O 55: Poster Session - Nanostructured Surfaces and Thin Films

Time: Tuesday 18:15–20:00 Location: P2/2OG

O 55.1 Tue 18:15 P2/2OG

Dynamic contact angles on adaptive surfaces — •Xiaomei Li, Simon Silge, Hans-Jürgen Butt, and Rüdiger Berger — Max-Planck-Institut for Polymer Research, Ackermannweg 10, 55128 Mainz, Germany

Adaptive surfaces change their physical-chemical properties due to the presence of a liquid or its vapor. Surface adaptation is predicted to be one cause for contact angle hysteresis [1]. We measured the dynamic advancing and receding contact angles of sliding drops on 1H,1H,2H,2H-perfluorooctyltriethoxysilane (PFDTES) surfaces and on polystyrene-poly(acrylic acid) (PS-PAA) copolymer surfaces using a home-built tilted plane setup. PFDTES surfaces as example for a non-adaptive surfaces were prepared by chemical vapor deposition. PS-PAA copolymer surfaces as adaptive surfaces were fabricated by spin-coating. Two modes of adaptation were investigated: velocity dependent contact angles which reflect adaptation time scales from 5 ms to 2 s and drop-wise adaptation for adaptation time scales >10 s. The velocity dependent contact angles are compared to predictions from the hydrodynamic and molecular kinetic theories. The latter potentially allows modeling of dynamic contact angles and contact angle hysteresis caused by adaptation processes. [1] Hans-Jürgen Butt, Rüdiger Berger, Werner Steffen , Doris Vollmer, Stefan A. L. Weber, Langmuir, 34, 11292 - 11304 (2018).

O 55.2 Tue 18:15 P2/2OG

Surface Modifications by Ion-Induced Plasma Expansion — •Ayman Sherif El-Said[1] and Waleed Moslem[2] — [1]Physics Department, Dhahran 31261, Saudi Arabia — [2]The British University in Egypt (BUE), Cairo, Egypt

The development of ion sources and accelerators technology offers a new window for the creation of surface nanostructures in an efficient and accurate way. These nanostructures are fabricated without any further chemical treatment, which is common in the traditional lithographic methods. The driving force for the production of nanostructures by single ion impact is mainly the energy deposition of the incident ion in the utilized material [1, 2]. Therefore, it is found that MeV C60 cluster ions enables the creation of nanohillocks of size larger than the ones produced by GeV monoatomic ions. Furthermore, slow highly charged ions were able to create nanostructures similar to the ones created by swift heavy ions [3, 4]. Here, we introduce plasma expansion as a new approach for elucidating the formation mechanism of ion-induced nanostructures [5]. The role of both potential energy and kinetic energy of the impinging ions for the creation of nanostructures by ion-induced plasma is discussed.

[1] E. Gruber, L. Bergen, P. Salou, E. Lattouf, C. Grygiel, Y.Y. Wang, A. Benyagoub, D. Levavasseur, J. Rangama, H. Lebius, B. Ban-d'Etat, M. Schleberger, F. Aumayr, J. Phys.: Cond. Mat. 30, 285001 (2018).
[2] O. Ochedowski, O. Osmani, M. Schade, B. K. Bussmann, B. Ban-d'Etat, H. Lebius, and M. Schleberger, Nat. Comm. 5, 3913 (2014).
[3] A.S. El-Said, R.A. Wilhelm, R. Heller, M. Sorokin, S. Facsko, F. Aumayr, Phys. Rev. Lett. 117, 126101 (2016).
[4] Richard A. Wilhelm, Ayman S. El-Said, Franciszek Krok, Rene Heller, Elisabeth Gruber, Friedrich Aumayr, Stefan Facsko, Prog. Surf. Sci. 90, 377 (2015).
[5] W.M. Moslem, A.S. El-Said, R. Sabry, A. Shalouf, S. K. El-Labany, H. Phys. Lett. A 381, 102 (2017).

O 55.3 Tue 18:15 P2/2OG

Growth of ultrathin single crystalline Bi(111) on Si(111) — •Jesper Moes, Jan Cuperus, Daniël Vanmaekelbergh, and Ingmar Swart — Utrecht University, Debye Institute for Nanomaterials Science, Utrecht, The Netherlands

The spin-orbit derived surface states of bismuth films are of great interest for spintronic applications. STM techniques are ideal for the investigation of its electronic properties. We have grown ultrathin Bi(111) films on a Si(111) substrate with atomically flat areas of up to 100nm x 100nm. The surface states were observed via differential conductance spectroscopy and scattering by point defects. Further insight is obtained by combining quasi-particle interference and density functional theory calculations.

O 55.4 Tue 18:15 P2/2OG

Rapid Water Permeation through Carbon Nanomembranes: Variation of Precursor Molecules and Substrates — •Dario Stierl, Hoang Linh Le, Michael Westphal, Niklas Biere, Yang Yang, André Beyer, Dario Anselmetti, and Armin Gölzhäuser — Faculty of Physics, Bielefeld University, 33615 Bielefeld, Germany

Carbon nanomembranes (CNMs) of ∼1 nm thickness are produced by electron-induced crosslinking of self-assembled monolayers (SAMs). Recently, a remarkably high water permeance in combination with a high selectivity has been achieved by 1.2 nm thick free-standing CNMs which originate from p-terphenylthiol (TPT) SAMs on gold substrates [1]. All tested organic solvents were blocked by this type of CNM down to the detection limit, which results in selectivity values of above 100. This contribution reports on water permeation measurements which investigate the effect of preparing CNMs on different substrates as well as varying the CNM precursor molecules. In particular, CNMs from TPT-SAMs on silver as well as p-quaterphenylthiol (QPT) monolayers on gold were studied by X-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM), helium ion microscopy (HIM) and liquid permeation measurements with the mass-loss method.

[1] Y. Yang *et al.*, *ACS Nano* **2018**, 12, 4695.

O 55.5 Tue 18:15 P2/2OG

Real-time observation of ion-induced surface nanopatterning on crystalline Ge(001) by in-situ GISAXS — •Denise Erb[1], Peco Myint[2], Kenneth Lutterodt-Evans[3], Karl Ludwig[2], and Stefan Facsko[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Germany — [2]Boston University, USA — [3]Brookhaven National Laboratory, USA

As a contact-less technique, GISAXS is well suited for in-situ and real-time investigation of surface self-assembly processes. We implemented a custom-made UHV sample environment for GISAXS at the ISR beamline of the NSLS-II synchrotron and observed the nanoscale pattern formation kinetics on a crystalline Ge(001) surface under ion irradiation. The Ge(001) surface is known to develop a nanoscale pit-and-mound pattern of faceted pyramidal structures under irradiation with 1 keV Ar+ ions at normal incidence. The edges of the pyramidal structures are aligned along the <100> and <010> direction, while their sidewall facets have a uniform polar tilt from the <001> direction. Such a regular surface morphology results in a GISAXS intensity distibution with distinct features. From the development of these features with ion fluence, we can conclude on the corresponding development of the surface morphology. Thereby, we directly monitor the lateral characteristic length as well as the polar facet angle as indicators of the kinetics of this ion-induced self-assembly process. The temporal development of these quantities is found to be in good agreement with results of numerical integration of the established continuum equation for surface height evolution under ion irradiation.