O 74: Nanostructures at surfaces: Other aspects

Time: Wednesday 16:45–18:30 Location: MA 141

O 74.1 Wed 16:45 MA 141

Asymmetric coupling on the chiral PdGa{111} surfaces — Samuel Stolz[1,2], Oliver Gröning[1], Harald Brune[2], and •Roland Widmer[1] — [1]Empa, nanotech@surfaces, 8600 Dübendorf, Switzerland — [2]EPFL, ICMP, 1015 Lausanne, Switzerland

Intermetallic PdGa exists in two enantiomeric crystal forms A and B due to its P213 space group and all its surfaces are chiral. Furthermore, the (111) and (-1-1-1) surface terminations of the same crystal form are structurally different. In particular, one is terminated by a single, isolated Pd atom (Pd1), while the other reveals isolated Pd trimers (Pd3). We demonstrated a 98% enantioselectivity of Pd1 and Pd3 by the adsorption of prochiral 9-Ethynylphenanthrene (9-EP) [1].

To profit from this high enantioselectivity we aimed to perform highly chiral asymmetric, covalent coupling reactions and have chosen an Azide-Alkine Huisgen Cycloaddition. Therefore, 9-EP as the alkine and 3-(4-Azidophenyl)propionic acid as the azide, were co-adsorbed on Pd1 and Pd3. The catalysed reaction is regiostereoselective on Pd1 and one out of four reaction products is favoured over the others yielding in an enantiomeric excess of up to 66%.

On the other hand, no reaction between 9-EP and the azide was observed on Pd3. Therefore, the reactivity for this particular reaction not only the depends on the d-band center, but much stronger on the surface geometry [2] as evidenced by the ensemble effect [1].

[1] J. Prinz, EPFL Thèse N°6337 (2014).

[2] J. K. Nørskov et al., Chem. Soc. Rev. 37 (2008) 2163-2171.

O 74.2 Wed 17:00 MA 141

Nanostructuring of dielectric surfaces by nanosecond laser irradiation — •Pierre Lorenz[1], Xiongtao Zhao[2], Martin Ehrhardt[1,2], Frank Frost[1], Joachim Zajadacz[1], Igor Zagoranskiy[1], Klaus Zimmer[1], and Bing Han[2] — [1]Leibniz-Institut für Oberflächenmodifizierung e. V., Permoserstr. 15, 04318 Leipzig, Germany — [2]Advanced Launching Co-innovation Center, Nanjing University of Science and Technology, 200 XiaoLingWei, 210094 Nanjing, Jiangsu, China

Nanostructuring of dielectric surfaces by nanosecond laser irradiationIndustrial utilisation of a laser-generated nano-structuring process requires a fast and cost-effective patterning approach. The so-called ISPM-LIFE (laser-induced front side etching using in-situ pre-structured metal layer) method allows the nanostructuring of dielectric surfaces in a two-step process: (i) a low laser fluence irradiation results in a nanopattern formation of the thin metal film, caused by laser-irradiation instabilities of the molten metal film and (ii) subsequent high-fluence laser pulses of those pre-structured metal pattern (e.g. holes in metal film, metal reticular-like structures and metal droplets) results in nanostructuring of the dielectric surface by *transferring* those metal patterns. The surface nanostructuring of fused silica and sapphire was studied with different nanosecond laser (wavelength 248 nm, 532 nm and 1064 nm using single and double laser pulses) and applying a thin metal layer (chromium and molybdenum with layer thicknesses from 10 nm to 50 nm). The intermediate and the final structures were investigated by AFM and SEM.

O 74.3 Wed 17:15 MA 141

Spin control induced by molecular charging in a transport junction — Sujoy Karan[1,2], •Carlos García[3], Michael Karolak[4], David Jacob[5,6], Nicolás Lorente[3,7], and Richard Berndt[1] — [1]Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, 24098 Kiel, Germany — [2]Institute of Experimental and Applied Physics, University of Regensburg, 93053 Regensburg, Germany — [3]Donostia International Physics Center (DIPC), Paseo Manuel de Lardizabal 4, 20018 Donostia-San Sebastián, Spain — [4]Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany — [5]Departamento de Física de Materiales, Universidad del País Vasco, UPV/EHU, Av. Tolosa 72, 20018 San Sebastián, Spain — [6]IKERBASQUE, Basque Foundation for Science, Maria Diaz de Haro 3, 48013 Bilbao, Spain — [7]Centro de Física de Materiales CFM/MPC (CSIC-UPV/EHU), Paseo Manuel de Lardizabal 5, 20018 Donostia-San Sebastián, Spain

We present experiments and calculations showing that the molecular electron affinity influences its spin transport. We use a scanning tunnelling microscope to trap a meso-substituted iron porphyrin, putting the iron centre in an environment that provides control of its charge and spin states. A large electron affinity of peripheral ligands is shown to enable switching of the molecular S = 1 ground state found at low electron density to S = 1/2 at high density, while lower affinity keeps the molecule inactive to spin-state transition. These results pave the way for spin control using chemical design and electrical means.

O 74.4 Wed 17:30 MA 141

Fabrication of micro-lenses on single-mode optical fibers by two-photon direct laser writing — •Sepideh Mazloomzadeh and Stefan Linden — Physics Institute, University of Bonn, D 53115

We report on the fabrication of different micro-lenses attached to the end facet of single-mode optical fibers using two-photon direct laser writing [1]. The lens types studied are plano-convex lenses and Fresnel lenses with diameters of several tens of microns. Such micro-lenses could be used in different applications such as laser to single mode fiber coupling or fiber to fiber coupling. We currently characterize the optical properties of the micro-lensed fibers and study the coupling efficiency and tilt effects.

[1] Timo Gissibl, Simon Thiele, Alois Herkommer & Harald Giessen, "Sub-micrometre accurate free-form optics by three-dimensional printing on single-mode fibres", Nat.Commun. 10,1038 (2016)

O 74.5 Wed 17:45 MA 141

Comparison of the switching behavior of 2D and 3D single molecules induced be mean of tip position and bias actions — •Loïc Mougel[1,2], Lukas Gerhard[1], Adam Gorczynski[1], Marcel Mayor[1,3], and Wulf Wulfhekel[1,2] — [1]Institut für Nanotechnologie, Karlsruhe Institute of Technology, 76344 Eggenstein-Leopoldshafen, Germany — [2]Physikaliches Institut, Karlsruhe Institute of Technology, 76131 Kasrlsruhe, Germany — [3]Department of Chemistry, University of Basel, St Johanns-Ring 19, 4056 Basel, Switzerland

Switching a molecule between different metastable states is interesting with regard to future applications in the field of molecular electronics.

We used scanning tunneling microscopy (STM) at temperature around 5K to study the switching behavior of individual tripodal organic molecules with a Tetraphanylmethane or a Triazine core within islands of different controlled order.

The molecules with different cores are three-dimensional or planar. They were deposited with a spraying and/or evaporation method on clean Au(111) surfaces. We were able to induce switching processes which allowed us to study the correlation of the switching behavior of neighboring molecules in threefold symmetric arrangement.

O 74.6 Wed 18:00 MA 141

Confined lattice dynamics in ultrathin Ge/Fe3Si/GaAs heterostructures — •Jochen Kalt[1,2], Małgorzata Sternik[3], Ilya Sergeev[4], Bernd Jenichen[5], Olaf Leupold[4], Ramu Pradip[1,2], Hans-Christian Wille[4], Przemysław Piekarz[3], Krzysztof Parlinski[3], Tilo Baumbach[1,2], and Svetoslav Stankov[1,2] — [1]1Laboratory for Applications of Synchrotron Radiation, Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]2Institute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany — [3]Institute of Nuclear Physics, Polish Academy of Sciences, Kraków, Poland — [4]Deutsches Elektronen-Synchrotron, Hamburg, Germany — [5]Paul-Drude-Institut für Festkörperelektronik, Berlin, Germany

We studied the phonon properties of ultrathin $^{57}Fe_3Si$ layers in Ge/$^{57}Fe_3Si$/GaAs heterostructures as a model system for lattice dynamics modifications in metal/semiconductor interfaces. Epitaxial $^{57}Fe_3Si$ layers with thicknesses from 2ML to 36ML were grown on GaAs(001) substrates and capped by a 4 nm thick amorphous Ge layer. Sample characterization with various methods showed the formation of epitaxial Fe_3Si nanostructures with perfect stoichiometry and high interface quality. Nuclear Inelastic Scattering was used to determine the iron-partial phonon density of states at room temperature as a function of layer thickness. While the phonon DOS of the 36 ML sample is fully reproduced by the ab initio calculated DOS of bulk Fe_3Si, significant deviations are observed for lower interface thicknesses leading to anomalies in the thermoelastic properties.

O 74.7 Wed 18:15 MA 141

Nonlinear optical Circular Dichroism from plasmonic Metasurfaces — •Bernhard Reineke[1], Guixin Li[1], Shumei Chen[2], Franziska Zeuner[1], Martin Weismann[3], Ventsislav Kolev Valev[4], Kok Wai Cheah[5], Nicolae Panoiu[3], Shuang Zhang[2], and Thomas Zentgraf[1] — [1]Department of Physics, University of Paderborn, Warburger Straße 100 D-33098 Paderborn, Germany — [2]School of Physics & Astronomy, University of Birmingham, Birmingham B15 2TT, UK — [3]Department of Electronic and Electrical Engineering, University College London, Torrington Place, London, WC1 E7JE, UK — [4]Department of Physics, University of Bath, Claverton Down, Bath, BA2 7AY, UK — [5]Department of Physics, Hong Kong Baptist University, Kowloon Tong, Hong Kong

Circular Dichroism is the unequal absorption of left and right circularly polarized light. This effect is weak in planar Metasurfaces. Alternatively, Second Harmonic Generation Circular Dichroism (CD) from planar Metasurfaces is more responsive, than its linear analogue. We report a strong nonlinear circular dichroism for Second and Third Harmonic Generation from specially designed plasmonic Metasurfaces. In the future, these results, together with cheaper fabrication methods for Metamaterials enable a greater freedom in designing nonlinear optical devices.