DS 1: Thin Film Properties

Time: Monday 10:00–11:00 Location: H3

DS 1.1 Mon 10:00 H3

Ultra-thin lithium fluoride on Ag(100): growth and morphology — •Vladyslav Romankov and Jan Dreiser — Swiss Light Source, Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland

Thin films of lithium fluoride (LiF) are of high interest for spintronic applications [1], and they can be potentially used as decoupling layers for single-molecule magnets [2] and other molecules. In the present work we show that two strikingly different morphologies of LiF/Ag(100) can be achieved by keeping the Ag substrate at two different temperatures during the deposition of LiF.

Polarized X-ray absorption spectroscopy, scanning tunneling microscopy and low energy electron diffraction reveal that LiF grows epitaxially, preferring a vertical growth over the layer-by-layer growth. At room temperature LiF forms anisotropic strained dendrites with branches parallel to the [011] and [0$\bar{1}$1] directions of the substrate. Conversely, at a substrate temperature of 500 K LiF assembles into more relaxed square islands displaying a Moiré pattern. The strong qualitative difference between the two morphologies makes LiF/Ag(100) an interesting model system to study the dependence of the growth kinetics on the temperature.

References: [1] A. J. Drew et al., Nature Materials, **8**, 109, (2009); [2] C. Wäckerlin et al., Advanced Materials, **28**, 5142, (2016).

DS 1.2 Mon 10:15 H3

Stacking fault fold and step junctions as nucleation sites of threading dislocations in III-nitride films — •Georgios Dimitrakopulos[1], Isaak Vasileiadis[1], Joanna Moneta[2], Polyxeni Chatzopoulou[1], Philomela Komninou[1], and Julita Smalc-Koziorowska[2] — [1]Physics Department, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece — [2]Institute of High Pressure Physics, Polish Academy of Sciences, Sokołowska 29/37, 01-142 Warsaw, Poland

III-nitride semiconductor heterostructures have been employed with great success in optoelectronic and electronic devices despite the high densities of threading dislocations (TDs) that they contain. In order to unlock the full potential of these materials, it is imperative to diminish the TD nucleation sites. We present a mechanism of TD nucleation taking place at folds and steps of basal stacking faults (BSFs), particularly intrinsic I1 BSFs, that are frequent in (0001) epilayers due to their low self-energy. In-depth analysis by transmission electron microscopy (TEM) revealed that TD introduction is geometrically necessary at nodes of Shockley-like partial dislocations (PDs) at such BSFs. These PDs have the same Burgers vectors as normal Shockley PDs but exist only at junctions of the two variants of the BSF stacking sequence. In I1 BSF overlaps, the introduction of Frank-Shockley PDs is avoided, thus eliminating the elastic strain along the growth direction. Overlapped BSFs were observed to form hexagonal closed domains in which the coexistence of PD segments makes TD nucleation energetically favorable.

DS 1.3 Mon 10:30 H3

Cellulose nanofibrils as sustainable template material for thin silver nanowire electrodes fabricated via spray deposition — •Marie Betker[1,2], Constantin Harder[1,3], Elisabeth Erbes[1,4], Matthias Schwartzkopf[1], Andrei Chumakov[1], Daniel L. Söderberg[2], and Stephan V. Roth[1,2] — [1]Deutsches Elektronen Synchrotron, Notkestrasse 85, 22607 Hamburg, Germany — [2]KTH Royal Institute of Technology, Teknikringen 8, 10044 Stockholm, Sweden — [3]Physik-Department E13, Technische Universität München, James-Franck-Str. 1, 85748 Garching, Germany — [4]Institute for X-ray Physics, Goettingen University, Friedrich Hund Platz 1, 37077 Goettingen, Germany

Cellulose nanofibrils (CNFs) are wood-based, lightweight, and flexible, making them suitable for the fabrication of sustainable composite materials. With spray deposition the preparation of thin, homogenous CNF films of large scale and with an low roughness as well as their functionalization with e.g. nanoparticles is possible. We use CNF as a sustainable template material for the fabrication of two different types of thin silver nanowire (AgNW) electrodes via spray deposition: (I) A layered structure of a AgNW-network on top of a thin CNF layer and (II) a thin layer consisting of a mixture of CNF and AgNW. We compare the structural and electrical properties of both types using SEM, AFM, grazing incidence small angle X-ray scattering (GISAXS), and four-point measurements. The results demonstrate that type (II) is more conductive, leading to the conclusion that CNF has beneficial templating effects on the electronic properties of the AgNW network.

DS 1.4 Mon 10:45 H3

Epitaxial growth of $(Cr_{1-x}Fe_x)_2AlC$ MAX Phase thin films by pulsed laser deposition — •Hanna Pazniak[1], Marc Stevens[1], Martin Dahlqvist[2], Benjamin Zingsem[1,3], Johanna Rosen[2], Michael Farle[1,4], and Ulf Wiedwald[1] — [1]Faculty of Physics and Center for Nanointegration (CENIDE), University of Duisburg-Essen, Germany — [2]Thin Film Physics Division, Department of Physics, Chemistry, and Biology (IFM), Linköping University, Sweden — [3]Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons, Forschungszentrum Jülich, Germany — [4]Kirensky Institute of Physics, Federal Research Center KSC SB RAS, Russian Federation

MAX phase epitaxial thin films attract increasing attention with respect to high-temperature applications [1]. The partial substitution of M atoms in their nanolaminated structure is a promising way to tailor magnetic properties. In this study, we synthesized $(Cr_{1-x}Fe_x)_2AlC$ ($0<x<0.2$) epitaxial thin films by Pulsed Laser Deposition on MgO(111) and Al_2O_3(0001) at 600°C using pure elemental targets. By combining structural characterization and density functional theory, we explored the phase composition of synthesized $(Cr_{1-x}Fe_x)_2AlC$ solid solutions, finding a Fe solubility limit of 4 at.%. Excess Fe leads to the formation of the $(Cr,Fe)_5Al_8$ intermetallic secondary phase.

[1] M. Stevens, H. Pazniak, et al., MRL 9, 343 (2021).

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