beads with diameters ranging from 0,5 μm to 3 μm are drying under surface acoustic wave agitation. The beads show a periodical arrangement after the water is evaporated. By means of optical diffraction we study in-situ the resulting colloidal films for different colloid concentrations, evaporations rate of the solvent and the pulse width and amplitude of the surface acoustic wave. We present first results on an improved formation of ordered domains and a control of the nucleation site within the droplet under acoustic agitation.