Leibniz-Institut
für
Oberflächenmodifizierung e. V.

BIANNUAL REPORT 2004/2005

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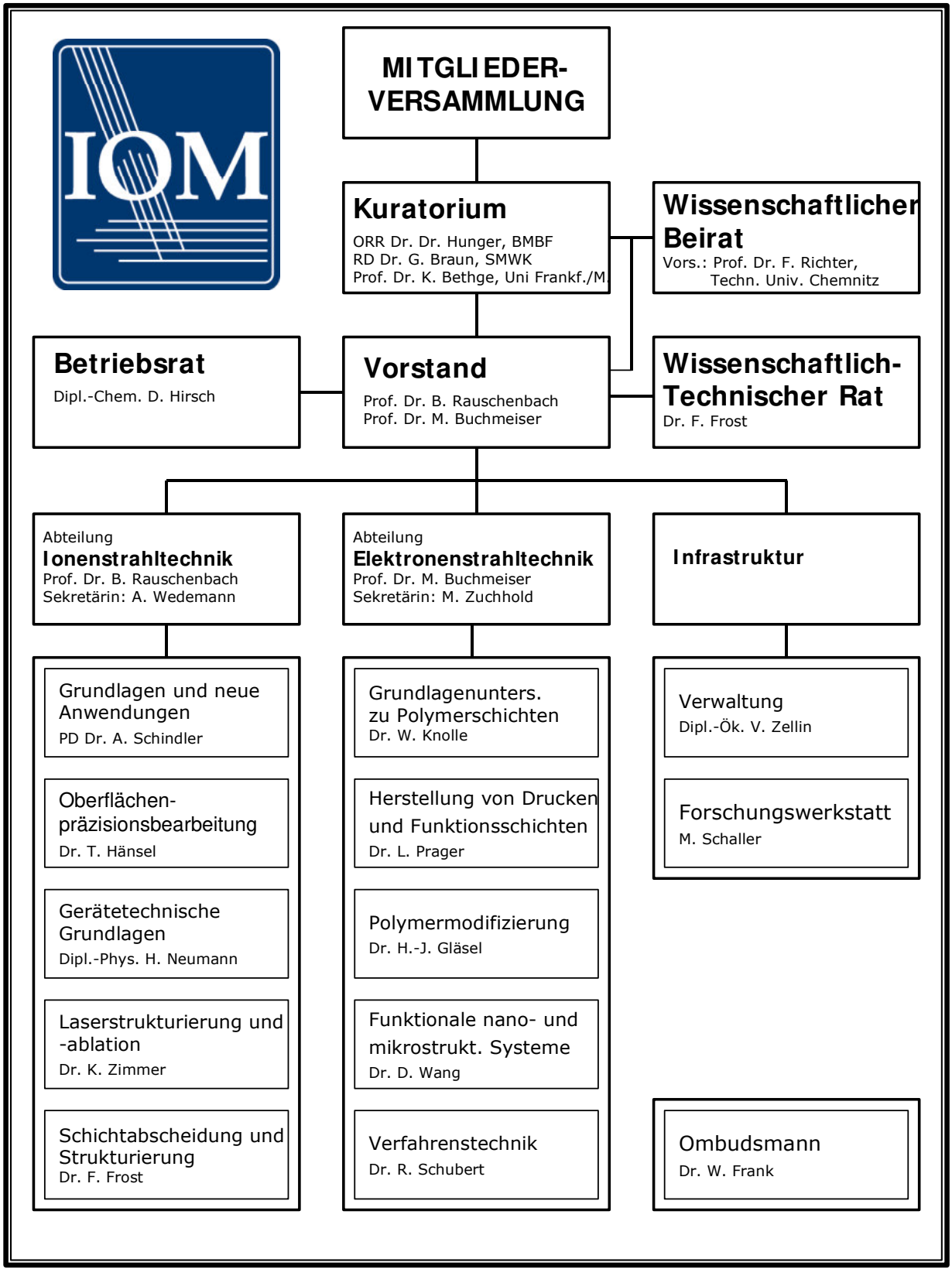


Contents

Preface

The Leibniz-Institut für Oberflächenmodifizierung e.V. (IOM) deals with application-oriented fundamental research in chosen areas of the modification of surfaces and thin films by pursuing complete lines from explorative fundamental research to the point of near-industrial applications.

The IOM has 47.5 permanent positions, including scientific, technical, and administrative personal. In average about 90 additional employees are funded from special programs as well as governmental and industrial projects. The IOM is a member of the Leibniz Association.

In its research, the IOM puts strong emphasis on collaborations with industry, small and medium enterprises, universities, and other research laboratories. The IOM also participates in joint projects directly funded by industry or Federal Agencies such as the BMBF or by the Free State of Saxony. Among extensive research other activities, the participation in DFG research units, and main focus programs should be mentioned. The last two years were again copious years for the commencement of new activities in this direction. The successful cooperation with chemical, optical, and semiconductor industry was continued. Results of both fundamental and applied research could be jointly transferred into industry.

In this report the IOM presents its scientific activities and major achievements in the years 2004 and 2005. In this context, the Biannual Report 2004/2005 presented here gives a comprehensive summary of our results. In the first part, overviews on selected projects are given, arranged according to the structure of the IOM research program. These overviews are supplemented by feature articles on selected topical highlights. Finally, the appendices give a full list of publications, talks, teaching activities, and other achievements of the IOM staff.

The Institute would like to thank all friends and organisations who supported its progress in the last two years. Special thank is due to our Board of Trustees and Scientific Advisory Board. Our partners from industry and other research institutes play an essential role for the IOM. The Board of the Institute would like to thank all members and guests of the institute for their active and excellent contributions to a successful development.

Leipzig, January 2006

Prof. Dr. Bernd Rauschenbach
Prof. Dr. Michael Buchmeiser

In January 2005 Rainer Mehnert has finished his professional activities in our Institute. He was a member of the Board of the IOM and the Head of the Electron Beam Department.
Very many thanks for his work at the IOM and our best wishes.

A warm welcome to our new colleague Michael Buchmeiser.
Since January 2006 he is a member of the Board of the IOM and the Head of the Electron Beam Department.
We are glad that he joined us and wish him success and good luck for his future.

In 2005 Axel Schindler received the Manfred von Ardenne Award from the Europäische Fördergemeinschaft für Dünne Schichten for his contributions to the transfer of the ultra-precision surface treatment into the industry.

Bashkim Ziberi received the Young Scientist Award of the European Material Research Society in the year 2004 for his studies to self-assembly processes on surfaces by ion beam erosion.

Scientific and Technology Results

Reports and Selected Results

Ultra-precision surface finishing by ion beam techniques

T. Hänsel, F. Frost, R. Fechner, A. Schindler

Introduction

Ion beam etching (IBE) and ion beam sputter deposition (IBSD) become more and more established in high precision surface processing for advanced optical, electronic, and mechanical products. In optics fabrication ion beam figuring (IBF) and ion beam smoothing (IBS) are able to overcome physical constraints of the conventional full lap and small tool abrasive polishing processes. This together with an accurate control of the removal rates and the high stability in time and shape of the ion beam of different size result in an efficient correction of low, mid, and high spatial frequency surface errors down to the sub-nanometer amplitude level with almost no or minimum surface or subsurface damage, respectively due to the gentle beam surface interaction. Reactive ion beam etching (RIBE) is an effective technique to transfer 3D resist mask micro- and nano-structures proportionally into hard optical materials, e.g. for nano-optics or diffractive optical elements.

Ion beam figuring

Present ion beam figuring technology development in the IOM [1,2] is aimed to correct surface errors of millimetre spatial size range and below nanometer dimension in height to meet the demanding requirements especially for lithography DUV, EUV, and synchrotron optics. Therefore we concentrate on the development of ion sources for stable and reliable long-term operation with rotationally symmetric Gaussian beam shape. We operate a 13.56 MHz RF-source with an 8 mm FWHM beam. This beam is reduced by diaphragms of different sizes to 2 mm, 1 mm and 0.5 mm FWHM, respectively. We used this source for the surface figuring of advanced synchrotron beam line optics very successfully [3].

IBF is performed by controlled scanning line by line across the surface with a dwell time distribution calculated by a deconvolution program proportional to the desired material removal depth distribution. For the adequate surface topology

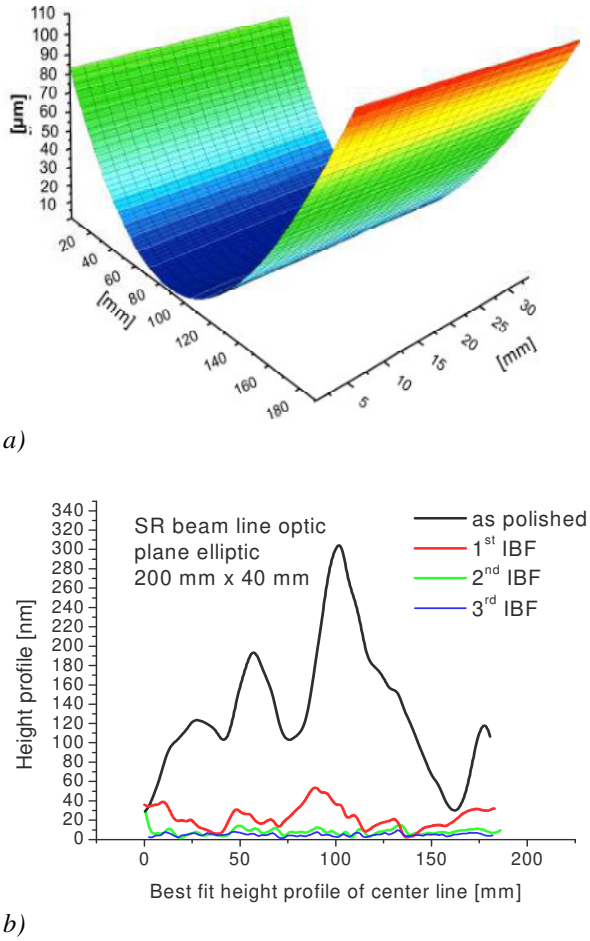
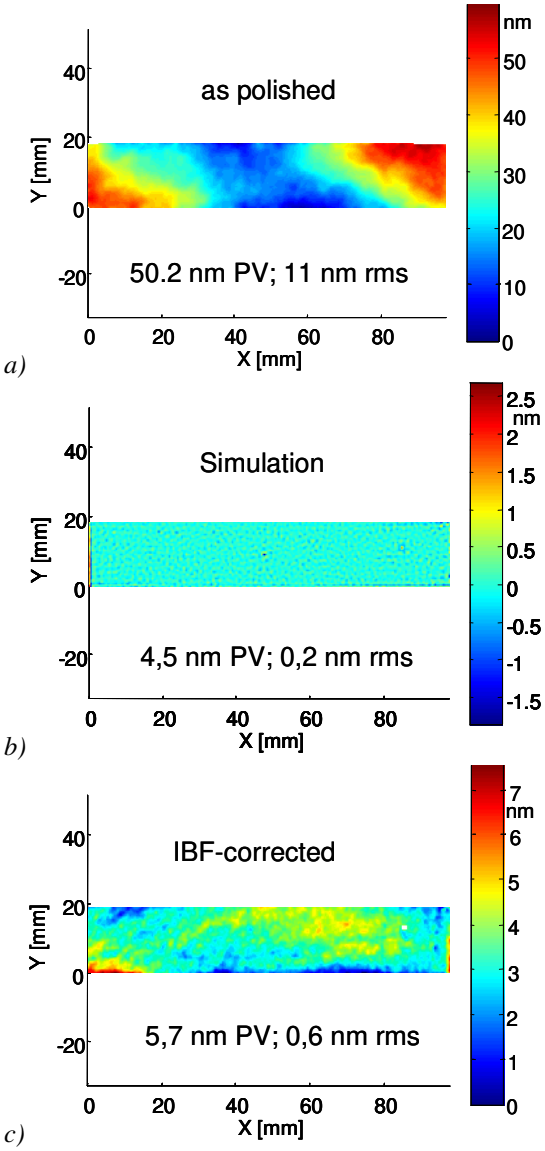


Figure 1: a) Pseudo 3D presentation of a plane-elliptical surface of a synchrotron-beamline optic stitched from seven adjacent sub-apertures with a 30 % overlap in one direction. Each sub-aperture interferogram was measured with a pixel distance of 0.082 mm, b) best fit height profiles of the plane elliptical mirror.

measurements of the asphere surfaces we developed a stitching interferometry method [4].

Figures 1 and 2 show recent results of ion beam polishing error correction of synchrotron beam line optics surfaces [3]. We used small spot ion beams down to a size of 2 mm FWHM to improve the surface figure in a sequence of IBF processing steps.



a)

b)

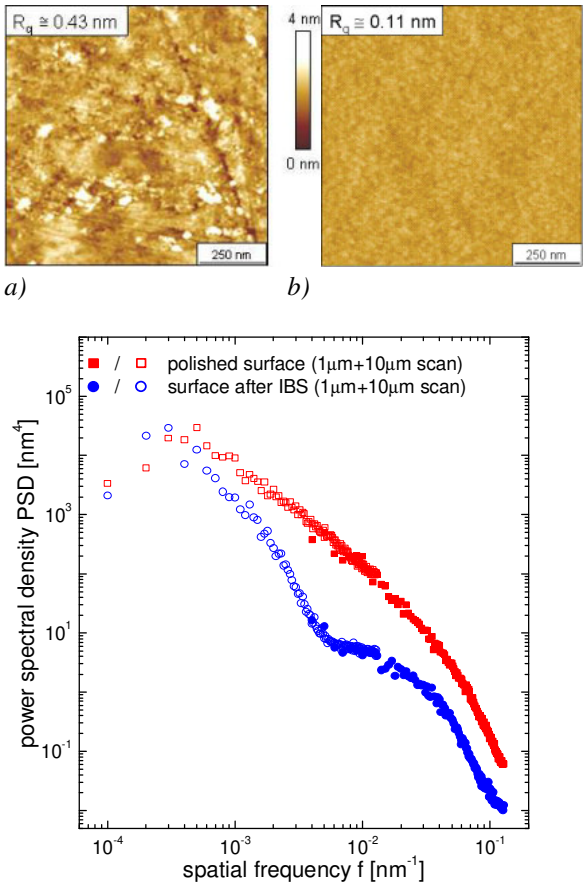
c)

Figure 2: a) Interferometer surface topology measurements of a 100 mx20 mm Si plane substrate for a synchrotron beam-line grating as polished, b) computer simulation result for the IBF surface error correction, c) interferometer surface topology measurement of the surface after IBF correction.

Ion beam smoothing

Detailed investigations have been conducted in the IOM for the use of the planarising film technique and the near normal incidence ion beam etching direct smoothing as single step techniques or both methods combined for optical surfaces smoothing [5].

Normal incidence ion beam etching direct smoothing is illustrated in Figure 3, where the surface of an as-received quartz wafer was



a) *b)*

c)

Figure 3: Ion beam direct smoothing of fused silica; a) optically polished; b) after Ar IBE (E_{ion}: 600 eV, α_{ion}: 0°, 300 nm material removal); the roughness has been reduced from 0.43 nm to 0.11 nm rms; c) angular averaged power spectral density for the surfaces shown gives evidence of smoothing for all spatial wavelengths grasped by the AFM (10^{-4}-0.128 nm^{-1}).

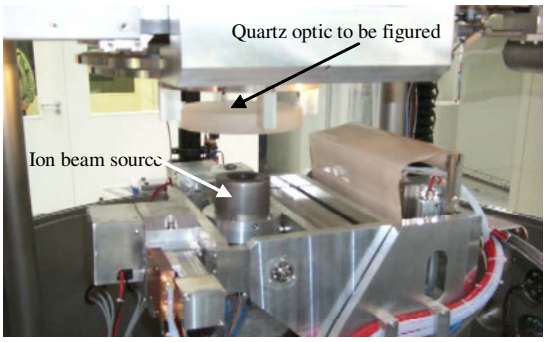
smoothed under optimised ion beam sputter conditions down to 0.1 nm rms roughness. Figure 3c shows that smoothing occurs over all spatial frequencies covered by the AFM measurements. We have demonstrated the smoothing of surface features resulting from magneto-rheological finishing on silicon surfaces [6] and of ion beam etched ZERODUR® [7].

Ion beam figuring plant

During the last three years we have developed and qualified IBF technology for the final machining of high performance optics components mature for production requirements.

The NTG/NTGL GmbH has developed a modular machine system by comprising three standard

a)



b)

Figure 4: a) Ion beam figuring plant UPFA1 at the class 100,000 clean room lab in the IOM, b) upper part of the process chamber has been lifted (for easy maintenance work); the five axis system with the ion source and the face down mounted optic on the carrier are shown inside the chamber.

units for the IBF and ion beam smoothing of optics up to 300, 450, and 700 mm in diameter, respectively [8]. The main components of the systems are (i) a stainless steel processing chamber with a base vacuum of 10^{-4} Pa, (ii) a vacuum pumping system including a turbo molecular pump and a mechanical pump, (iii) a computer controlled precision five axes system (x, y, z, tilt A and tilt B) for the scanning path movement of the ion source, (iv) an RF-ion source with an automated Faraday cup system for measuring the beam profile and the beam position, (v) a workpiece handling system comprising lens carrier, automatic transport system, and self-adjusting mechanical fixing in the processing position of the lens, (vi) a vacuum load lock chamber enabling uninterrupted operation of IBF with handling time of the workpiece within a minute, (vii) a power supply cabinet for all machine parts and the computer hardware, and (viii) a process gas handling system. The machine is operated from a laptop computer.

The plant type for optics up to 700 mm in diameter has as an option a lens carrier lifting and turning device for easy handling the heavy weight parts. Figure 4 shows the IBF unit for up to 450 mm parts installed in the IOM test lab. The machine is operated from a class 100,000 clean room. In Figure 4b where the upper part of the process chamber has been lifted (for easy maintenance work) the five axis system with the ion source and the face down mounted optic on the carrier are shown inside the chamber.

Ion beam source

The ion source is an RF-type (13.56 MHz) developed by the IOM (Figure 5). The source is equipped with an RF-matching network to adjust the characteristic impedance. This allows the stable operation during moving the source by the five-axes motion system. The source has been optimised for long-term stability with respect to minimise downtime and to provide for stable and reliable beam removal function over hours. At the same time we improved the versatile use of the source by enabling different beam sizes with reasonable working distances by means of different extraction grid designs and additional diaphragm mounted in front of the source for getting reduced beam sizes down to 0.5 mm FWHM. A hidden hot filament neutraliser mounted outside of the beam area allows a more then 100 hours maintenance free operation of the source. In Figure 5 results of the beam shape diagnostics are shown.

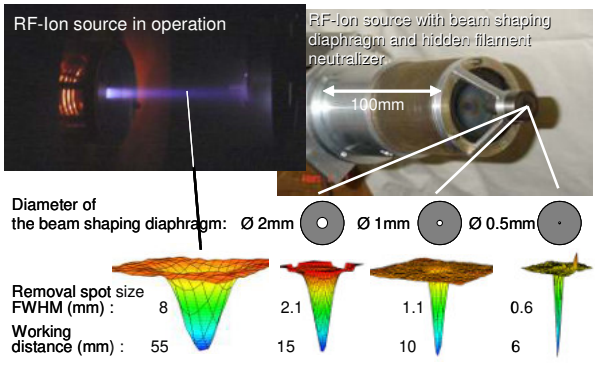


Figure 5: Measured sizes of the footprints of the beam by interferometry of an etched depletion on fused silica for different operation conditions of the RF ion source without and with beam shaping diaphragms; the etch depths has been normalised in this presentation with respect to the 8 mm spot.

RIBE proportional transfer of 3D resist masks

With the help of reactive ion beam etching (RIBE) we increase the profile depth of 3D resist mask, fabricated by holographic lithography [9], necessary for high efficiency diffractive optical elements like Fresnel lenses or diffraction gratings, and we transfer the diffractive structure from the soft resist into the hard fused silica or glass material in a single step. We use a standard ion beam etching plant with a six-inch broad beam Kaufman-type ion source. To optimise the etch rate ratio between the resist mask and the optical material we vary the gas flow rates of the etch gases of CF_3H/O_2 or CF_4/O_2, respectively. In this way, we adjust the desired grating depth very precisely. Figure 6 shows examples of a Fresnel lens for DUV application and of Raman monochromator gratings both made of fused silica.

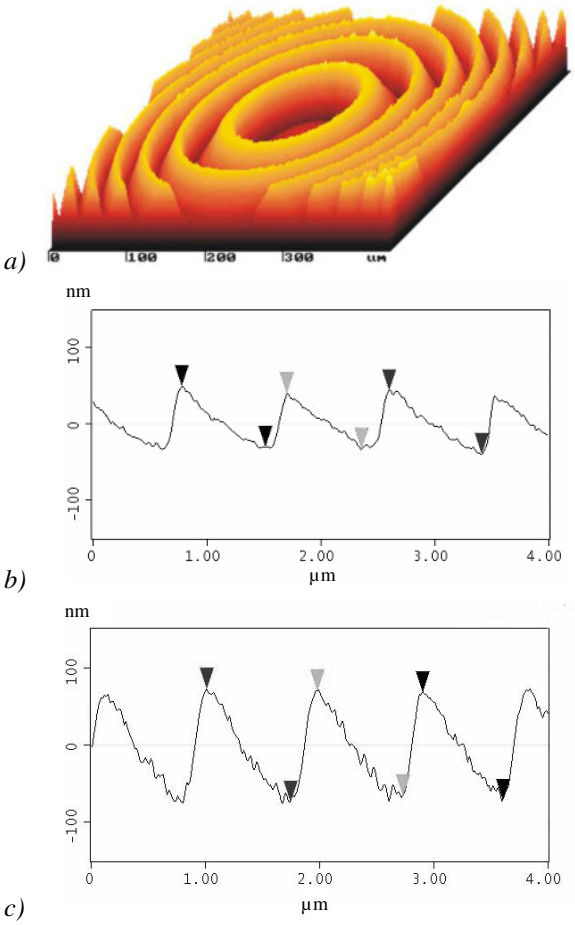


Figure 6: AFM measurements of a) a Fresnel lens transferred into fused silica and b), c) of a master grating structure for a Raman monochromator with a line density of 1180 L/mm; b) resist mask, c) topology transferred by RIBE into a fused silica surface.

Conclusion

Ion beam etching is a versatile technology with a high degree of predictability due to the high stability of state of the art ion sources and the acquired knowledge of the physics of beam surface interaction. The independent control of the ion energy and the ion current density over wide ranges and the possible additional use of chemical reactive species in combination with physical sputter removal allow solving tasks in a wide variety of applications.

The developed techniques, the productive machines and the fabrication results show that ion beam etching technologies are advanced and powerful tools for present and future surface processing and finishing in precision optics technology.

Literature

[1] S. D. Jacobs, Technical Digest: Frontiers in Optics 2004, 88th OSA Annual Meeting, October 10-14, 2004, Rochester, New York, USA, (Optical Society of America, Washington DC, 2004)
[2] A. Schindler et al., Optical Fabrication & Testing, OSA Technical Digest (Optical Society of America, Washington DC, 2001), 64
[3] T. Hänsel et al., Technical Digest: Frontiers in Optics 2004, 88th OSA Annual Meeting, October 10-14, 2004, Rochester, New York, USA, (Optical Society of America, Washington DC, 2004)
[4] T. Hänsel, A. Nickel, A. Schindler, Proc. SPIE Vol. 4449, 265-275, (2001)
[5] F. Frost et al., Appl. Phys. A 78, 651 (2004)
[6] A. Schindler et al., Proc. of the SPIE 5180, 64 (2003)
[7] F. Frost et al., Thin Solid Films 459, 100 (2004)
[8] Nano Technologie GmbH, http://www.ntgl.de/
[9] R. Brunner, et al. Proc. SPIE Vol. 5183, 47-55, (2003)

Broad beam ion source development

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in collaboration with
H. Kersten, Christian-Albrechts-Universität Kiel and H. Leiter, EADS Space Transportation GmbH

Introduction

Modern thin film technologies as well as surface modification processes require high standards in either thin film quality or bulk surface properties, which became especially apparent since industry utilizes these techniques in broad varieties of different products. Ion broad beam techniques offer more and more solutions mastering superior requests in research as well as in industrial high end applications.

To obtain a satisfying source performance, which is mainly determined by the chosen grid system, detailed knowledge about the basic beam parameters like beam composition, beam profile, and ion energy distribution is necessary and obtained by various ion beam diagnostic methods.

On the basis of this knowledge together with a validated computer simulation of the broad ion beam performance the design of process adapted grid systems is feasible.

In close co-operation with partners from industry our ion source concept was successfully adapted and utilized in different ion beam process equipments. Lately, the advantage of broad ion beam techniques is demonstrated e.g. during deposition of multilayer for mask blanks to be used in soft x-ray lithography (EUV), thin film head production processes, ion beam figuring applications, surface smoothing of fused silica, self organized pattern formation during ion erosion (e.g. on silicon) and hardening of stainless steels without lost of it's good corrosion resistivity.

Ion source concept

Different types of broad beam ion sources have been established, since the time ion sources are applied in material processing [1,2,3]. Beside of specific grid system and the choice of source materials, broad beam ion sources can be classified according to the plasma excitation principle.

But which scheme of plasma excitation is best? Sources with hot filament excitation (Kaufman type) are easily to handle, but require frequent maintenance cycles and are limited in reactive gas operation. For that reason, sources with electrode-less excitation principles were developed, giving longer operation cycles and better performance in reactive gas operation.

A well introduced electrode-less technique for plasma heating is the so called transformer coupled plasma (TCP) with a RF driven primary coil and the plasma acting as the secondary one. A TCP configuration requires a high RF power at the primary coil, and, especially for plasma etching equipment, a faraday shield is helpful to eliminate a direct capacitive coupling between the primary electrical field at the coil and the plasma. However, most of the really established configurations are running by the unwanted capacitive coupling, resulting in higher plasma sheath potentials within the source and consequently high sputter erosion of the source components assembled in the discharge chamber.

A very effective electrode-less excitation principle is the electron cyclotron resonance heating (ECR) in a microwave field. The introduction of a steady magnetic field, which establishes resonance between the applied microwave frequency ω_{MW} and the electron cyclotron frequency $\omega_{ce} = eB/m_e$, allows for the operation with high plasma densities as well as no cavity resonance is required for the plasma performance. Because of the cyclotron resonance, the gyrating electrons rotate in phase with the right hand polarised wave, seeing a steady electric field over many gyro orbits. With the electron mean free path large enough, the ECR heating provides for the most effective energy transfer, very low plasma sheath potentials, and low source parts erosion.

Beside the plasma excitation, the source performance is strongly affected by the grid system. Different shapes of the grid design as well as the

geometry of the grid holes realise specific beam profiles. Typically the ion sources are equipped with a double or alternatively triple grid system. Double grid systems are used as the standard solution, whereas triple grid systems deliver clearly a better beam performance for high end applications. The third grid, mostly driven at ground potential, realises defined potential conditions at the grid beam side and delivers well defined beam divergence angles. Finally, the accelerator grid gets protected from redeposition especially for reactive gas operation, which also reduces the risk of arcing.

The grid material, it's mechanical, electrical, thermal and chemical properties and on the other hand it's sputter yield under different conditions plays an important role in the grid system design, life time and stability. For grid system design the sputter yields in dependence on the applied ion energy and incidence angle are to be known, however, for the relevant energy range and ion-grid material combinations a lack of literature data was found. Figure 1 exemplifies our results for measured and calculated sputter yields of molybdenum (Mo) under xenon (Xe) ion bombardment [4, 5].

Since many years different types of ion sources with hot filament, RF and ECR excitation are

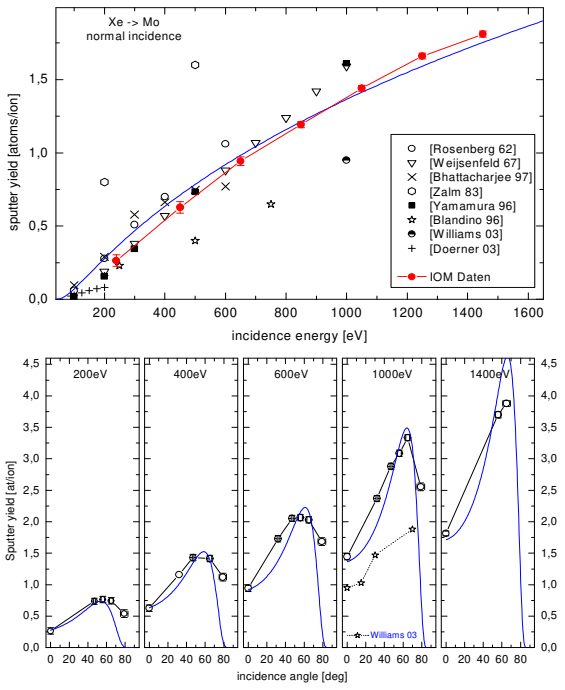


Figure 1: Experimental (squares) and calculated (blue lines)sputter yields for Xe sputtered Mo.

developed at the IOM in Leipzig. These ion sources are designed in a modular concept with beam diameters between 40...350 mm for circular sources and up to several meters for sources with a rectangular design, all equipped by technology-specified grid systems. All types of plasma discharges used here, are running within a ceramics housing providing for full grid support, electrical contacts and gas supply.

Ion beam diagnostics

A 4000 l/sec turbo pumped HV chamber is used for the characterisation of the ion sources. A chamber pressure p_{tot} between 1×10^{-6} mbar and 5×10^{-4} mbar is set by the process gases flow into the source. Because of the gas flow conductance of the grid system, the pressure in the discharge chamber and in the vacuum vessel differs by about one order of magnitude.

An in-house developed 256 Faraday cup array provides information on the beam current density profile across an area of 20 cm x 30 cm. Additionally, an in situ movable single Faraday probe is used for ion density measurements near the grid system, because the large faraday array located

Figure 2: Equipment for Faraday and thermo cup measurements: Computer controlled positioning system-3 linear axis, 1 rotation axis (360 degree), Positioning accuracy < 0,1 mm; vacuum chamber length: 3 m, diameter: 1,2 m; pumping system: 2 turbo pumps ~ 4000 l/s, base pressure: < $1 \cdot 10^{-6}$ mbar.

close to the grids (2 mm - 5 mm) hinders the gas flow through the ion source. Figure 2 shows the equipments.

For description of the plasma density profile at the sheath an indirect method is used too. By measuring beam and accelerator currents in dependency of the applied total grid system voltage and fitting this current functions by using a zero order Bessel

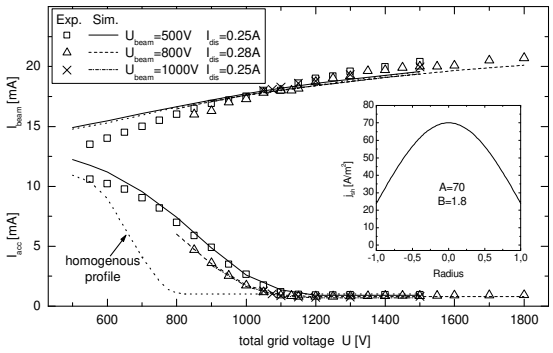


Figure 3: Measurement of beam and accelerator currents in a 3 cm Kaufman-type ion beam source; lines are simulated currents with a zero-order Bessel function (plasma sheath profile in the insert).

function, the plasma profile at the sheath is approximated (Figure 3).

An energy selective mass spectrometer (Hiden Analytical Ltd., EQP 300) is used to observe the beam composition, the ion energy distribution and the divergence angle of the ion beam in different distances. Using the differentially pumped mass spectrometer, a mass and energy resolved analysis of positive beam ions is obtained by sampling through a grounded 200 µm aperture. The ion analysis is provided by an electrostatic sector field analyser (1000 eV), a quadruple mass filter (300 amu) and finally a channeltron secondary electron multiplier with counting electronics responsible for ion detection. Energy and mass dependent effects have to be taken into consideration of the quantitative discussion of the experimental results [7] and for adaptation of the ion source on the process demands.

Ion beam simulation

Computer simulations are another important feature in the broad beam source development for validation of the experimental results. The ion beam from a broad-beam ion source is extracted by a multi-aperture grid system of two or three grids. A single beamlet is extracted through each aperture and the superposition of the beamlets delivers the broad beam. The ion beam parameters are determined by the geometrical parameters of the extractions system, the applied voltages and the plasma parameters. Dishing the grids increases the stability during operation and focuses (inward dished) or defocuses (outward dished) the ion beam, offering additional parameters to design the beam.

A simulation strategy has been developed at IOM to model the beam parameters. Single beamlets are modelled in two-dimensions (axial symmetry) using the well-approved ion trajectory code IGUN. Additional modules treat secondary effects to model the beam contamination and the lifetime of the grids affected by charge-exchange and other processes. The broad beam is modelled by a superposition of simulated beamlets at the target position taking into account an inhomogeneous plasma profile (using diagnostic methods described before and PIC-simulation results[6]), the eventually dishing of the grids and other beam shaping elements. The results are the current-density distribution and beam-shape parameters like FWHM and divergence.

Finally, the ion beam profile can be visualized by the interaction of the ions with a micro-disperse particle cloud which has been charged and confined in an additional rf-plasma. By this method, the interaction of the ions (momentum transfer, ion drag) as well as inhomogeneities in the beam can be realistically observed and estimated [8]

Ion beam profile control

Different technologies require specially adapted ion beam density profiles. Taken this into account, three different methods for ion beam profile control are investigated in combination with the ECR plasma excitation.

Electrical beam profile control

The 1D electrical beam profile control of a linear ECR- ion beam source by a segmented accelerator grid (30 segments on 600 mm) and a 30 times beam switch on the basis of a pulse length modulation for switching this segments between positive (blocking) and negative (accelerating) potentials could be successful demonstrated. [9,10]

Grid geometry method

Second, an ion beam profile control by changing the geometry of the grid hole diameters together with the transparency of the whole grid system is shown on measured profile density plots (Figure 4).

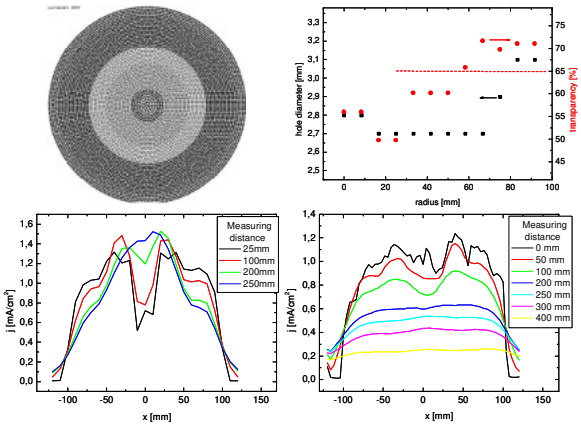


Figure 4: Modelling (top) on the basis of experimental sheath density distribution measurements(bottom left):grid system with homogenous divergence angle by hole diameter and transparency variation; goal (bottom right): homogenous ion beam density profile at 200 mm distance

gated method for ion beam profile control. Using 7 sources with special grid systems in the cluster an ion beam of 400 mm in diameter could be produced with homogeneity of less then ± 5 %. On the other hand a high dense ion beam of about 25 mA/cm^2 can be produced by the alignment of 7 sources with focussed grid systems, whereby the focus a each ion beam is located in the same position approximately 300 mm in distance from the decelerator grid of the centre source.

Conclusions

Broad beam ion source development strategies are presented which are especially suited to meet the current requirements in high end film deposition, surface modification and structuring. The sources are designed with a modular concept independent from the excitation principle. A discharge lining from Al_2O_3 provides for full grid support and all electrical and gas supplies. Additionally, the lining guarantees a full reactive gas compatibility for all ion source types.

The grid material investigations are exemplified shortly. Especially for grid diameters more than 40 mm the mechanical properties play an important role and require intensive developments in the field of grid building technologies.

The report of different diagnostic techniques for the plasma discharge and the ion beam is suitable to demonstrate the development basics for source adaptation on technological demands. The mass spectrometric results allow conclusions about processes occurring in the plasma discharge. Especially the information about the beam energy and mass composition could provide important correlations about the process performance. The methods for direct and indirect plasma sheath description are stringent necessary as the basis of a validated broad beam modelling.

A validated modelling of beam properties with help of analytical data designing grid system configurations is one of the most important tools in source adaptation. The described strategy is well suited for both, grid life time evaluation and for ion beam shape prediction.

The three methods for a beam profile control were shortly outlined. The electrical method is described more in detail in a further short paper of this report. The use of the “zone grids” method was demonstrated on an example of a 7 zone grid system for an ECR source with 200 mm ion beam diameter. The advantage of this method is the production of nearly the same beamlet divergence over the whole ion beam diameter. The possibility of source clustering was demonstrated on the basis of two main existing single source properties-compact design and interference free and independent excitation control.

Finally, the interplay of ion source hardware development and process technology development in a good co-operation is the key to further success and the basis of modern ion beam technology performance.

Literature

[1] J.J. Cuomo, S.M. Rossnagel, H.R. Kaufman: „Handbook of Ion Beam Processing Technology“ – Noyes Publications, Park Ridge (1989)
[2] B. Wolf: „Handbook of Ion Sources“ – CRC Press, Boca Raton (1995)
[3] H.W. Loeb, Plasma Physics and Controlled Fusion Vol. 47, Number 12B, Dec. 2005
[4] M.Tartz et al, Paper AIAA-2005-4414, 41. Joint Propulsion Conference, Tucson (2005)
[5] H. Neumann et al, Proceedings of the 4th Int. Spacecraft Propulsion Conf. 2004, Sardinia
[6] S. Jankuhn et al., Rev. Sci. Instrum., in press
[7] M. Zeuner et al., J. Appl. Phys. 80 (1996), 611
[8] H. Kersten et al., New J. Phys. 5 (2003) 93
[9] Patent: DE 10 2004 002 508 A1
[10] F. Scholze et al., Rev. Sci. Instrum., in press

Direct processing of surfaces and thin films with micron and sub-micron precision using ultraviolet and ultrashort pulse lasers

K. Zimmer, R. Böhme, T. Rudolph, D. Ruthe

Introduction

In addition to applications in engineering laser material processing is as well of increasing industrial interest in the field of micron technologies for, e.g., scribing, drilling, welding, and surface patterning of bulk materials and thin films. However, regarding the materials used, the aim of processing, and lateral dimensions this applications call for laser processing techniques with a high precision, a high reliability, and minimal material alterations. Of course industrial applications require a high flexibility, high speed, and the easy control of the processes, too.

According to the current developments high precision, low damage, and high throughput laser processing can be achieved in particular with short wavelength (UV) and ultrashort pulse (fs) laser radiation. For the intended application both the machining tool–the laser beam–and the interaction processes with the material have to be controlled and optimised. However, material processing can be achieved not only by etching but also by modifying the near surface region.

Accurate pulsed laser processing requires for high-precision lateral and vertical resolution the confinement of the laser-matter interaction to the near surface region. Therefore the requirement of a high material absorption coefficient that is essential for material patterning using laser ablation processes is regularly achieved with UV photons by linear absorption or with fs laser pulses by nonlinear processes. In addition high surface absorption causes reduced pulse energies and therefore assists low damage material processing.

Since some of interesting materials, e.g., oxides and fluorides, are highly transparent at usual laser wavelengths different approaches for enhancing the laser absorption near the surface by means of additional irradiation (VUV light) or by means of additional material is currently under development. Especially the indirect laser processing techniques using additional materials allow low-energy material processing with established lasers.

Micron and sub-micron structures

Laser-induced bumps

Regularly laser modification of absorbing materials causes alterations of composition, morphology, or structure of a near surface material volume. One example of the topographic effect of a laser modification process is the “swelling” of glass in consequence of laser irradiation forming bumps. The heights of such laser-induced bumps

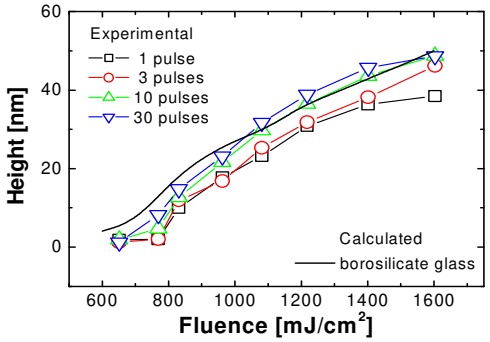


Figure 1: Measured height of laser-induced bumps onto borosilicate glass in dependence on the laser fluence for different pulse numbers and the expected height calculated from a thermo-mechanical model.

are shown in Figure 1 in dependence on the applied laser fluence for borosilicate glass using a KrF excimer laser ($\tau_p = 25$ ns, $\lambda = 248$ nm). The height of the bumps increases with the laser fluence up to the onset of laser ablation and can achieve 45 nm. The laser irradiation of the glass causes the heating of a near surface material above the softening point and the material expansion. After the pulse the fast cooling rates do not allow the complete relaxation of the glass and cause the freezing in the material expansion approximately at the glass transition point. The result of numerical calculations of the material swelling taking into account the laser heating, the thermal material expansion and the softening, and the phase changes of the glass is shown in Fig-

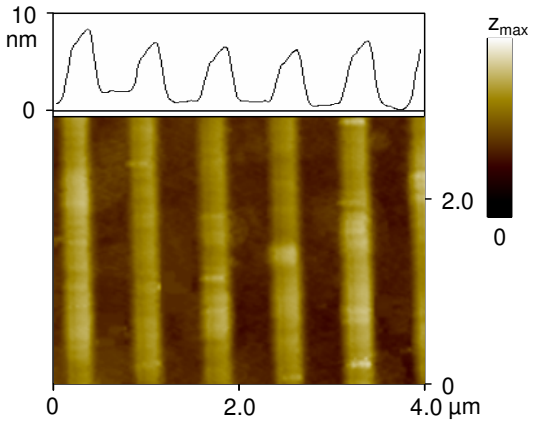


Figure 2: Sub-micron line gratings on borosilicate glass measured by AFM using tapping mode.

ure 1 in addition to the experimental values. The well agreement of the calculated and the experimental bump height confirms the validity of the model.

This laser-induced swelling process has been used for the fabrication of surface patterns on glass with only one laser pulse. In addition to micron-sized bumps sub-micron gratings with a grating period of ≈760 nm were generated as shown in Figure 2. The line grating features sharp line edges regardless a sinusoidal intensity distribution due to the interfering laser beams was used. Therefore the bump formation is a high contrast process that apparently improves the resolution of the whole laser patterning process.

Laser processing for nanostructures

Nanostructured surfaces and materials with their unique and extraordinary properties are of high interest for science and technology but can not be obtained directly by laser processing due to the limited optical resolution achievable even with UV wavelengths. On the other hand the connection of nanostructures with microstructured surfaces is usually necessary to realise, e.g., electrical interconnections to micron and sub-micron patterns. With this goal laser-induced surface modification is studied in micron-sized areas for local generation of nanostructures.

The irradiation of surface coated silicon substrates with UV laser pulses of different wavelengths causes alterations of the surface morphology below the ablation threshold of the substrate. The example depicted in Figure 3 a) demonstrates the formation of nanoparticles upon ns UV laser irradiation of an iron nitride coated silicon surface. The lateral size of the particles formed inside of the laser exposed area depends on the laser fluence and the pulse number and ranges from 5 to 25 nm. Increasing the fluence above the ablation threshold either the film or the already formed nanoparticles can be removed in order to increase the patterns complexity further.

Such local excimer laser modified substrates were exploited for the stimulation of carbon nanotubes (CNT) growth in a thermal CVD process using an acetylene/nitrogen gas mixture. In Figure 3 b) a bundle of vertical aligned carbon nanotubes is shown. The well-defined CNT bundles have a base area according to the size of the laser spot (100 x 100 µm²) and feature very sharp edges. The inset of Figure 3 b) shows an enlarged view of the side wall of the bundle that proves the alignment of the nanotubes perpendicular to the surface. Because the individual nanotubes have certain chiralitys they touch and probably stick

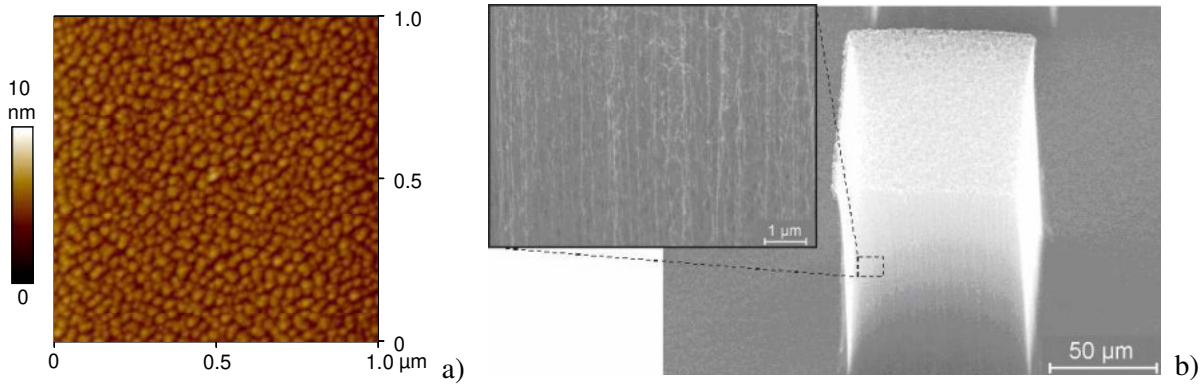


Figure 3: a) AFM image of a laser-modified surface having a dense film of nanoparticles. b) SEM image of a bundle of vertical grown carbon nanotubes. The local growth of the aligned nanotubes was attained only in the laser irradiated surface areas. Increasing the fluences beyond ≈1 J/cm² the particles are removed by ablation.

together due to van der Waals forces between adjacent CNT's. Hence, the individual nanotubes that prop up each other are forming a CNT network that stabilises the long nanotubes of the CNT bundles and therefore allows the growth of bundles with a height up to 150 µm within a growth time of about 5 min. The bundles consist of multi-walled CNT's with a diameter in the range from 10 to 30 nm as Raman and TEM investigations have shown. As known, the nanoparticles together with the growth conditions determine the properties of the nanostructures, for instance the diameter of CNT. Therefore, the variation of the nanoparticles properties by selecting appropriate laser processing parameters at different substrate areas might be used to adjust the nanostructures to the needs of applications locally and therefore probably allows the fabrication of arrays with specific CNT bundles.

Applications of laser processing

Etching of surfaces for micro-optical applications

Apart from the work on machining of refractive micro-optical elements using small laser spot direct writing techniques, grey scale and contour mask technique [1] here the laser machining of diffractive surface pattern is presented. The challenging requirements of micro-optical surface processing can be fulfilled to a large extend by indirect laser machining due to the low etch rates, the smooth etched surface, and the low contaminations achievable with this technique [2]. Because low roughness etching is achieved only in a narrow fluence window the usage of grey scale techniques currently is ruled out and the etching of variable depth phase gratings for a HeNe laser beam shaping was performed by the more flexible direct writing technique. After process optimisation a reproducibility of the etch depth of better than 15 nm and roughness of less than 10 nm rms at multilevel test patterns were achieved. An example of a grating beam homogeniser and its optical effect is shown in Figure 4. The good consistence of the calculated and the measured grating depth distribution (0 to 350 nm) across the etched grating is shown in the upper part whereas the laser beam homogenisation due to the locally different grating depths that cause an equivalent phase shift to the laser beam is shown in the lower part. The remaining roughness of the grooves bottoms (≈10 nm rms) results mainly from the overlapping of adjacent laser pulses and can further be improved by exploiting specific projection masks with a partially gray scale design. Consequently backside etching is suited for direct writing of diffractive surface structures [3].

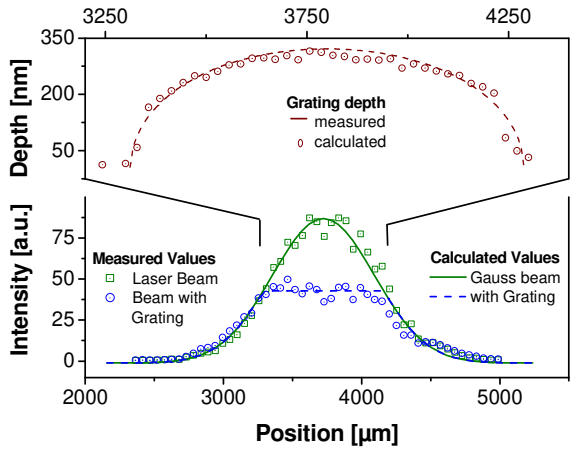


Figure 4: Depth distribution of a laser written variable depth fused silica grating and the optical effect for beam homogenisation.

Laser scribing for electronic applications

The basic investigations on the low damage ablation of thermal sensitive semiconductors were continued for the interconnection of thin film CIS solar cells. Both the external and the integrated interconnection were achieved by exploitation the recent developed low-defect laser scribing technique. The current efforts aim to raise the speed and the precision of the scribing for highly efficient thin film solar cell modules [4].

Encouraged by the excellent quality of the scribing results, the trimming of resistors made by thick film technique was investigated. The scribing shows a high quality such as clean grooves, high stability, and low aging of the resistively. However, by laser irradiation with laser fluences below the ablation threshold a laser-induced modification of the films was observed which leads to a reduction of the resistance and can be used for trimming, too, but now towards lower resistance values.

Figure 5 shows the reduction of the resistance on the number of trimming scans onto the area of a thick film resistor. Both optical microscopy and

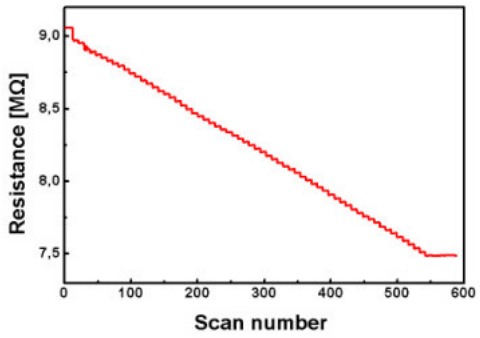


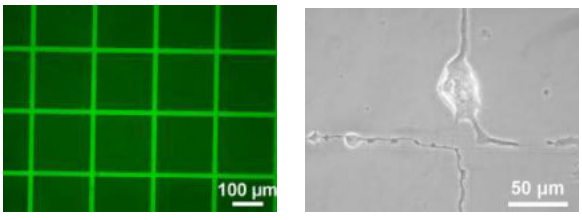
Figure 5: Reduction of the resistance of a thick film resistor on the number of laser exposures with a fluency below the ablation threshold.

SEM imaging show no visible alteration of the laser-processed surface. Therefore the trimming can be achieved in addition to ablative scribing by material modification without ablation and therewith coupled adverse processes such as crack formation or debris deposition. Using this new approach both the increasing and the reduction of the resistance upon laser irradiation can be achieved and allow new strategies in device trimming in the microelectronic technology.

Biomedical applications

Recently small sample and high throughput analytics of chemical and biological substances for lab-on-the-chip applications become reality. For these applications the surfaces have to be micromachined as well as functionalised. The local surface functionalisation by means of laser processing for bioanalytical applications has been shown. The approach combines the large area functionalisation by means of silane chemistry (SAM), plasma polymerisation, or coating techniques with the local processing capabilities of laser machining. Additionally, such functionalized patterns can be used for the local and guided growth of cells, respectively, that can be exploited for the growth of artificial tissue, the study of cell-drug interactions, or the investigation of nerve cell interactions in a controlled manner.

Due to the strict separation of functionalisation and micro patterning both steps can be optimised for the required functionalisation chemistry, the needed topography, and the used substrate material. Because the SAM functionalisation and its laser patterning can be applied repeatedly patterned surfaces with different chemical functionalities can be obtained. In the example shown in Figure 6 the degradation and therefore the patterning of UV transparent organosilanes films on borosilicate glass by excimer laser irradiation has been accomplished with only one laser pulse below the ablation threshold fluence. Therefore, a fast, reliable, and clean processing was achieved. Evidences for the substrate mediated, thermophysical nature of the patterning process has been deduced from the theoretical and experimental investigations of the laser-induced degradation process using different substrate materials as well as dissimilar laser wavelengths. Sub-micron resolution can be achieved because the optical resolution of the UV laser is practical not reduced due to the low thermal diffusivity of the glass.



a) b)

Figure 6: Fluorescence and phase contrast microscope image of a functionalized and laser microstructured sample and the local and guided growth of HB-12317 hybrid cells along the surface patterns.

Literature

[1] K. Zimmer, A. Braun, "Excimer laser machining for 3D-surface structuring", in: Photo-Excited Processes, Diagnostics and Applications, Ed. A. Peled, Kluwer, Boston (2003).
[2] R. Böhme et al., Appl. Phys. A 80 (2005) 433.
[3] K. Zimmer, R. Böhme, Appl. Surf. Sci. 243 (2005) 415.
[4] D. Ruthe, K. Zimmer, T. Höche, Appl. Surf. Sci. 247 (2005) 447.

Novel aluminium carboxylate nanofillers for radiation-cured protective polymeric coatings

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Introduction

Early studies of the modifying effect of nanopowders on radiation-cured polymeric coatings were based on organometallic nanoparticles. Notwithstanding their pronounced modifying effect on viscoelastic data, inorganic nanopowders such as silica and alumina were used for practical extensions. By functionalising the latter nanoparticles in a heterogeneous hydrolytic condensation (HHC), an enhancement of surface mechanical properties was attained. In order to evade toxicological by-products and to improve the rheological application behaviour, the organometallic nanopowders were revisited. The latter are applicable to radiation curing of (meth)acrylic dispersions and also to thermal curing of two-component systems (epoxide/polyol, isocyanate/polyol).

In previous studies of the modifying effect of nanopowders on polymeric coatings and foils, organometallic species were employed such as cerium(IV)sorbate of obviously low practical relevance, and the focus was set on viscoeleastic rather than on surface mechanical data [1]. For an enhancement of surface mechanical properties commercial inorganic nanopowders were used (first of all amorphous SiO_2; trade name AEROSIL). A polymerisation activity was imposed on the surface of these nanoparticles by grafting alkoxysilanes (trade name DYNASYLAN) onto them in a heterogeneous hydrolytic condensation (HHC) [2]. Notwithstanding the successful practical applications of the HHC route [3], its further development was urgently motivated: (i) The HHC nanodispersion could be processed by heated (typically 40 °C) roll application, however eluding application at room temperature incl. dipping and spraying. (ii) In addition to that, in the course of the acid catalyzed HHC detrimental alcohols are formed bringing about a marked transesterification of the respective monomer/oligomer nanodispersion. Combined autocatalytic HHC and Michael addition (MA, [4][2]) with small amounts of aminosilanes (typically 2 wt.-% instead of 15 wt.-%) may largely remove these complications. Furthermore, an adsorptive particle organophilation (APO) also proved feasible on the presupposition that a monomer/oligomer fraction of adequate molecular mass (around 600 g/mol) forms part of the nanodispersion. The simplification to evade the formation of toxic by-products is potentially compensated by surface-active impurities which may override the APO principle [4][3]. In addition, finer powders ($d_m < 20$ nm) are inapplicable in the APO route.

These environmental and rheological aspects led us to revisit organometallic nanopowders because the latter are organophil by preparation. In doing so, a literature concept [4][1] is of relevance which bases on boehmite or pseudo-boehmite nanoparticles. After surface modification by carbonic acids, these carboxylate alumoxanes (together with counter-reactive groups) were dispersed in polymerisation-active substrates and subsequently thermally cured. The obtained nanocomposites revealed an enhanced flexural strength but a remarkable mechanical reinforcement did not occur. This can be traced back to the high concentration of the carbonic acids which involves a likewise high ligand concentration on the particles´ surfaces. Obviously these both high concentrations have a softening effect on the polymeric surroundings. Thus a more intrinsic chemical structure of the organometallic nanoparticles appears highly desirable. In our route, a one-step precipitation furnishes the more intrinsic organometallic nanopowders in a quite direct and cost-efficient way with nearly quantitative yield.

An assessment of our novel organometallic nanofiller [4][4] was based on comparative preparations of nanocomposites using AEROSIL OX50 (SiO_2)

[3] and the non-intrinsic organometallic nanopowders [4][1].

Preparations

Organometallic nanopowders

A basic aluminium maleate (Almal) was obtained nearly quantitatively in a one-step precipitation reaction from dissolved aluminium isopropylate with aqueous maleic acid solution (molecular ratio 2:1). Thermogravimetric analysis testified the final product to bis-aluminiumdihydroxy-maleate. Scanning electron micrographs revealed on an average 100 nm particle aggregates of about 30 nm primary particles where the latter measure was derived by means of combined ultracentrifugation and dynamic light scattering. The ^{27}Al MAS NMR spectra (with the main line at 2.4 ppm) were typical of an octahedral surrounding. The vibration-spectroscopic characterisation of the Almal nanopowder as prepared (cf. Figure 1) is exceedingly informative: The respective FTIR spectrum reveals a wavenumber difference between the asymmetric and symmetric OCO stretching vibration bands of 118 cm^{-1}. This value speaks of a bidental ligand coordination. Furthermore, the corresponding FT-Raman spectrum in Figure 1 comprises the C=C stretching vibration band at 1660 cm^{-1} which markedly differs from the corresponding acrylate value (1634 cm^{-1}), thus enabling a spectroscopic determination of the acrylic and maleic C=C conversions.

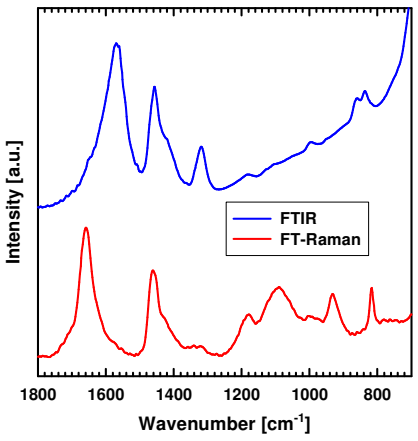

Figure 1: FTIR and FT-Raman spectra of the Almal nanopowder as prepared.

In addition to Almal, analogous nanoparticles were obtained with ligands such as D,L-malate (Almalat), citrate (Alcit), oxalate (Aloxal), and stearate (Alstear). For comparison, the corresponding FTIR studies on Aloxal and Almalat brought out much greater wavelength differences (277 cm^{-1}, 203 cm^{-1}, respectively) clearly evidencing monodental coordinations in the latter both cases. While the Almal nanofiller proved optimal for acrylates and epoxides, Almalat, Alcit, and Aloxal could readily modify the isocyanate/polyol system. Alstear proved advantageous for bulk modification of nonpolar polymers, e.g. polypropylene from an extrusion procedure. In the outlook, preparation of basic aluminium phosphates and phosphonates is envisaged to impose flame retardance on polyurethane foams**.**

The performance of all the intrinsic organometallic nanopowders could be further enhanced by the application of a mild tempering (24 h, 120 °C). This is probably thanks to a removal of adsorbed water from the nanoparticles and concomitant reduction of polarity and hardness increase.

The possibility is worth mentioning to transfer all the various aluminium carboxylate nanopowders as specific precursors to a more brute thermal treatment (oxidative atmosphere, 10 h, 1100 °C), yielding corundum nanopowders. Quite astonishing, macroscopic properties such as the mean density are specifically influenced by the ligands of the precursor nanoparticles. While the aluminium carboxylate nanoparticles proved amorphous in X-ray diffraction (XRD), the resulting nanocorundum particles revealed a rather perfect crystallinity and a smooth spherical surface morphology. In advance, we expect from these nanocorundum powders a very high synergetic action in nearly all nanomodification schemes.

The preparation of the non-intrinsic Almal reference compound according to [4][1] (Almal-Cook) was done by a synthesis of nano-boehmite according to example 1 of the aforementioned USP and subsequent reaction with equimolar amount of maleic acid (instead of 4-hydroxybenzoic acid in example 2). While our Almal proved amorphous in XRD and reveals an intrinsic structure (homogeneous ligand distribution over the whole

nanoparticle), Almal-Cook consists of the crystalline boehmite nucleus surrounded by the carboxylate ligand shell. The latter non-intrinsic structure with the exceedingly high organics concentration at the surface readily provides for organophil features but unfortunately also for a softening effect in the pertinent polymeric nanocomposites.

Reference nanodispersions

An acrylate mixture of hexafunctional aliphatic urethane acrylate (EB5129) and trifunctional polyether acrylate (SR454, mass ratio 1:2) was filled by 30 wt.-% Almal, using a dispermate (yielding Almal 01). Furthermore, a 1 h application of a high-energy attrition ball mill could readily implement perfect optical transparency. One can expect that the latter property can be achieved in a direct way by further optimising the original particle preparation route. Although dispensable in an Almal modification, small amounts (2 wt.-%) vinyl trimethoxysilane (VTMO) were added which compare to the much larger proportions in the SiO_2/HHC route (> 10 wt.-%). A gentle thermal treatment (5 min, 100 °C) as accomplishable in curing lines by IR lamp arrays further improves the surface mechanical data through thermal post-condensation processes (both between particle surfaces and polysiloxane shell and within the latter shell itself). By just varying the organic matrix, five dedicated Almal-dispersions were prepared bringing about adapted rheology (roll application, dipping, and spraying), enhanced adhesion, and exterior durability. The components 30 wt.-% Almal-Cook / 2 wt.-% VTMO and 25 wt.-% AEROSIL OX50 / 12.5 wt.-% VTMO were admixed to the abovementioned acrylate system to obtain the reference dispersions Almal-Cook 01 and Carat (SiO_2/HHC).

Nanocomposite coatings on acrylate basis

The nanodispersion films were applied on paper utilising a doctor blade (slit width 50 µm) in the doctor blade coater Simex AF-3. In UV curing a Hg middle-pressure lamp was used (120 W/cm; O_2 concentration < 200 ppm).

Characterisation

Acrylate-based nanodispersions

The organometallic lacquers reveal largely shear-independent low viscosities (cf. Figure 2), thus enabling roll (Almal 01, 02, 06), spray (Almal 07, 08), and dip applications at room temperature.

The rheology adaptation by just choosing an appropriate acrylic component forms an outstanding result which becomes exceedingly obvious in the light of the Carat data. Anticipating the poor surface mechanical parameters mediated by the non-intrinsic Almal-Cook filler, the pertinent rheological characteristics were omitted here.

Acrylate-based nanocomposite coatings

Abrasion tests (Taber Abraser, 2 CS-0 friction rolls covered by emery paper S-42, each friction roll charged by 500 g weights) furnish most significant surface mechanical data. Figures 3 and 4 clearly prove the superiority of the Almal route.

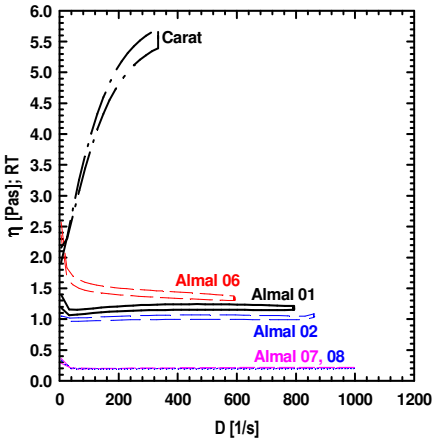

Figure 2: Rheological characteristics of Carat and various Almal dispersions at room temperature.

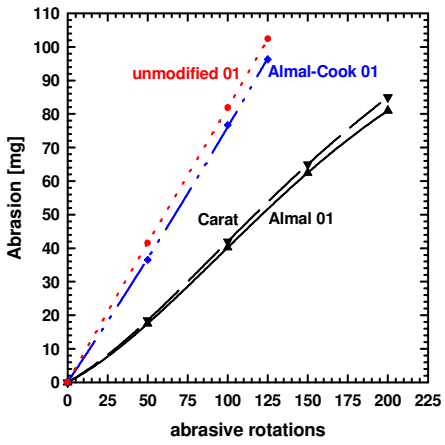

*Figure 3: Abrasions for organometallic (intrinsic Almal 01, extrinsic Almal-Cook) and SiO_2 (*Carat) routes.*

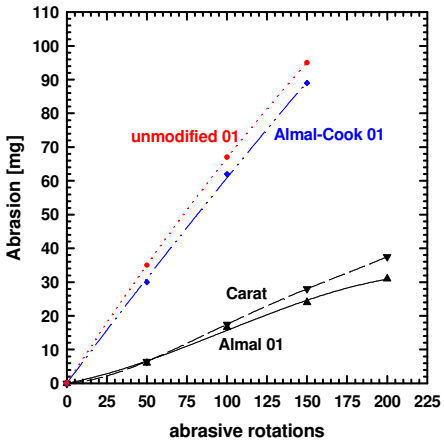

Figure 4: The same as in Figure 3 but now demonstrating the effect of post-condensation.

By the way, the synergetic nano/micro effect is worth mentioning if a microcorundum powder (e.g. 10 wt.-% round milled alumina L9 or the sharp-edged ZWSK F 600) is added to a respective nanoformulation. Of course, the decrease of abrasion owing to nano/micro modification (typically by a factor > 5) is highly appreciated but due consideration must also be given to the abrasive action of the micro-component on parts of the application plant. Here, however, besides round milled alumina the Almal-derived nanocorundum powder yields a positive alternative thereby even maintaining optical transparency.

The Almal enforcement becomes also manifest in pertinent findings obtained by related characterisation techniques. Thus, as compared with unmodified reference coating, the diamond scratching hardness increases by typically 2.0 N, the Martens indentation hardness by 70 N/mm^2, the storage modulus by 1.5 Pa·s, and, finally, glass transition temperature shifted by +30 K.

Summary

Novel organometallic nanopowders were obtained from an efficient precipitation route. These metal carboxylates tend to reveal open architectures [5] and, therefore, it appears hardly conceivable to attribute a greater hardness to them. Therefore, from the very beginning the active enforcement principle must be reconsidered.

The peculiarities of this innovative modification route also comprise the synergetic effects of a micropowder additive and a post-condensation, as expected. Surprisingly, these organometallic nano-fillers are also amenable to nanomodification of two-component systems (epoxide/polyole and isocyanate/polyol) – corresponding work is under way (cf. the pertinent brief report by Wennrich et al.). As for polypropylene bulk systems filled by basic aluminium stearate nanopowder (Alstear) through extrusion (filler content below 5 wt.-%) we confine ourselves to just quoting an enhanced notched impact strength by as much as 40 % with the tensile strength kept unchanged. The exceedingly broad application field does not only comprise mechanical enforcement of acrylic and two-component coatings as well as bulk systems but, in addition to that, also focuses on quite different modification goals like flame retardance when utilising basic aluminium phosphates or phosphonates.

Acknowledgements

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Literature

[1] H.-J. Gläsel et al., Nucl. Instr. Meth. B 151 (1999) 200.
[2] H.-J. Gläsel et al., Macromol. Chem. Phys. 201 (2000) 2765; Macromol. Mater. Eng. Phys. 287 (2002) 546; WO 2000/022052, WO 00/022039.
[3] R. Mehnert et al., Z. Materialwiss. Werkstofftechnik 32 (2001) 774.
[4] 1USP 6 369 183; 2WO /4438101; 3PCT/EP02/13156; 4patent file application AZ 102005032353.7.
[5] C.N.R. Rao, S. Natarajan, R. Vaidhyanathan, Angew. Chem. Int. Ed. 43 (2004) 1466.

Thin functional layers as barriers for oxygen and water vapour

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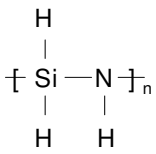
Introduction

Uncoated polymer foils are quite permeable for gases like oxygen and water vapour. For many packaging applications in food and drug industry, higher diffusion barrier properties against these gases are needed. Coatings with thin functional layers of quite different origin may solve this problem, however, high flexibility and transparency of the parent foils must be maintained.

During the last two years the IOM was engaged into different approaches for the generation of barrier layers such as the surface coating with silica, e.g. using polysilazanes or alkoxysilanes as precursors, or with acrylate formulations filled with nanoparticles or with layered silicates. Selected examples will be outlined in more detail below.

Silica layers from polysilazanes

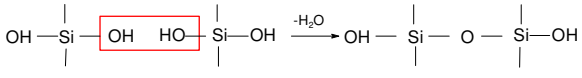
Polysilazanes are polymers with a $–SiR_1R_2-NH-SiR_3R_4$-backbone shaping a 3D network. The substituents R_1 – R_4 may be H, alkyl, vinyl, benzyl, etc. In the simplest case, with H at all positions R_1 – R_4 an inorganic polymer, perhydropolysilazane (PHPS), is at hand:



Under atmospheric conditions PHPS undergoes fast hydrolysis by water vapour forming silanols:

$$–(SiH_2NH)– + 2H_2O \rightarrow –(Si(OH)_2)– + H_2 + NH_3$$

These silanols are transformed in a dense SiO_x network by a subsequent condensation process which can be promoted either by increasing temperature or by addition of catalysts:



Polysilazanes are produced and sold by Clariant GmbH. Due to its proneness to spontaneous hydrolysis PHPS can not be handled as neat substance but rather in form of solutions in either xylol or dibutyl ether (DBE). The commercially available 20 % by weight solutions in xylene NP110 and DBE NL120 additionally contain an amino catalyst or a metal catalyst, respectively.

These solutions may be applied to a user-defined substrate by dip or spin coating or spraying followed by the subsequent evaporation of the solvent via gentle thermal treatment. PHPS then forms a thin transparent layer with a density of 1.3 g cm^{-3} and a refraction index of 1.60–1.65 in the visible range of light.

Within the scope of the research cooperation with Clariant GmbH, such layers were produced on different substrates like PET foils, aluminium foils, polymers, or silicon using solutions with a PHPS content down to 0.5 % by weight, resulting in coatings with thicknesses down to less than 100 nm. By varying the conditions of thermal treatment, i.e. temperature, duration, humidity, and by adding various catalysts, PHPS layers were transformed to dense SiO_x layers with about 2.2 g cm^{-3} density, a refraction index of about 1.54, and a surface Martens hardness of 3.2 GPa.

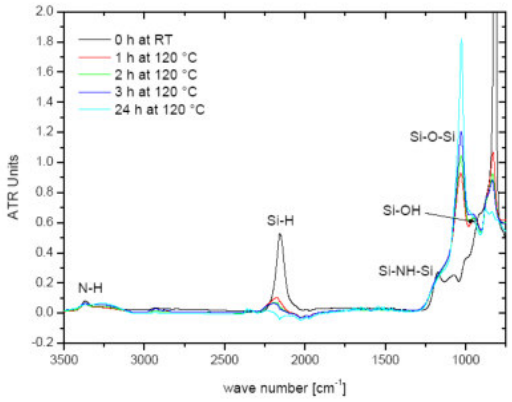


Figure 1: ATR-FTIR spectra of the transformation process of PHPS to silica.

The transformation of PHPS to SiO_x was monitored by ATR-FTIR spectroscopy. Figure 1 shows some typical spectra. Figure 2 shows a REM photograph of a layer prepared by this method on a PET foil. It can be seen that the SiO_x layer formed consists of packed grains.

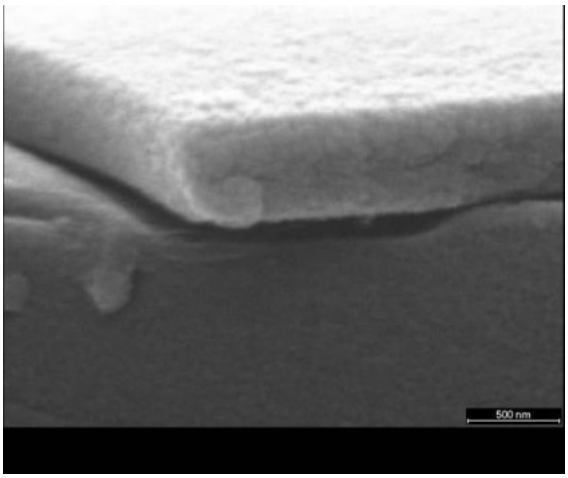


Figure 2: REM photograph of a PHPS coating transformed to silica by thermal treatment.

Using TOF-SIMS spectroscopy depth profiles of elements were gained. The diagram (Figure 3) shows largely homogeneous depth profiles of several ions consisting of the relevant elements. It should be mentioned that sensitivity differs between different ions and the detected ion currents do not allow direct inference with the concentration of the elements.

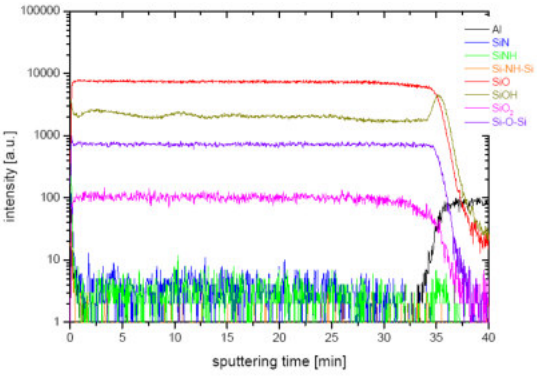


Figure 3: TOF-SIMS diagram of a SiO_x-layer generatedby thermal treatment (2h 180 °C) of a PHPS (NP110) layer on aluminium foil.

ESCA measurements show that the percentages of elements present on the surface are: oxygen 57.7 %, silicon 31.8 %, nitrogen 5.0 %, and carbon 5.5 %. Apart from carbon which probably originated from the added catalyst, the empirical formula SiO_xN_y with $x+y=2$ is fulfilled, however indicates some remaining polysilazane structures.

Applying differential scanning calorimetry (DSC), one can see that after 3 hour treatment at 60 °C the transformation process is not completed and even after 3 hours at 180 °C some reaction enthalpy is detectable (Figure 4). This is in accordance with the ESCA measurement where a remaining quantity of nitrogen was detected.

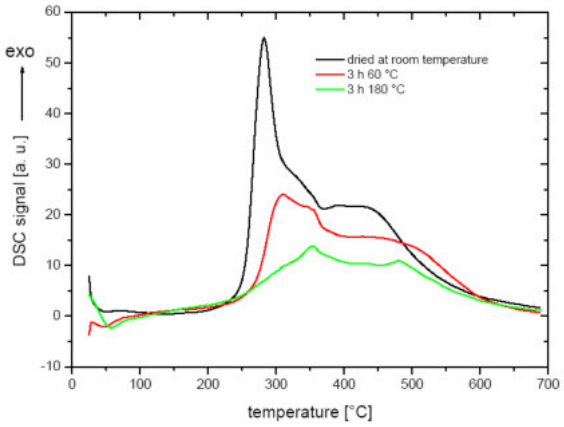


Figure 4: DSC diagram of powder obtained from 3% solution NP110 on glass dried and optionally heated.

By coating such solutions onto 36 µm PET foils the oxygen transmission rate (OTR) and the water vapour transmission rate (WVTR) were improved significantly as shown in Table 1 for OTR.

Table 1: Transmission rates for oxygen and water vapour of PHPS based coatings.

sample/treatment	**OTR** [cm^3 m^{-2} d^{-1} bar^{-1}]	
36 µm PET	34	
3 % NP110 1 week at 20 °C	17.8	
3 % NP110	80 °C	180 °C
1 h at T	1.7	0.7

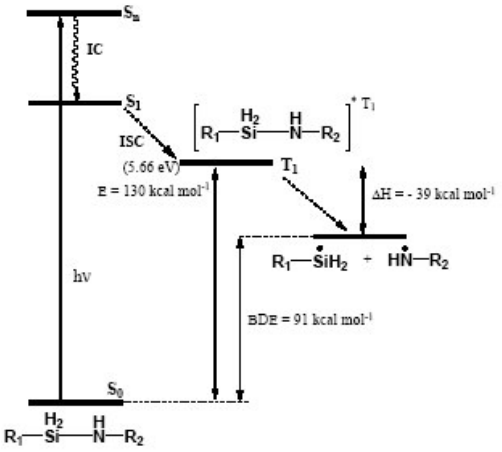
However, extensive research on the effect of a variety of catalysts focussing on the acceleration of the transformation process of PHPS and on decreasing temperature was not really successful. Even at high temperatures of about 200 °C

approx. 10 minutes were necessary in order to achieve the complete transformation of PHPS into SiO_x [1, 2].

Large scale production processes require processes that are, as a minimum, one order of magnitude faster. In addition, coating of thermally sensitive substrates needs to be accomplished in both packaging and electronic industries. This leads to a demand for process temperatures below 80 °C.

A potential solution has been proposed by quantum chemical calculations suggesting the possibility of photolytic Si-N bond scission schematically shown in Figure 5.

The calculated threshold energy of 5.66 eV is related to a UV photon with a wavelength of



Figur 5: Energy scheme of the hypothetic molecule R1-SiH_2-NH-R2 after photoexcitation.

220 nm. Accordingly, irradiation with UV light with a wavelength below 220 nm should be able to initiate the transformation process of PHPS.

The result of transmission measurements on 100 nm layers of PHPS before and after thermal treatment in the deep UV/VUV region using synchrotron radiation (PTB-BESSY) is in good agreement with calculations. Radiation about 200 nm is mainly absorbed by the layer. Hence, the irradiation energy is not wasted into the substrate. Otherwise, the penetration depth of the photons is in the order of the layer thickness and the absorption occurs not only in a thin surface layer. Industrially available radiation sources in this range are low pressure mercury lamps with an emission of 185 nm and excimer lamps with emissions of about 172 nm and 222 nm.

Based on these considerations, research in collaboration with Clariant GmbH on the VUV stimulated oxidation of PHPS films into a thin flexible silica layer has been started focussing on the production of coated PET foils from roll to roll in the speed range of 10 m per minute.

UV-curable coatings with layered silicates

Dust-based defects and micro cracks in barrier coatings based on vacuum and hydrolysis/condensation processes are one of the most significant drawbacks [3]. Therefore, the filling of

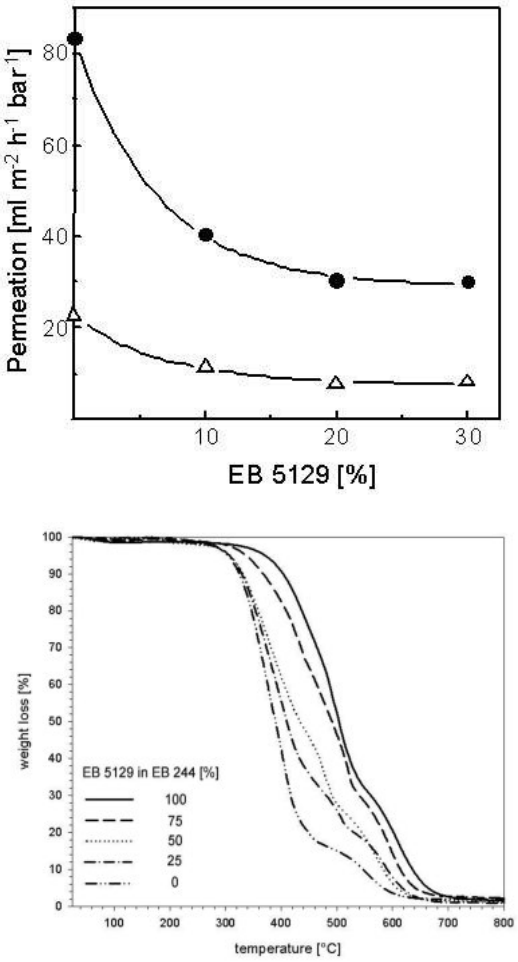


Figure 6: Top: Permeation of oxygen (●) and nitrogen (Δ) through a crosslinked acrylate layer on PE in dependence of the amount of EB 5129 in an aliphatic bifunctional acrylate EB 244. OTR at 0 % relative humidity. Bottom: Thermogravimetric data for different blends of EB 244 and EB 5129.

these dust-based defects with a suitable coating is a promising strategy for the further reduction of gas permeability. Encouraged by previous studies based on EB-cured barrier polymers [4] we have engineered the barrier properties of selected UV-

curable systems by the use of nano-scaled layered fillers. In this context, we focused on UV-curable acrylates and cycloaliphatic epoxides which were selected by the "Permachor"-principal [5].

Besides of specific functional groups, the polymer network density exemplary adjusted by different mixing ratios of the bifunctional acrylate EB 244 (UCB) and the hexafunctional acrylate EB 5129 (UCB) influences the barrier properties of the final films (Figure 6). Thermogravimetrical data support these findings. However, a high content of EB 5129 resulted in high E-moduli. The coatings lost their flexibility and became brittle and unsuited for barrier applications.

It is well known that barrier properties of coatings may be improved by the addition of impermeable layered silicates where the extent in one dimension is in the nanometer range [6]. In addition, improved tensile properties, thermal stability, and resistance to swelling by solvents were observed in different layered silicate nanocomposite systems. Due to the chemical structure of both the flakes and the polymer and the processing conditions the arrangement of the layered silicates in the polymer matrix ranges from tactid over intercalated to delaminated structures. Moreover, the size and the shape of the silicates as well as the content of impurities differs which influences the final properties of the film. Therefore, the screening and adjustment of a matching polymer-nanocomposite system was necessary for achieving the desired properties. This has already been demonstrated for many polymer-nanocomposite systems but was rather poorly investigated for UV-curable systems. In order to generate intercalated or exfoliated polymer-silicate structures a general approach was found in the substitution of the inorganic cations between the silicate-layers by organic alkylammonium ions. This procedure adapted the clay surface polarity to the polarity of the polymer and thus expanded the gallery between the sheets which enabled the polymer to penetrate between the sheets of the silicate. However, the use of these so called organoclays resulted in an inhibition of cationic UV curing. In addition, viscosities increased dramatically already at low loading levels which complicated the application of these formulations. A positive influence on the barrier properties at an applicable loading level was not observed.

In order to circumvent these problems layered silicates, particularly muscovites, and talcum were used for the reduction of the permeability of coatings for oxygen without substituting the inorganic cations between the layered sheets. Using these systems the permeation of oxygen was successfully reduced by a factor of 3-5.

Finally, based on these principal investigations an oxygen transmission value of an UV curable system below 10 $cm^3/(m^2\ d)$ for an applicable film thickness was attained. The arrangement of the layered silicate in such a coating is shown in Figure 7. The low viscosity as well as the good adhesion to plastics enables an application of these formulations in form of spray coatings for 3-dimensional work pieces as well as for barrier adhesives in laminates [7].

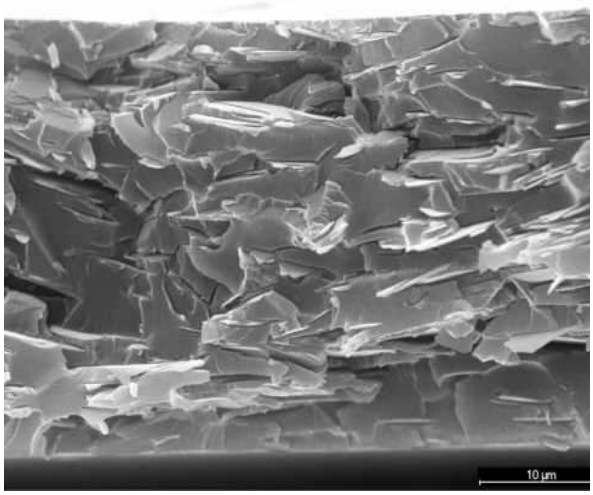


Figure 7: Scanning electron micrograph of the arrangement of MICA-sheets in a UV cured formulation.

Literature

[1] F. Bauer et al., Prog. Org. Coat. 53 (2005) 183.
[2] S. Stojanović et al., 13. NDVaK, Dresden, (2005) 192.
[3] M. Hanika et al., Chem. Eng. Technol. 26 (2003) 605.
[4] T. Scherzer, Nucl. Instr. Meth. B 131 (1997) 382.
[5] M. Salame, Polym. Eng. Sci. 26 (1986) 1543.
[6] P.C. LeBaron, Z. Wang, T.J. Pinnavaia, Appl. Clay Sci. 15 (1999) 11.
[7] WO2005040294, DE10362060 (A1)

Production of functional coatings: Solid-phase extraction materials for trace analysis

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Introduction

Functional coatings comprise a wealth of applications, from mechanical protection against scratches and abrasion to chemical protection like stain resistance and corrosion protection. In recent time, the tasks assigned to and tackled by functional coatings grow ever further: transparent gas barriers are sought-after, optical properties such as gloss or refractive index must be met.

Solid-phase extraction

Solid-phase extraction (SPE) is a versatile method of sample preparation for trace analysis. The method is derived from classical solvent extraction using a polymer as solvent. The polymer is stirred in the aqueous sample, in the example shown later from a polluted creek, and the pollutants (analytes) are equilibrated between the aqueous phase and the polymer depending on their relative solubility. The diffusion of molecules into polymers is not very fast so that the diffusion lengths achieved within the time span of a laboratory extraction (in the order of minutes to hours) are limited to a fraction of a millimetre. For this reason it is favourable to use a coating on an inert support instead of a chunk of material.

Solid-Phase Micro Extraction SPME was developed in the late 1980es [1]. This method uses coated fibres or capillaries quite similar to GC-capillaries as enrichment phase. The rather straight-forward adaptation of GC-phase knowledge to SPME has fostered the rise of this method. The very small active phase volumes though result in limited performance in trace analysis. As a consequence, around the turn of the century the Stir Bar Sorptive Extraction SBSE was developed [2] increasing the active volume from 0.5 µL for SPME to 25-250 µL in SBSE.

While in SPME a range of fibres are available covering unpolar and polar analytes, in SPE only PDMS-phases are state of the art. PDMS works extremely well with unpolar analytes, but fails with more polar ones which in SPME are covered by polyacrylate phases.

Requirements for SPE-materials

The coatings are envisaged for use in thermodesorption-GC/MS. In this method analytes are desorbed from the loaded coating by means of a nitrogen stream at elevated temperatures, typically 250 °C. The coating thus has to fulfil the following requirements:

- high extraction yields at room temperature,
- stability against thermal decomposition at 250 °C (in inert atmosphere).

High extraction yields are correlated with low chain-chain interactions (ease of diffusion), while thermal stability requires strong interactions. Thus, classical thermoplastic materials cannot fulfil both requirements. The commercially used SPE material, PDMS, shows the way: A strong, moderately cross-linked main-chain for temperature stability combined with weak side-chain interactions for ease of solute inclusion.

Production of Coatings

In the science of coatings technology and chemistry are intertwined, superior results can only be obtained by mastering both. Levelling is an example for this interweavement: perfectly smooth surfaces are only obtained by using a formulation that is adapted to the substrate and to the application/cure technology. Quite trivially do different sample sizes require different technologies. At the IOM various technologies are established covering the entire scale-up chain from microscope slide size for expensive coatings via beer mat-

sized lab scale coatings for the determination of haze, scratch, and abrasion resistance to pilot scale roller coaters.

Surface magnification by micro folding

In contrast to the conditions encountered with PDMS recoveries obtained with polyacrylate SPE materials do not scale with the phase volume but rather with the surface area. The effect may be caused by slow diffusion in the polar material. Two methods for surface magnification were tested: the manufacture and use of flat strips and the application of micro wrinkles produced via monochromatic VUV-irradiation. 172 nm-photons selectively generate radicals in the top layer only. The thin cured layer swims on its own liquid precursor and the interplay of shrinking tension vs. viscous drag creates a unique wrinkle pattern (Figure 1).

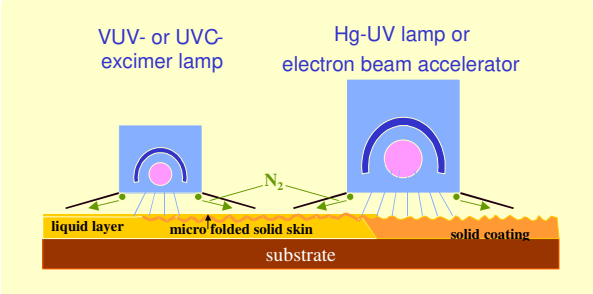

Figure 1 Principle of surface magnification via micro folding. The wrinkled surface is fixed with a second irradiation step (depth cure).

The method is described in depth in another article in this publication and in [3].

Coating machines

The efforts put into validation and verification of a novel material would be futile unless there is a method of assuring a constant quality production. A long term focus of the IOM is therefore the scale-up of coating processes using reel-to-reel coaters. A Krönert machine ("Labcoater I") is available running web speeds from 5 to 200 m/min at a working width of up to 450 mm, equipped with a corona pre-treatment, a three-reel coater (gravure and flexo), a 150 kV, 50 mA linear electron accelerator LEA, a 120 W/cm Hg-Arc, 308 nm-, 222 nm-, and 172 nm-excimer lamps, each producing 50 W/cm. All curing devices can be flushed with N_2 (< 50 ppm O_2). The machine is also equipped with an infrared heater and a lamination station, but for drying solvent or water based coatings the second "Labcoater II", a five-roll EHA machine, is used.

Figure 2: Thick acrylate coatings crack after heating to 250 °C when applied onto a glass rod due to differing thermal expansion coefficients. The magnet inside the glass rod is left with some expansion space for the same reason.

Special Coating Procedures used for SBSE

The thermodesorption units in trade are manufactured to suit the format of SBSE, i.e. comparatively short, compact stir bars. A typical unit uses glass tubes with an inner diameter of 4 mm and a 60 mm long heat zone. In order to produce coatings adapted to these conditions glass-encapsulated magnets were fixed in the centre of a silicone hose and the remaining rim filled with acrylate. After curing the magnet has an 0.5 mm thick acrylate jacket much like the PDMS-jacket of the commercial SBSE-Twisters®. Figure 2 shows their appearance after heat treatment.

In order to overcome the thermal expansion problem and yet provide the acrylate with some mechanical stability at 250 °C glass fibre fabrics were chosen as skeleton. In this case, the fabric was laid on a polyethylene foil, soaked with the acrylate monomer formulation, covered with another polyethylene foil and the superfluous liquid squeezed out by means of a cylindrical steel bar. After curing the sandwich in the UV tunnel the polyethylene foils can be pulled off without damaging the composite leaving a smooth surface. By using structured lamination foils structures could be replicated into the glass fibre composite. In order to obtain more rigid samples polyimide foils

can be used as support with the acrylate being coated on both sides.

Analytical Procedures

Reagents and materials

An EPA phenolic standard consisting of seven phenols (phenol, 2-chlorophenol, 2,4,-dimethylphenol, 2,4-dichlorophenol, 4-chloro-3-methylphenol, 2,4,6-trichlorophenol, pentachlorophenol) with a concentration of 500 mg/dm³ of each phenol and alpha-hexachlorocyclohexane, delta-hexachlorocyclohexane, and hexachlorobenzene standards were obtained from Supelco (Bellefonte, PA, USA). Methanol, acetone, and sodium chloride were purchased from Merck (Darmstadt, Germany). The commercial stir bar Twister® for sorptive extraction was provided by Gerstel. It consists of a 10 mm length glass-encapsulated magnetic stir bar onto which a 0.5 mm thick PDMS tube (22 µg = 25 mm³) is mounted. Prior to first use, the stir bar was conditioned 16 h at 250 °C with a nitrogen stream of 30 cm³/min.

Extraction Procedure

All the studies to optimize the extraction procedure were performed using 50 cm³ aqueous sample spiked at a concentration level of 10 ng/cm³ of each compound. To perform the extraction under the optimal conditions the sorbent media was introduced into a 50 cm³ flask containing 50 cm³ of a water sample saturated with NaCl and submitted to a stirring speed of 1500 rpm for PDMS Twister or to a shaking speed of 500 min^{-1} for PA strip for an extraction time of 4 h at room temperature. After that, the Twister or PA strip was removed from the aqueous solution with tweezers, rinsed with purified water, dried with a lint-free tissue, and inserted into an appropriate Gerstel thermal desorption glass tube (187 mm length x 4 mm inner diameter).

For determination of recoveries, a plug of pesticide-grade glass wool (Supelco, Bellefonte, PA, USA) was placed inside of an empty Gerstel thermodesorption glass tube. One end of the plug was sealed with a metallic gauge stopper for thermodesorption tubes (Gerstel). The tube was then spiked with 1 mm³ of a standard solution containing the selected compounds and connected to a cold nitrogen stream (30 cm³/min) for 1 min to allow evaporation of the solvent. The tube was immediately transferred to the thermodesorption device for subsequent analysis.

Instrumental

Thermodesorption GC-MS of the selected compounds sorbed on the Twisters® and strips was performed on an Agilent system (Agilent Technologies, Palo Alto, CA, USA) coupled to a Gerstel TDS A thermodesorption device. A cold injection system (CIS) using liquid nitrogen as a coolant consisted of an empty liner for cryofocusing the analytes prior to introduction into the capillary column.

The optimized conditions utilized for the thermodesorption system were as follows: desorption temperature, 250 °C; desorption time, 5 min; and helium flow rate, 100 cm³/min (solvent vent mode). Both transfer lines, situated between the thermodesorption system and the CIS, and between the GC and the MS detector, were set at 250 °C.

The method utilized for the cold injection system was as follows: during thermal desorption, temperature set at –20 °C; heating at a rate of 10 K/s to 250 °C (hold for 2 min); the injector was used in splitless mode with a splitless time of 1.5 min.

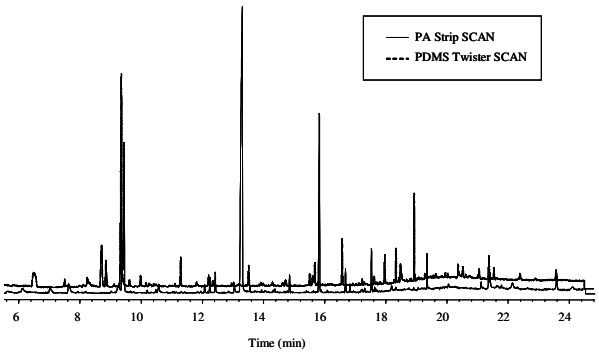

Figure 3: Background scan of a PDMS Twister® vs. a PA strip. In both cases a flat background is obtained spiked with some characteristic deterioration products.

An HP-5ms capillary column (30 m x 250 µm i.d., 0.25 µm film thickness) was used with a GC oven program from 50 °C (2 min) to 200 °C at 10 K/min, and to 270 °C (5 min) at 25 K/min. Helium was used as carrier gas with a flow of 1 cm³/min. A detection method using single ion monitoring (SIM) mode which considered two characteristic ions for each compound was estab-

lished for detection. The characteristic ions for each studied compound are shown in Table 1.

Table 1: Octanol/water partition coefficients (K_{ow}) and m/z of the analytes.

Compound	Ions (m/z)	log K_{ow}
Phenol	66, 94	1.46
2-Chlorophenol	64, 128	2.15
2,4-Di-Me-Phenol	107, 122	2.3
2,4-Di-Cl-Phenol	63, 162	3.06
4-Cl,3-Me-Phenol	107, 142	3.1
2,4,6-Tri-Cl-Phenol	196, 198	3.69
α-Hexa-Cl-C_6H_6	181, 219	3.8
Hexachlorobenzene	284, 286	5.73
Pentachlorophenol	266, 268	5.12
δ-Hexa-Cl-C_6H_6	181, 219	4.14

Analytical Results

Qualifying a novel material for use in trace analysis requires a thorough testing, in the following only the most important achievements are reported. Details will be published soon [4]. First we will report the results with the commercial Twister® as reference (Table 2) and compare them to the results with our PA strips (Table 3). Extraction efficiencies were determined vs. analytes directly desorbed from glass wool.

Table 2: Figure of merit for the compounds studied using PDMS Twisters®. The repeatability is given as relative standard deviation $\sigma_{n-1}/\bar{x}$.

Compound	σ_{n-1}, %	LOD ng/dm³	EE (%)
Phenol	10.5	435	1.3
2-Chlorophenol	5.2	196	3.8
2,4-Di-Me-Phenol	2.8	41	2.7
2,4-Di-Cl-Phenol	1.8	9.7	11.6
4-Cl,3-Me-Phenol	4.6	107	2.2
2,4,6-Tri-Cl-Phenol	2.2	7.0	40.7
α-Hexa-Cl-C_6H_6	3.8	1.4	95.1
Hexachlorobenzene	4.9	0.2	83.7
Pentachlorophenol	4.0	14	84.5
δ-Hexa-Cl-C_6H_6	3.7	2.0	86.0

As evident from Table 3, the PA strips outperform the PDMS Twisters® in enrichment of polar compounds and close up to them in unpolar compounds, thus being a true alternative.

Table 3: Figure of merit for the compounds studied using the PA strips. The repeatability is given as relative standard deviation $\sigma_{n-1}/\bar{x}$.

Compound	σ_{n-1}, %	LOD ng/L	EE (%)
Phenol	19.2	25.4	6.9
2-Chlorophenol	6.4	11.2	7.7
2,4-Di-Me-Phenol	5.9	3.5	13.1
2,4-Di-Cl-Phenol	6.0	0.54	39.8
4-Cl,3-Me-Phenol	7.7	15.3	23.9
2,4,6-Tri-Cl-Phenol	5.8	0.26	69.3
α-Hexa-Cl-C_6H_6	8.3	4.00	98.5
Hexachlorobenzene	6.2	0.11	96.9
Pentachlorophenol	11.7	1.9	91.3
δ-Hexa-Cl-C_6H_6	17.9	14.3	86.1

Furthermore, and somewhat to our surprise, as monomers in technical quality were used without further purification, the pretreatment chosen (16 h at 250 °C in a nitrogen stream) effectively removes residues that could bleed during thermodesorption. The background noise is as low as the one from PDMS.

Conclusion

The results shown here pave the way to introducing polyacrylate materials into the realm of SBSE in the near future. A first manuscript is in preparation [4], a grant application is filed together with two industrial partners.

Literature

[1] C.L. Arthur, J. Pawliszyn, Anal. Chem. 62 (1990) 2145.
[2] E. Baltussen et al., J. Microcolumn Sep. 11 (1999) 737.
[3] R. Schubert et al., in 9. UCB Symposium: Garmisch-Partenkirchen, 1998.
[4] R. Rodil et al., in preparation (2006).

Influence of deposited layer at laser backside etching of fused silica

R. Böhme, K. Zimmer

The indirect laser processing of transparent materials offers a number of advantages compared to laser ablation like low threshold fluences, etch rates in the nanometer range, minimal material alterations, and low roughness. Due to this attributes high accurate surface patterns for, e.g., applications in micro-optics, are attainable but the underlying interaction processes are complex and not well understood. The indirect laser processing techniques LIBWE (*laser-induced backside wet etching*) [1] and LESAL (*laser etching at a surface adsorbed layer*) [2] make use of the laser absorption at the materials backside by means of organic liquids and adsorbed hydrocarbon layers, respectively. This intensive energy deposition near the interface of the solid and the absorbing medium causes the observed etch processes.

The proposed etch mechanism comprises a sequence of fast surface heating by the hot additive up to the melting/softening point followed by mechanical removing of the heated/softened surface region due to high pressures/stresses. On the other hand the regularly observed incubation effects and the analytically measured surface alterations give evidences for laser-induced surface modifications. Especially the deposition of hydrocarbon layers due to decomposition of the used organic absorbers has been detected for LIBWE as well as for LESAL [1-3].

This carbon-containing modified surface probably enhances the laser absorption, affects the materials interaction at subsequent laser pulses, and alters the etch mechanism but in a different manner for LIBWE and LESAL.

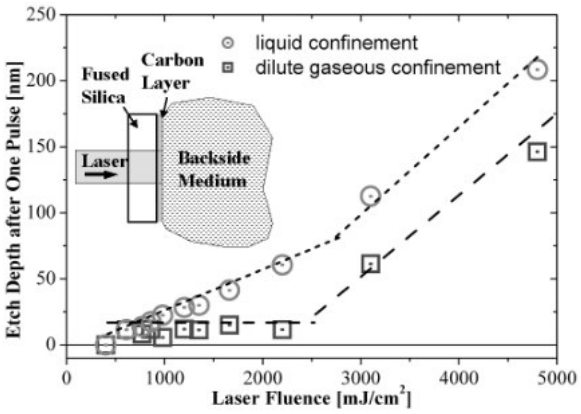

Figure 1: Etch depth of fused silica in dependence on the laser fluence after one-pulse treatment of solid/layer interface in liquid and air confinement.

Therefore the influence of the confinement to the backside etching was studied by backside ablation rate measurements of the of a 20 nm thick carbon layer on fused silica at two different ambient inert media without absorption that are gas (air) and liquid (water). In Figure 1 the measured etch depth after one laser pulse is depicted in dependence on the laser fluence in comparison for water and air. The confinement influences the etch rate and the laser fluence dependence of the etch rate significantly while the threshold fluence is similar. In the case of air rate saturation similar to LESAL [2] occurs whereas with liquid as backside medium a linear growing rate typical for LIBWE at moderate fluences [1] can be observed.

The less dense air permits a faster expansion of the ablation plume than in the case of water confinement and consequently affect the interaction time and interaction strength of the hot plume with the fused silica surface. The differences in the laser-plume-substrate interaction [4] cause the observed rate saturation at weak interaction (air) and the linear growing etch rate at strong interaction (water). Thus, the different backside media affect the thermal and the mechanical confinement of the etching processes that influence the dynamics of the interaction process and must be considered in developing a suited model for backside etching processes.

Literature

[1] R. Böhme, K. Zimmer, Appl. Surf. Sci. 247 (2005) 256.
[2] K. Zimmer, R. Böhme, B. Rauschenbach, Appl. Phys. A 79 (2004) 1883.
[3] R. Böhme, D. Spemann, K. Zimmer, Thin Solid Films 453-454 (2004) 127.
[4] R. Böhme, K. Zimmer, B. Rauschenbach, Appl. Phys. A 82 (2006) 325.

Ion beam assisted molecular beam epitaxy of high-quality m-plane oriented gallium nitride thin films on lithium aluminate substrates

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Recent research at the IOM proved that ion beam assisted molecular beam epitaxy (IBA-MBE) is well suited to deposit thin epitaxial wurtzitic gallium nitride (w-GaN) films of high crystalline and optical quality on 6H-SiC(0001) [1]. This originates in the additional energy input of the hyperthermal nitrogen ions into the film surface during deposition, leading to a ballistic enhancement of the adatom surface mobility.

C-plane oriented w-GaN, that became prominent in the last years as base for highly efficient blue light emitting diodes and laser diodes, is polar along the growth direction. This may lead to electric polarisation effects interfering with the electronic device performance. Thus, w-GaN films with a non-polar growth direction are of large interest. Non-polar, typically a-plane oriented w-GaN films deposited on r-plane Al_2O_3 exhibited the problem that a high nitrogen ion/gallium atom arrival ratio (I/A ratio) resulted in heavily tilted c-axis oriented w-GaN domains [2]. A higher film quality due to lower lattice misfit was shown for m-plane oriented GaN grown on the (100) plane of lithium aluminate (γ-$LiAlO_2$) [3].

Optimisation of the quality of non-polar m-plane oriented w-GaN films deposited by IBA-MBE at the IOM was accomplished by variation of the I/A ratio in particular. A substrate temperature of 700 °C was found to be optimal. The comparison of N-rich (I/A > 1) and Ga-rich (I/A < 1) deposition showed that the crystalline and optical quality of films deposited under slightly Ga-rich conditions is higher than under N-rich conditions. I/A >> 1 resulted in the presence of polar, c-plane oriented w-GaN domains, I/A << 1 resulted in droplets of surplus gallium at the film surface.

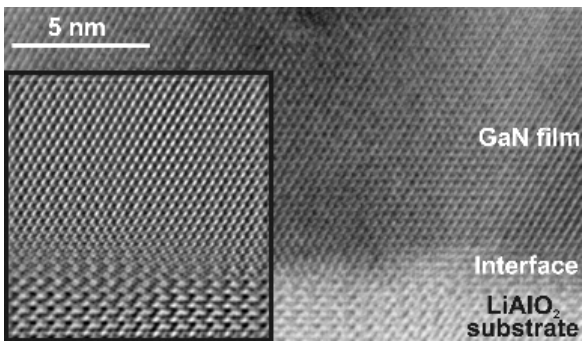

Figure 1: High resolution electron micrograph with zone axis w-GaN[0001] of an m-plane oriented IBA-MBE w-GaN film on $LiAlO_2$. The framed region was filtered to emphasise the high crystalline order.

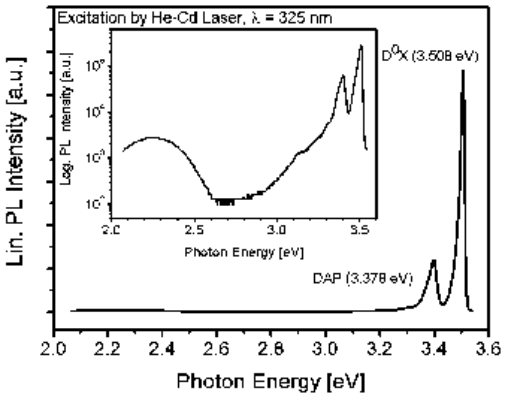

Figure 2: Photoluminescence spectrum of an m-plane oriented IBA-MBE GaN film on $LiAlO_2$. Note the strong and narrow (20 meV) near-bandgap transition signal at 3.508 eV).

X-ray diffraction measurements and high resolution electron microscopy demonstrated the high structural quality of the optimised films (Figure 1), whereas the high optical quality of the films was revealed by photoluminescence spectroscopy (Figure 2) [4]. However, these films are characterised by high, anisotropic, compressive mechanical stress of several GPa due to largely different thermal expansion coefficients of film and substrate [5].

Literature

[1] S. Sienz et al., J. Cryst. Growth 264 (2004) 184.
[2] J.W. Gerlach, W. Attenberger, B. Rauschenbach, Phys. Status Solidi C 0 (2002) 161.
[3] P. Waltereit, O. Brandt, K.H. Ploog, Appl. Phys. Lett. 75 (1999) 2029.
[4] J.W. Gerlach et al., Appl. Phys. Lett. 68 (2006) 011902.
[5] E. Eiper et al., J. Cryst. Growth 284 (2005) 561.

Self-organised nanostructures by ion beam erosion

B. Ziberi , F. Frost

Particle beams of low-energy ions or atoms are particularly suitable tools for ultraprecise processing of any arbitrary surface. Due to the ion bombardment material is eroded from the surface reminiscent of the sandblasting of surfaces or the erosion by water and wind. Beside the intended removal of material the surface topography is modified by the ion bombardment, as well. The surface evolution during ion erosion is effected by numerous atomistic mechanisms. Depending on the dominating process a large variety of erosion forms and patterns can be developed. Thus the interplay of surface erosion and surface diffusion give rise to self-organization, i.e. pattern formation for conditions far away from equilibrium, and causes well-ordered nanometer-sized structures. Recently, it was observed that self-organised, ordered hexagonal or square dot patterns can evolve from low-energy ion sputtering of III/V semiconductor surfaces under normal incidence, or under oblique incidence and simultaneous sample rotation initiating new interest in this alternative approach for surface nanostructuring [1].

In the last two years, our main focus was set on the pattern formation on Si and Ge surfaces during low-energy noble gas ion beam erosion [2-4]. In particular, it is demonstrated that (i) complex pattern formation processes do arise during erosion of Si and Ge surfaces and (ii) remarkabley high ordered dots as well as ripple patterns with structure sizes below 50 nm can be obtained by choosing appropriate ion beam conditions for both surfaces.

Two examples of generated nanostructures are shown in the figures. In the first example small wave-like structures were produced by oblique ion bombardment of Si wafer surfaces. In the second example ordered nanometer-sized dots also on Si surfaces were formed. The ordering of these structures increases with ion fluence, leading to remarkably well ordered patterns. The size and the geometrical shape of this structures can be adjusted by the ion beam and sample parameters.

Due to the application of qualified broad-beam ion sources, homogeneously patterned, large-area surface modification can be accomplished. Up to now, Si wafers with diameters up to 200 mm were processed. The simple and cost efficient one-step fabrication process ensures an extraordinary application potential for the generation of sub-wavelength nano-optic components or as templates for the growth of nanostructured functional thin films.

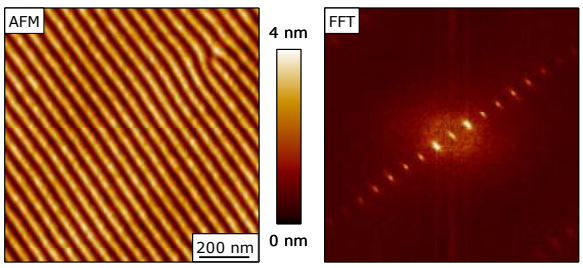

Figure 1: Nano ripples on Si with a periodicity of 50 nm generated by 1200 eV Kr^+ ion beam erosion under 15 deg ion incidence. Left: surface topography measured by AFM; right: Fourier transformed height profile.

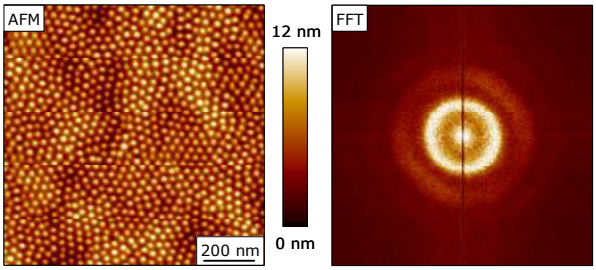

Figure 2: Hexagonal ordered nanodots on Si with a periodicity of 30 nm generated by 500 eV Ar^+ ion beam erosion under 75 deg ion incidence with simultaneous sample rotation. Left: surface topography measured by AFM; right: Fourier transformed height profile.

Literature

[1] S. Facsko et al., Science 285 (1999) 1551; F. Frost, A. Schindler, F. Bigl, Phys. Rev. Lett. 85 (2000) 4116: R. Gago et al., Appl. Phys. Lett. 78 (2001) 3316.
[2] B. Ziberi et al., Appl. Phys. Lett. 87 (2005) 033113.
[3] B. Ziberi et al., Phys. Rev. B 72 (2005) 235310.
[4] B. Ziberi, F. Frost, B. Rauschenbach, Appl. Phys. Lett., submitted.

Ion beam assisted deposition of chiral sculptured thin films

E. Schubert, B. Rauschenbach

Nanostructures with complex geometries promise a high application potential for instance as optical and photonic materials, magnetic storage devices or sensors. Glancing angle deposition (GLAD) in combination with a computer controlled substrate rotation is a sophisticated method to customize manifold nanostructure varieties [1].

In our work the particle flux is provided by ion beam sputtering and reaches the substrate under an extremely oblique angle-of-incidence (typically 85 deg respective to the normal). In this deposition configuration, highly porous sculptured thin films (STF) are created, which consist of slanted amorphous silicon needles with a diameter from 20 nm to 50 nm, whereas competitive growth mechanism due to geometric shadowing determine the nucleation and growth processes (Figure 1). By applying an appropriate substrate rotation during growth the nanostructure geometry can be tailored. Chevrons and square spirals (Figures 2b and 2c) are created with a symmetric stepwise substrate rotation of 180 deg and 90 deg, respectively. The fabrication of circular spirals, screws (Figure 2a) and vertical posts is realised by a constant substrate rotation, and the nanostructure geometry depends on the ratio from deposition rate to substrate rotation speed [2].

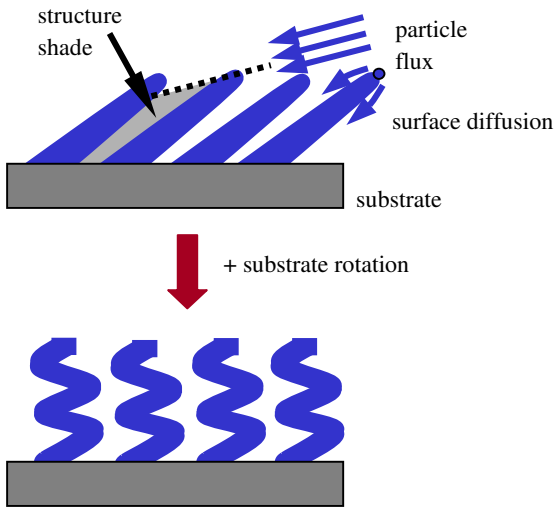

Figure 1: Principle of GLAD

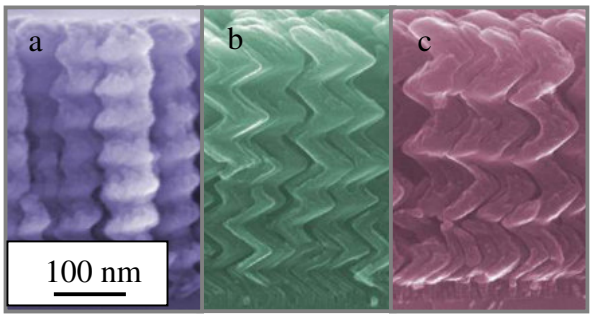

Figure 2: Chiral nanostructures from Si grown by GLAD: screws (a), chevrons (b), and spirals (c).

Chiral nanostructures exhibit a fibre-like fine structure, where each fibre exhibits a diameter of roughly 20 nm. A single chiral nanostructure is composed of a fibre bundle and the amount of fibres within one bundle determines the final diameter of the structure.

Sculptured thin film growth on unseeded substrates is determined by self-ordering phenomena yielding to periodic arrangements of chiral nanostructures across the substrate. Upon interaction with visible light the nanostructure arrangement supports directional diffraction making sculptured thin film acting like nanogratings. Periodic sculptured thin films can be also achieved by using prepatterned substrate templates (Figure 3).

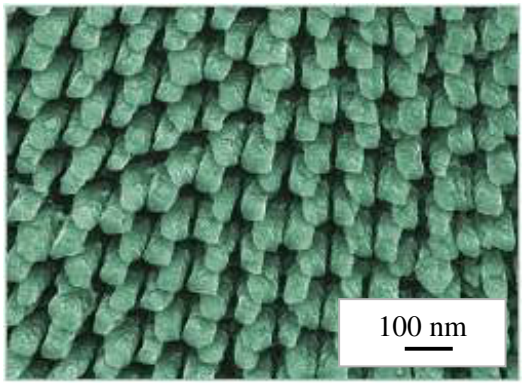

Figure 3: STF growth on substrate templates.

Literatur

[1] K. Robbie, M.J. Brett, and A. Lakhtakia, J. Vac. Sci. Technol A 13 (1995) 2991.
[2] E. Schubert et al., Appl. Phys. A 81 (2005) 481.
[3] E. Schubert et al., Nucl. Instr. Meth B 244 (2006) 40

Low-power plasma jet treatment of small size optics

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Low-power reactive plasma jets working at atmospheric pressure and with mm or sub-mm spot sizes are promising tools for highly deterministic local surface processing [1-5]. Especially, exploiting fluorine chemistry for etching silicon and silicon based materials like quartz, silicon nitride or silicon carbide and some metals like tungsten, molybdenum, or titanium as well as material combinations like the low thermal expansion material ULE™ can be removed effectively. Thus, the plasma jet is well suited for the figuring and figure error correction of small size optics as well as the correction of mid spatial frequency errors of large and medium size optics.

For that purpose a compact microwave driven plasma jet source has been developed and tested. Depending on the material under consideration Gaussian like etch spots with a FWHM between 0.3 mm and 0.7 mm have been achieved (see Figure 2).

The typical working distance is about 3 mm which allows the treatment of small size and strongly curved workpieces.

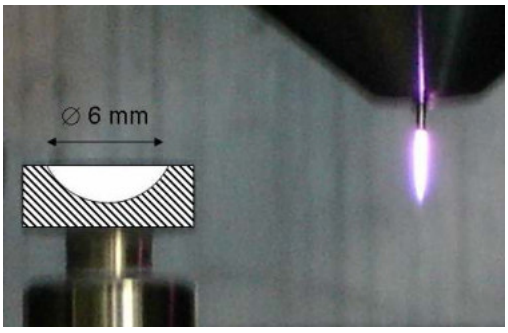

Figure 1: Plasma jet together with small size concave quartz optical element.

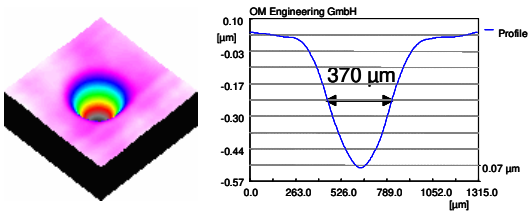

Figure 2: Removal spot of the plasma jet on silicon.

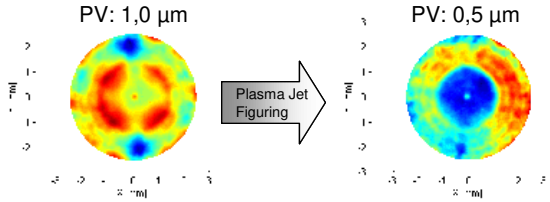

Figure 3: Shape error improvement of a small size and strongly curved concave lens with aspheric shape after single step scanning dwell time plasma jet processing.

The removal rate can be adjusted by varying microwave power and reactive gas flow (typical etch rates for quartz substrates lie between 10 nm/s and 100 nm/s).

Figure 1 shows the plasma jet together with a small size concave quartz optical element which has an aspheric shape. The edge angle of this element was more than 60 degrees. In a single step dwell time line by line scanning procedure the initial shape error of about 1 µm PV was reduced by nearly 50 % to about 500 nm PV as shown in Figure 3. In this case the plasma jet source had been mounted to a 3-axis moving system to keep the working distance constant during the figuring process. Work is continued using a 5-axis moving system that makes it possible to position the plasma jet always normal to the surface. Thus, a significant improvement of the figuring result is assumed due to the fact, that the angle dependence of the etch rate and the shape deformation of the etch spot near the edges are avoided.

Literature

[1] E. Stoffels et al, Plasma Sources Sci. Technol. 11 (2002) 383
[2] T. Okumura et al, Jpn. J. Appl. Phys. Vol. 42 (2003) 3995
[3] H. Yoshiki et al, Jpn. J. Appl. Phys. Vol. 42 (2003) 4000
[4] T. Okumura, M. Saitoh, I. Matsuda, Jpn. J. Appl. Phys. Vol. 43 (2004) 3959
[5] T. Ichiki, R. Taura, Y. Horiike, J. Appl. Phys. 95 (2004) 35

A new EUVL mask blank deposition tool

J. Dienelt, H. Neumann, F. Scholze, J.W. Gerlach, T. Höche, B. Rauschenbach
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The internationally favourable technology to achieve the 45 nm node is the extreme ultra-violet lithography (EUVL) with an exposure wavelength at 13.4 nm. Extremely high demands will be made on the deposition technology for the reflection masks [1,2]: (i) The relative deviation of reflectance over an area of 150 mm×150 mm of less than 1 % is required. (ii) The particle or the defect density for masks should be less than 10^{-3} cm^{-2} for 6 inch square. (iii) The deposition rates of Mo and Si have to be as high as possible to process an EUV mask blank within one hour.

A schematic view of the new EUV mask blank deposition tool is shown in Figure 1. The Mo and Si layer deposition is performed with a segment controlled linear electron cyclotron resonance

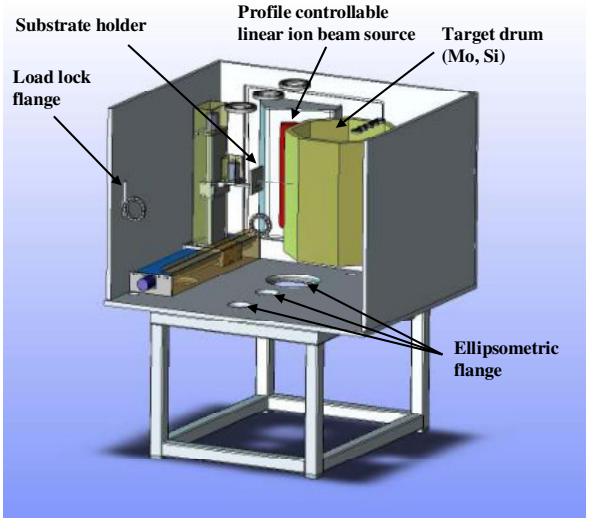

Figure 1: Schematic view of the process chamber of the ion beam sputter deposition tool.

(ECR) ion beam source. 8 Mo and 8 Si targets are mounted on a rotating target drum where the target surface is positioned in the ion beam focus. The base pressure of the process chamber is less than 5×10^{-8} mbar using a combination of a turbo molecular and a cryo pump. The particle minimisation is realised by: 1) huge process chamber dimension, 2) permanently rotating of the target drum, 3) vertical handling and deposition of the mask blank, 4) exclusive material selection for contact pads and chamber lining, 5) electrical beam profile control by the ion beam source (no substrate rotation necessary), and 6) ion source material and geometry optimisation. A handler chamber is modular designed to mount an additionally process chamber as well as a further load lock. The transfer of the mask blanks from the load lock to the process chamber is carried by a particle specified (<0.1 particle/cycle) linear pneumatic rod.

The deposited Mo/Si multilayers were studied by TEM, AFM, ellipsometry, X-ray reflectometry, etc. As example, in Figure 2, a cross section taken

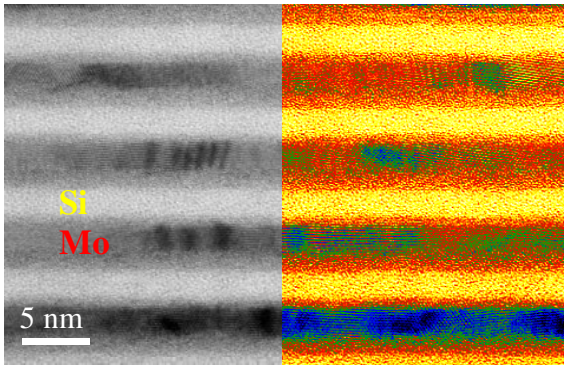

Figure 2: XTEM micrograph and the corresponding element mapping by EEL of a Mo/Si multilayer on the mask blank.

from an as-deposited Mo/Si multilayer sample prepared by ion-beam thinning is shown together with the corresponding element mapping across five periods of the layer stack (details see refs. [3-5]).

This industrial suitable deposition tool is ready for use for application of high-quality EUV mask blanks.

Literature

[1] B. Rauschenbach, Vacuum 69 (2002) 3.
[2] J. Dienelt et. al., Microelectr. Engng. (2006).
[3] E. Schubert et. al., J. Vac. Sci. Technol. B 23 (2005) 959.
[4] T. Chassé, H. Neumann, B. Rauschenbach, Nucl. Instr. Meth B 206 (2003) 377.
[5] T. Chassé et. al, Vacuum 71 (2003) 407.

Plasma immersion ion implantation of Ti alloys for medical application

S. Mändl, D. Manova

Biocompatibility itself is a concept easy to understand and difficult to define, thus necessitating further fundamental research on surface interactions. Several modes can be identified, albeit it is still not possible to give a succinct description of their respective mechanisms: (i) surface topography on the µm- and nm-scale;. (ii) electronic density of state at the surface; (iii) outdiffusion of metallic cations; (iv) generation of wear particles and their transport, e.g. in macrophages towards a final agglomeration in the lung and spleen.

Plasma immersion ion implantation (PIII) is a powerful method to obtain hard and wear resistant surface on Ti alloys and NiTi by oxygen or nitrogen implantation [1,2]. By adjusting the temperature, treatment time, and heating regime, different phase compositions and layer thickness can be obtained. Depending on the specific system, a strong influence of the resulting microstructure on the wear and fatigue properties was observed.

In addition to the microstructure, the phase formation is also strongly influenced by the temperature and heating regime. Oxygen implantation into NiTi and pure Ti always leads to the formation of rutile, independent of the temperature and the heating regime. Ti_6Al_4V shows a mixture of anatase and rutile, together with the formation of alumina at temperatures beyond 600 °C with anatase, the metastable low temperature phase, favored against rutile when the samples are preheated to 400 °C before starting the ion implantation.

A similar effect is observed during nitrogen implantation into pure Ti [3]. Starting the implantation at room temperature leads to the parallel formation of δ-TiN and ε-Ti_2N, as observed by X-ray diffraction (XRD). In contrast, additional external heating with a start of the ion implantation at 350 °C results in the dominance of Ti_2N.

Correspondingly, the treatment time, temperature, and heating regime translate into different mechanical properties as mediated by the layer thickness, phase composition, and microstructure. Using a rotating ball-on-disc test, no significant

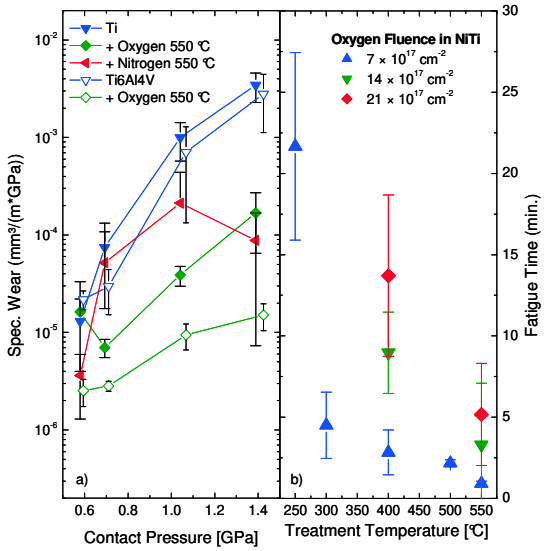

Figure 1: a) specific wear and b) fatigue time for oxygen implantation at different contact pressures, implantation temperatures and ion fluxes.

difference in the wear rate of untreated Ti and Ti_6Al_4V was found (see Figure 1a), whereas oxygen implantation leads to a wear reduction of two orders of magnitude for the former material, increasing to 2.5 orders of magnitude for the latter one.

As the fatigue time of oxygen implanted NiTi, as depicted in Figure 1b, actually increases with decreasing implantation temperature and increasing ion fluence, a complex interplay of adhesion problems due to the sharp interface between the rutile surface and the NiTi intermetallic base material, coupled with thermal stress annealing can be proposed in this system.

Literatur

[1] S. Mändl, J.W. Gerlach, B. Rauschenbach, Surface Modification of NiTi for Orthopaedic Braces by Plasma Immersion Ion Implantation, Surf. Coat. Technol. 196 (2005) 293.

[2] S. Mändl, PIII Treatment of Ti Alloys and NiTi for Medical Applications, Surf. Coat. Technol. (in press).

[3] D. Manova et. al, Phase Formation in Ti after High Fluence/High Temperature Nitrogen Implantation, Nucl. Instrum. Meth. B 242 (2006) 282

UV/VIS absorption spectra of alkyl-, vinyl-, aryl- and thiylperoxyl, and some related radicals in aqueous solution. A quantum-chemical study

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Alkylperoxyl and alkoxyl radicals only absorb in the UV, while vinylperoxyl, phenylperoxyl, alkylthiylperoxyl and benzyloxyl radicals have strong absorptions in the visible. Using Time Dependent Density Functional Theory (TD DFT) the UTD/B3LYP/6-31G+(d,p) method we have calculated the long-wavelength absorption maxima of these and related radicals in vacuo and in aqueous solution [1]. The latter has been accounted for by a dielectric continuum model (SCRF=PCM). The vinyl peroxyl radical long-wavelength absorption band is due to a $-2\beta[\pi]\rightarrow 0\beta[n(O)_z]$ transition. The $n(O)_y$ orbital lies above the π orbital, but since it is orthogonal to the $n(O)_z$ orbital the oscillator strength of the $-1\beta[n(O)_y]\rightarrow 0\beta[n(O)_z]$ transition is close to zero (Figure 1).

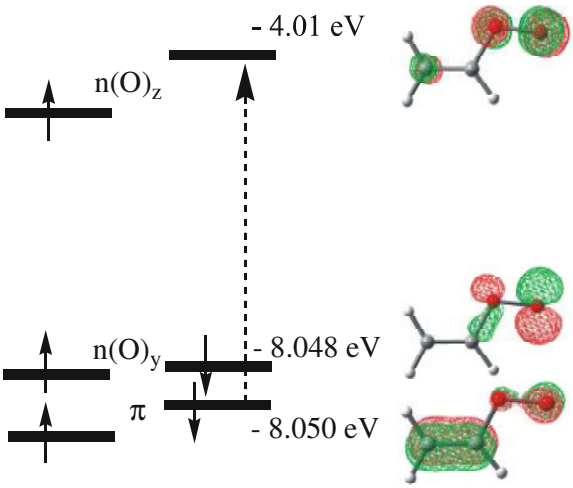

Figure 1: MO schemes for transitions of the ivnylperoxyl radical in water.

Upon chlorine substitution, the first absorption band is red-shifted. The π orbital is now raised above the $n(O)_y$ orbital, and the transition is denoted as $-1\beta[\pi]\rightarrow 0\beta[n(O)_z]$ (Figure 2).

The absorption of the phenylperoxyl radical in the visible is accounted by two nearby transitions of the same type, i.e. $-2\beta[\pi]\rightarrow 0\beta[n(O)_z]$ and $-1\beta[\pi]\rightarrow 0\beta[n(O)_z]$. Due to the charge transfer character of these transitions there is a marked red-shift upon going from the gas phase to aqueous solutions. The benzyloxyl and phenoxylmethyl radicals are related to the phenylperoxyl radicals in so far as one of the peroxyl oxygens is replaced by a methylene group.

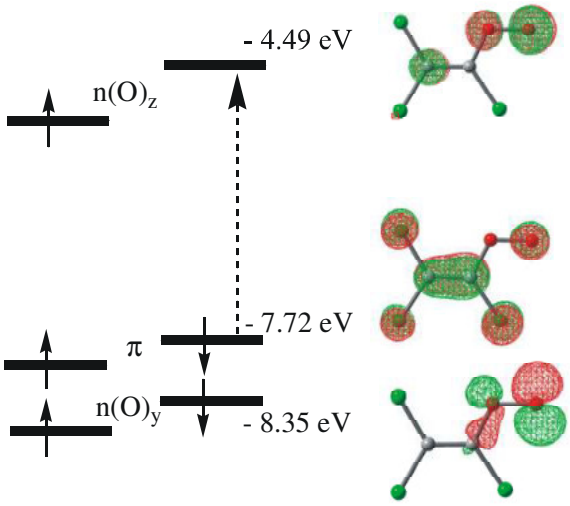

Figure 2: MO schemes for transitions of the chlorine substituted vinylperoxyl radical in water.

The benzyloxyl radical also absorbs in the visible and the transition is of the $-2\beta[\pi]\rightarrow 0\beta[n(O)_z]$ plus $-1\beta[\pi]\rightarrow 0\beta[n(O)_z]$ type, i.e. it is closely related to that of the phenylperoxyl radical. The phenoxymethyl radical only absorbs in the UV ($\lambda_{max}=320$ nm; spectrum obtained by pulse radiolysis) and this absorption band is due to $0\alpha[\pi]\rightarrow+2\alpha[\pi^*]$ plus $-1\beta[\pi]\rightarrow 0\beta[\pi]$ transitions. The absorption in the visible of the alkylthiylperoxyl radical is a $-1\beta[n(S)_z]\rightarrow 0\beta[n(O)_z]$ transition. Alkylthiyl and some other sulfur- and carbon-centered radicals react reversibly with O_2. The energetics of these reactions have been addressed by DFT quantum-chemical calculations.

The programmes for calculations of absorption spectra of free radicals can be used now to predict the positions of the absorption maxima which allows for the theory-based optimization of irradiation sources. With radicals whose transitions have CT character the dielectric constant of the medium has to be taken into account.

Literatur

[1] S. Naumov, C. von Sonntag, J. Phys. Org. Chem. 18/7 (2005) 586.

Thermal and photo-induced transformations of amine radical cations

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Amines and their radical cations play a significant role in many areas of polymer, biological, and synthetic chemistry, e.g. as co-initiators in EB- and UV-induced curing, as enzyme inhibitors with considerable biological significance, or as important intermediates in the Hofmann-Löffler-Freytag reaction for the synthesis of pyrrolidine derivatives. The thermal and photochemical transformations of amine (*n*-propyl $\mathbf{1}^{\bullet+}$, *n*-butyl $\mathbf{2}^{\bullet+}$) radical cations generated radiolytically in freon matrices have been investigated using low-temperature EPR spectroscopy [1]. The rapid generation of the primary species by a short exposure (1-2 min) to electron irradiation (77 K) allowed the thermal rearrangement of $\mathbf{1}^{\bullet+}$ to be monitored kinetically as a first-order reaction at ~125 K by the growth in the well-resolved EPR signal of the distonic radical cation $^{\bullet}CH_2CH_2CH_2NH_3^+$ ($\mathbf{3}^{\bullet+}$).

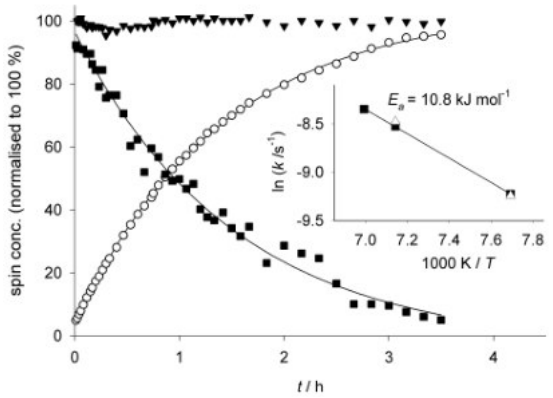
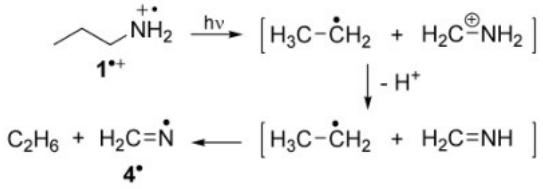


Figure 1: Time dependence of total spin concentration (▼) (normalised) and relative contribution of species $\mathbf{1}^{\bullet+}$ *(■) and* $\mathbf{3}^{\bullet+}$ *(○) as measured at 140 K. Inset: Arrhenius-plot for transformation* $\mathbf{1}^{\bullet+} \rightarrow \mathbf{3}^{\bullet+}$.

By comparison, the formation of the corresponding $^{\bullet}CH_2CH_2CH_2CH_2NH_3^+$ species from $\mathbf{2}^{\bullet+}$ is considerably more facile and already occurs within the short irradiation time. These results directly verify the intramolecular H-atom migration from carbon to nitrogen in these ionized amines, a reaction considered to be of key mechanistic significance in the classical Hofmann-Löffler-Freytag reaction. The rates of these reactions are found to be in accord with theoretical calculations that predict a much lower barrier for the 1,5-shift in the *n*-butylamine radical cation than for the 1,4-shift in the *n*-propylamine radical cation. For $\mathbf{1}^{\bullet+}$, the 1,4-H shift is also brought about directly at 77 K by exposure to ~ 350 nm light, although there is also evidence for the 1,3-H shift requiring a higher energy. A surprising result of the present work is the formation of the methylene imino radical $H_2C{=}N^{\bullet}$ ($\mathbf{4}^{\bullet}$) after photoexcitation. It is suggested that this occurs as a consequence of the β-fragmentation of $\mathbf{1}^{\bullet+}$ to the ethyl radical and the $CH_2{=}NH_2^+$ cation, followed by consecutive cage reactions of deprotonation and hydrogen transfer from the iminonium group.



Additionally, at high substrate concentrations the propane-1-iminyl radical $CH_3CH_2CH{=}N^{\bullet}$ was detected. Its formation is attributed to a modified reaction sequence in which $\mathbf{1}^{\bullet+}$ first undergoes a proton transfer within a cluster of amine molecules to yield the aminyl radical $CH_3CH_2CH_2N^{\bullet}H$. A subsequent disproportionation of these radicals can then yield the propane-1-imine precursor $CH_3CH_2CH{=}NH$ which is known to easily undergo hydrogen abstraction from the nitrogen.

Both cases highlight the great stability of $RCH{=}N^{\bullet}$ radicals due to a strong hyperconjugation between the C–H σ-orbital(s) and the nitrogen 2p orbital of the unpaired electron. Iminyl radicals are important reaction intermediates and are often detected under circumstances where normally their formation would not be expected.

Literature

[1] I. Janovský et al., Chem. Eur. J. 10 (2004) 5524

Surface modification of nano-sized zeolites

F. Bauer, E. Bilz, A. Freyer
in collaboration with W.H. Chen, S.B. Liu
Academia Sinica

Selectivity enhancement of zeolite catalysts for hydrocarbon processing often invokes inactivation of unselective sites by post-synthesis modifications. This issue, which is closely related to the external surface area of zeolite particles, is more crucial for catalysts consisting of nano-size crystallites. Surface modifications by chemical liquid deposition of organosilicon compounds or pre-coking treatment have been used to deactivate non-selective acid sites present on the external surfaces of zeolite H-ZSM-5 and H-FER.

Solid-state ^{31}P MAS NMR of adsorbed tributylphosphine oxide (TBPO) probe molecules has been shown to be an excellent technique for the characterisation of external acid sites on zeolite crystallites [1]. As shown in Figure 1, a significant decrease in the amount of strongest acid site (i.e., resonance peak at 90 ppm) on H-FER has been preferentially obtained after pre-coking.

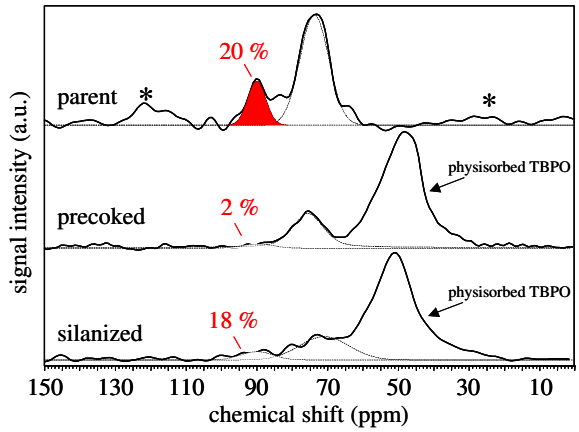


Figure 1: ^{31}P MAS NMR spectra of TBPO adsorbed on H-FER samples before and after surface modification. The asterisks indicate spinning sidebands.

To determine the genuine distribution of coke species formed during the pre-coking procedure, carbonaceous deposits have been released by HF dissolution of the zeolite framework. After extraction by CH_2Cl_2 a huge amount of "insoluble coke" remained in form of black particles. The MALDI-TOF mass spectrum revealed a broad molecular weight distribution up to 1300 Da corresponding to coke species with $n_C < 100$ (Figure 2). Obviously, such large carbon entities are preferentially deposited on the external surface and/or in the pore-mouth region. The MS patterns with repeating mass increments of 24, 37, and 50 Da point to a belt-like topology of polyaromatic deposits.

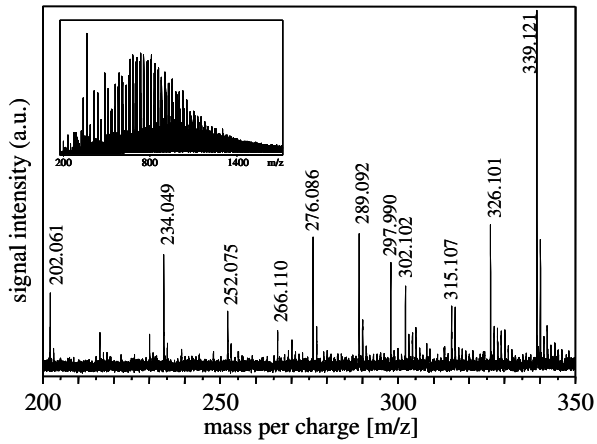


Figure 2: Low-molecular part of MALDI-TOF mass spectrum of CH_2Cl_2-insoluble coke prepared by pre-coking treatment at 450 °C (insert: full mass spectrum).

Effects of surface modification by chemical liquid deposition of organosilicon compounds and the pre-coking technique on selectivity during xylene isomerisation and skeletal isomerisation of n-butene have been studied over Pt/H-ZSM-5 and H-FER, respectively.

A significant reduction of undesired xylene disproportionation reactions was only found after pre-coking treatment of H-ZSM-5. Thus, the effective inactivation of strong acids site on the external surfaces of nano-sized crystallites allows decreasing the xylene loss during xylene isomerisation. Liquid phase deposition of organosilicons, however, resulted in pore narrowing of both zeolites revealed by sorption measurements. These findings are in agreement with the observed enhancement of para-selectivity [2].

Literature

[1] F. Bauer et al., Micropor. Mesopor. Mater. 72 (2004) 81.
[2] F. Bauer, E. Bilz, A. Freyer, Appl. Catal. A, 289 (2005) 2.

Polymeric nanocomposite coatings based on isocyanate/polyol systems reinforced by aluminium carboxylate nanofillers

L. Wennrich, H.-J. Gläsel, E. Hartmann, M.R. Buchmeiser
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Cetelon Nanotechnik GmbH & Co. KG Leipzig

Novel aluminium carboxylate nanopowders have been developed [1]. Owing to their organophilic nature, the aluminium-organic particles are promising fillers for scratch and abrasion resistant nanocomposites. The efficiency of these nanopowders was proven in radiation-cured (meth)-acrylic systems. The aim of this study was the development of transparent aluminium-organic nanoparticles-reinforced isocyanate/polyol (two-component) systems with enhanced scratch and abrasion resistance.

Aluminium carboxylates were synthesized through precipitation reaction from dissolved aluminium isopropylate in aqueous solutions of carbonic acids [1]. A series of analogous nanomaterials was obtained by utilizing different acids: maleic (*Almal*), D,L-malic (*Almalat*), L-(+)-tartaric (*Altar*), mucic (*Almuc*), oxalic (*Aloxal*), citric (*Alcit*), 2,2-di(hydroxymethyl)propionic (*Aldihyp*) and L-glutamic (*Alglutam*) acid. Polyol (*110/012464/00*) and isocyanate (*065/000103/00*) with *Cetelon* charge codes in parentheses were chosen for the preparation of the two-component systems. The nanopowders were dispersed in the polyol component (2 h, 60 °C, 3000 rpm) and subsequently subjected to a bead mill treatment (ZrO_2, 0.4-0.7 mm, 4 h, 30 °C, 5000 rpm). After addition of isocyanate (mixing ratio polyol/isocyanate 10/3) and subsequent dilution in butyl acetate, application of the substrates was realized by spraying. The nanocomposite coatings were thermally cured at 120 °C for 90 min (aluminium) and 90 °C for 10 h (PMMA), respectively.

For the characterisation of the nanocomposite coatings microindenter and abrasion tests as well as haze measurements were performed. The modification of the two-component lacquer with the relevant nanofillers results generally in significantly enhanced hardness, e.g. to 175 % for *Almal* modified coatings (Figure 1). The abrasion tests (Taber Abraser CS-0/S-42, two 500 g weights) show in all cases a slightly decreased abrasion of the nanocomposite coatings compared to the unmodified material (e.g. to 80 % for *Almalat* addition).

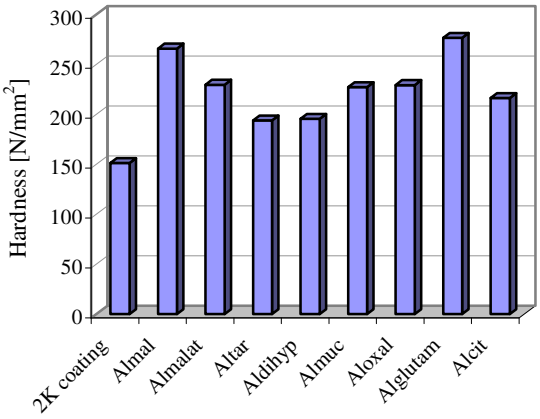

Figure 1: Martens hardness (100 mN; 20 s) of the nanocomposite coatings (35 wt.-%; ~50 µm on PMMA) compared to the unmodified reference coating.

In most cases the admixture of the nanocomponent markedly reduces transparency (e.g. haze values of 3.8 % and 5.0 % for *Aloxal* und *Alcit* addition, respectively). This unsatisfying feature is probably due to particle agglomerates and is currently under investigation.

Summarising, aluminium-organic nanofillers can readily enhance hardness and abrasion resistance of the two-component (isocyanate/polyol) system. However, this particular modification tends to reduce transparency. This disadvantage can be removed by the application of high-energy attrition ball milling or, alternatively, by precluding agglomerisation in an optimised particle preparation route.

References

[1] IOM patent *Metallorganische Nanopulver,* patent file number 102 005032 353.7 (08.07.05)

In-line monitoring of the conversion in UV-cured coatings by near-infrared spectroscopy

T. Scherzer
in collaboration with H. Lucht
LLA Instruments GmbH, Berlin

Most functional properties of UV-cured coatings strongly depend on the conversion which is achieved during irradiation. Therefore, continuous control of the conversion is required in order to ensure a constantly high quality of the product. However, in the past no analytical method had been proven to be suited for use in a production environment. Recently, it could be shown that near-infrared (NIR) reflection spectroscopy can be used for process control [1].

At first, NIR spectra have to be calibrated to calibration samples with well-known properties. Sophisticated chemometric evaluation methods (e.g. PLS) are used for the calibration procedure [2]. A typical PLS-based calibration using FTIR transmission spectroscopy as independent reference method is shown in Figure 1.

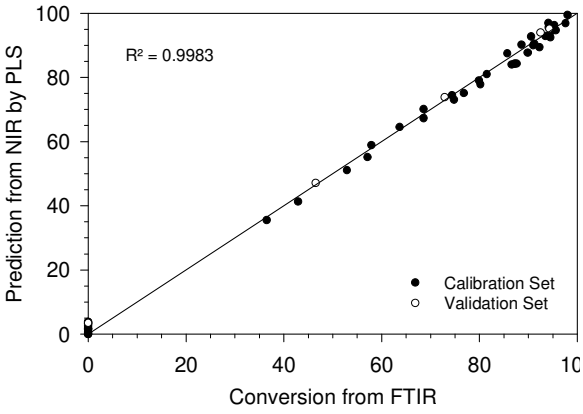

Figure 1 : PLS calibration of NIR reflection spectra of UV-cured acrylate coatings to the conversion determined by FTIR spectroscopy.

Alternatively, quantification can be carried out according to Beer-Lambert using the absorption band of the acrylic double bonds at 1620 nm [1].

For in-line monitoring of the conversion the probe head of the spectrometer is mounted on a coating machine. The conversion after UV or EB curing can be determined in any coating system based on (meth)acrylates and on almost any substrate. Typical examples are clear and pigmented coatings on polymer foils, paper, or fibreboard [3]. A special application are UV-curable pressure-sensitive adhesives. Their adhesive properties were found to respond extremely sensitive even to minor changes of the conversion [4] which requires permanent and reliable control of the conversion. An example is shown in Figure 2.

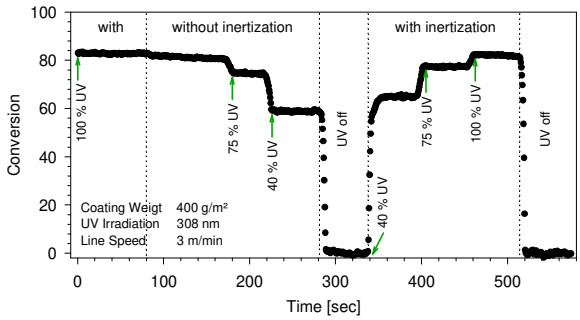

Figure 2 : In-line monitoring of the conversion in an acrylic hot-melt adhesive after UV irradiation with variable irradiance.

Cycloaliphatic epoxies which are the main component in cationic UV formulations do not show a specific absorption band which originates from their functional groups. Nevertheless, it could be shown that cationic systems can be characterised by NIR spectroscopy as well if the formulation contains vinyl ethers which are often used for dilution. The absorption of the vinyl groups at 1612 nm allows at least an indirect determination of the conversion and enables in this way a process control for such coatings.

Literature

[1] T. Scherzer, R. Mehnert, H. Lucht, Macromol. Symp. 205 (2004) 151.
[2] T. Scherzer et al., Polymer 46 (2005) 7072.
[3] T. Scherzer, R. Mehnert, H. Lucht, Proc. e|5 UV & EB Technol. Conf., Charlotte/NC, USA, 2.-5.5.2004
[4] A. Tauber et al., J. Coat. Technol. 74 (2002) 41.

Contributions to the improvement of UV-technology for the UV-curing of functional coatings

R. Schubert, M. Hinkefuß, R. Konieczny, M.R. Buchmeiser

About 95 % of radiation curable printing inks and varnishes are polymerised via free radical polymerisation. However, this reaction is very sensitive to O_2. Its presence results in incomplete curing and consequently the desired application properties of the final coating will not be reached. In principle, there exist two ways of reducing or compensating the influence of O_2. One is the use of high photoinitiator concentrations which entails a large number of disadvantages. Alternatively, an efficient rinsing of the UV-irradiation zone by inert gas, preferably N_2–termed "*inertisation*"-may be applied [1].

Meanwhile there exist several types of inertisation systems [2,3] both for reel to reel and panel coating, which aim on realizing low levels of O_2 in the irradiation zone by the economical use of nitrogen in an open channel. This is in principle applicable, however, it does not guarantee the removal of O_2 out of the coating layer since this process needs time and depends on mass transfer conditions. In this context, one important factor among others is the diffusion coefficient of O_2 inside the liquid layer especially depending on viscosity.

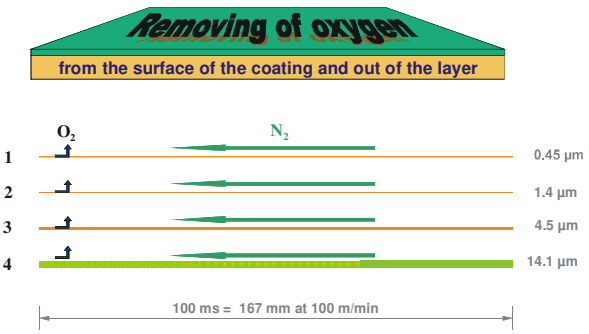

Figure 1: Diffusion coefficient of oxygen in:

1	*solid coatings*	10^{-8} $cm^2\ s^{-1}$
2	*highly viscous coatings*	10^{-7} $cm^2\ s^{-1}$
3	*medium viscous coatings*	10^{-6} $cm^2\ s^{-1}$
4	*low viscous coatings*	10^{-5} $cm^2\ s^{-1}$

Of additional importance is the mass transfer coefficient in the border layer. A high relative speed between web surface and N_2 is required to intensify mass transfer. This will be reached by using a low irradiation channel and an air knife nozzle.

In each case a long inerted channel, possibly placed in front of the UV-lamp, should be chosen.

Considering this know-how, a "high-speed" inerting system for UV-curing in flexo-graphic printing has been constructed and tested under production conditions up to 400 m/min.

This inertisation system consists of a low channel with an air knife, a volume nozzle on the inlet side, and a contactless turbulence barrier on the outlet side. The total nitrogen consumption was low.

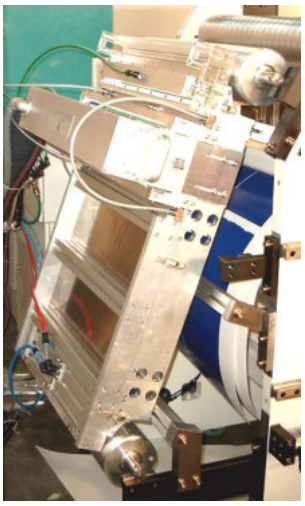

Figure 2: "High-speed" inertisation system with mercury-UV-lamp.

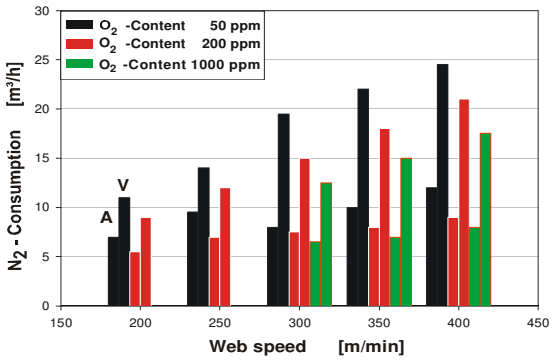

Figure 3: N_2 consumption of "high-speed" inertisation. A: air knife nozzle, V: volume nozzle

SPEED [m/min]	*O_2 [ppm]*	*N_2 total [l/m²]*
200	*50*	*3.0*
400	*50*	*3.0*
400	*1000*	*2.2*

Literature

[1] R. Schubert et al., Stickstoff-inertisierte UV-Härtungsanlagen, München (PTS) 2004
PTS-Manuskript: PTS-MS 479 p. C 14b 1-12
[2] EP 0 161 540 A1
[3] EP 0 830 217 B1

Development environment - friendly and waterbased flexo printing inks

P. Klenert

Today solvent-based printing inks are worldwide used in flexo printing and still dominate the market for non-absorbing substrates. Environmental, health, and safety legislation have put strain on users exposed to solvents. Therefore, the goal of the project is the substitution of volatile organic compounds (VOC)-based flexo printing inks by water based ones. However, water based inks are more difficult to dry and impose problems in adhesion and wetting since they contain about 75 % water in binding which must be removed in well aligned drying processes. In film packaging applications, different foils (e.g. PP, PE,PET,PA) are used with strong diverse surface properties requiring well aligned adhesion properties of the corresponding ink. In collaboration with an ink producer, the IOM has started a project with two main targets, i.e. (i) the development of water based ink systems with high solid contents in formulation for use with broad range of foils, (ii) the development of inks for lamination in course of adapted laminating process.

For our studies, a combined thermal and infrared drying system was developed. This drying application was installed between the presses to avoid back fission of inks. Using existing dryers the

Figure 1: Drying system between the presses.

optimum printing conditions necessary to achieve optimum print quality have been determined.

Finally, changes in ink formulation led to homogeneous ink density at different printing speeds.

The inks demand a well adapted adhesive.

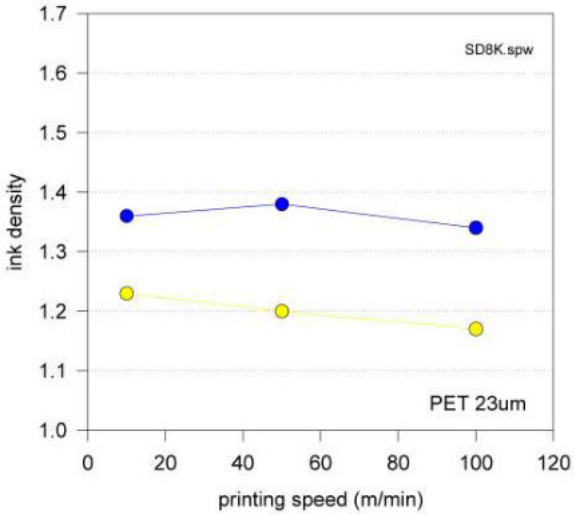

Figure 2 : Ink density versus printing speed.

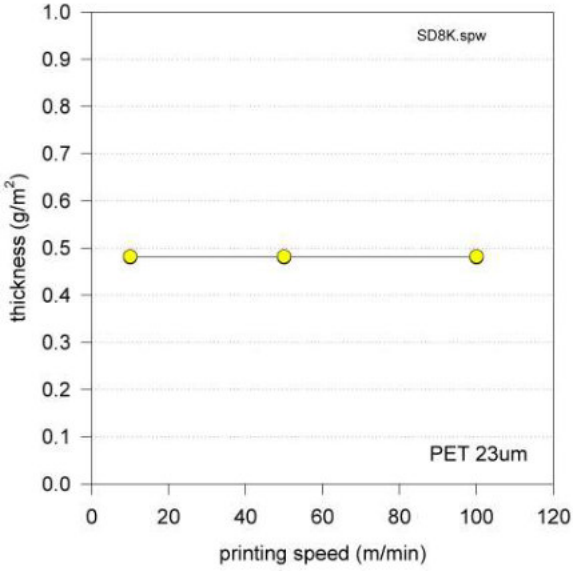

Figure 3: Iink thickness versus printing speed.

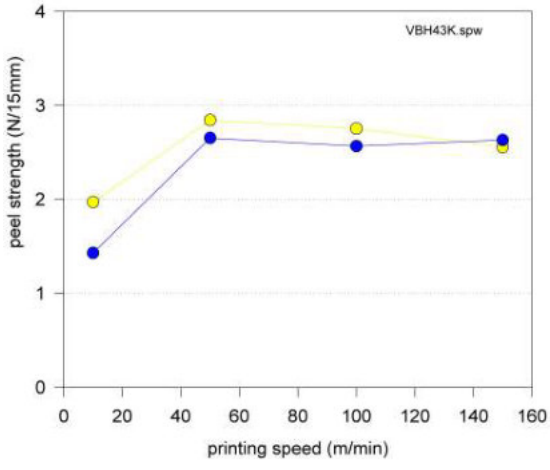

Figure 4: Peel strength versus printing speed.

Personal Activities and Scientific Events

Habilitations, Doctoral and Diploma Theses

Activities in Scientific Organisations

Honours and Awards

Scientific Meetings and Institute Colloquia

Lectures and Seminars

Personal Activities

Habilitations, Doctoral and Diploma Theses

Habilitations

Thomas Höche
Incommensurate Structural Modulations in Fresnoite Framework Structures
Universität Leipzig, Fakultät für Physik und Geowissenschaften, 2005

Doctoral Theses

Jens Dienelt
Chemisch unterstütztes Ionenstrahlätzen von Galliumarsenid: Prozessaufklärung und Anwendungen
Technische Universität Ilmenau, Fakultät für Mathematik und Naturwissenschaften, 2004

Stefan Sienz
Ionenstrahlgestützte Synthese von epitaktischen Galliumnitrid-Schichten auf Siliziumkarbid
Universität Leipzig, Fakultät für Physik und Geowissenschaften, 2004

Thomas Arnold
Untersuchungen zur Plasma-Oberflächen-Wechselwirkung beim Ätzen von Silizium mit einem $Ar/SF_6/O_2$-Plasmajet
Universität Leipzig, Fakultät für Physik und Geowissenschaften, 2005

Dirk Schumann
Lösungsmittelfreie Systeme aus biogenem Polyhydroxybutyrat und synthetischen Polymeren - Beiträge zu biologisch abbaubaren Beschichtungen
Universität Leipzig, Fakultät für Chemie und Mineralogie, 2005

Diploma Theses

Tina Otto
Zeitaufgelöste Untersuchungen zur Prozessaufklärung beim Laserrückseitenätzen
Hochschule Mittweida (FH), Fachbereich Mathematik, Physik und Informatik, 2004

Mirko Kramer
Konstruktion von Probenaufnahmen für LEII
Hochschule für Technik, Wirtschaft und Kultur Leipzig (FH), Fachbereich Maschinen- und Energietechnik, 2004

Claudia Fleischmann
Mikrostrukturierung von Festkörperoberflächen durch Ultrakurzpulslaser
Westsächsische Hochschule Zwickau (FH), Fachbereich Physikalische Technik und Informatik, 2004

Alexander Fleischer
Mechanische Eigenschaften von oberflächenmodifizierten Ti- und NiTi-Legierungen für biomedizinische Anwendungen
Hochschule für angewandte Wissenschaften Anhalt/Köthen (FH), Fachbereich Elektrotechnik, 2004

Marlen Ducherow
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Steffen Müller
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Hochschule für Technik, Wirtschaft und Kultur Leipzig (FH), Fachbereich Informatik und Mathematik, 2004

Markus Reinhardt
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Hochschule für Technik, Wirtschaft und Kultur Leipzig (FH), Fachbereich Informatik und Mathematik, 2005

Melanie Kitzing
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Universität Leipzig, Fakultät für Physik und Geowissenschaften, 2005

Martin Ehrhardt
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Technische Fachhochschule Wildau, Fachbereich Physikalische Technik, 2005

Anja Hänchen
Untersuchung der Phasenbildung mittels in situ Röntgendiffraktometrie während der Synthese von vergrabenen Übergangsmetalloxidschichten durch Hochenergie-Ionenimplantation
Hochschule Zittau/Görlitz (FH), Fachbereich Mathematik und Naturwissenschaften, 2005

John Fahlteich
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Universität Leipzig, Fakultät für Physik und Geowissenschaften, 2005

Frank Ulmer
Synthese dünner Metallfilme mittels ultrakurz gepulster Laserablation
Universität Leipzig, Fakultät für Physik und Geowissenschaften, 2005

Activities in Scientific Organisations

M.R. Buchmeiser

- Member of the International Advisory Boards of 'Macromolecular Rapid Communications' and 'Macromolecular Chemistry and Physics'
- Member of the Scientific Advisory Board of the Institut für Nichtklassische Chemie, University of Leipzig

B. Rauschenbach

- Speaker of the Thin Film Division of the German Physical Society (DPG)
- Member of the Advisory Board of the International Union of Vacuum Science, Technology and Application (IUVSTA)
- Member of the Curatorship for 'Innovation and Science'
- Member of the Advisory Board of the German Physical Society (DFG)
- Member of the Advisory Board of the German Vacuum Society (DVG)
- Member of the Council 'Condensed Mater' of the German Physical Society
- Member of the Coordination Board 'Plasma Surface Technologies'

Honours and Awards

A. Schindler
Manfred-von-Ardenne-Preis für Angewandte Physik, 2005

B. Ziberi
Young Scientist Award of the European Material Research Society, 2004

Arbeitsgruppe unter Leitung von Dr. A. Schindler
Finanzielle Zuwendung der Carl-Zeiss-Stiftung für die Entwicklung der Strahlbearbeitungsverfahren, 2004

Scientific Events

Scientific Meetings and Institute Colloquia

Scientific Meetings

Workshop *'Ionenstrahlphysik und –technologie'*, Leipzig, 11-13.04.2005

VI. Workshop der DFG-Forschergruppe *'Teilchenstrahlen-stimulierte Ultra-präzisions-Oberflächenbearbeitung'*, Leipzig, 03.05.2005

XII. Workshop *'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen'*, Mühlleithen, 14-16.03.2005

XI. Workshop *'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen'*, Mühlleithen, 14-17.03.2004

V. Workshop der DFG-*Forschergruppe 'Teilchenstrahlen-stimulierte Ultrapräzisions-Oberflächenbearbeitung'*, Großbothen, 14-15.05.2004

Institute Colloquia

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Advanced Mask Technology Center GmbH & Co. KG, Dresden
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Universität Leipzig, Biotechnologisch-Biomedizinisches Zentrum, Leipzig
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Institute of Chemical Kinetics and Combustion, Russian Academy of Sciences, Novosibirsk, Russia
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Center for Advanced Microstructures and Devices, Louisiana State University Baton Rouge, USA
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University Wuhan, School of Electrical and Mircoelectronical Materials, Wuhan, China
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PVD- und PACVD-Abscheidung harter, verschleiss- und reibungsarmer Schichten

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Tetra Pak, Plastic Packaging, Darmstadt
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F. Heyroth (07.04.2004)
Martin-Luther-Universität Halle-Wittenberg, Interdisziplinäres Zentrum für Materialwissenschaften, Halle
Atmosphärische Rasterelektronenmikroskopie: Möglichkeiten - Anwendung - Grenzen

J. Meijer (12.05.2005)
Ruhr-Universität Bochum, Central Laboratories of Ion beams and Radioisotopes, Bochum
Einzelionenimplantation zur Nanostrukturierung

M. Posselt (19.05.2005)
Forschungszentrum Rossendorf, Institut für Ionenstrahlphysik und Materialforschung, Rossendorf
Atomistische Computersimulation ionenstrahlinduzierter Prozesse: Implantation, Defektbildung, Defektmigration

G. Andersson (26.05.2005)
Universität Leipzig, Fakultät für Chemie und Mineralogie, Leipzig
Struktur von Oberflächen weicher Materie: Untersuchungen mit Elektronen- und Ionenstreuspektroskopie

D.K. Avasthi (01.06.2005)
Nuclear Science Center New Delhi, New Delhi, India
Nanostructuring with ion beams at Nuclear Science Center

S. Guder (09.06.2005)
Technische Universität München, Institut für Werkstoffkunde und Werkstoffmechanik, München-Garching
Schädigungsvorgänge an zementierten Hüftendoprothesenstielen

U. De (30.06.2005)
Variable Energy Cyclotron Centre, Kolgata, India
Rough oxide surfaces studied by Rutherford backscattering

T. Michely (07.07.2005)
RWTH Aachen, 1. Physikalisches Institut, Aachen
Atomarer Beschussschaden und Musterbildung durch Ionenbeschuss auf Metalloberflächen

S. Pissadakis (08.09.2005)
Institute of Electronic Structure and Laser, Foundation for Research and Technology, Hellas, Greece
Laser Induced Periodic Structures in Optical Bulks and Fibres: Photosensitivity and Surface Engineering Processes

B. Voit (06.10.2005)
Leibniz-Institut für Polymerforschung, Dresden
Hyperbranched polymers in thin film and coating applications

T. Oates and M. Vinnichenko (20.10.2005)
Forschungszentrum Rossendorf, Institut für Ionenstrahlphysik und Materialforschung, Rossendorf
In situ spectroscopic ellipsometry of metallic nanoparticulate thin films

W. Binder (27.10.2005)
Technische Universität Wien, Institut für Synthesechemie, Wien, Austria
Supramolekulare Chemie mit Polymeren: Neue Zugänge zu funktionalen Materialien und Oberflächen

M. Möller (01.12.2005)
Deutsches Wollforschungsinstitut, Aachen
Biofunktionale Oberflächen

A. von Keudell (06.12.2005)
Ruhr-Universität Bochum, Institut für Experimentalphysik II, Bochum
Strukturbildung in reaktiven Plasmen: von Nanoteilchen zur kontrollierten Rauigkeit

C. Hollenstein (08.12.2005)
Ecole Polytechnique Fédérale de Lausanne, Centre de Recherches en Physique des Plasma, Lausanne, Switzerland
Industrielle Plasmaphysik an der Universität: Einige Beispiele

Lectures and Seminars

Lectures

F. Bauer

- *Radioaktivität, Kernenergie und Strahlenschutz*
  HTWK Leipzig, Fakultät für Maschinen- und Energietechnik
  winter 03/04

- *Radioaktivität, Kernenergie und Strahlenschutz*
  HTWK Leipzig, Fakultät für Maschinen- und Energietechnik
  winter 04/05

- *Radioaktivität, Kernenergie und Strahlenschutz*
  HTWK Leipzig, Fakultät für Maschinen- und Energietechnik
  winter 05/06

M.R. Buchmeiser

- *Makromolekulare Chemie*
  Universität Leipzig, Fakultät für Chemie und Mineralogie
  summer 05

- *Makromolekulare Chemie, Spezial- und Funktionspolymere*
  Universität Leipzig, Fakultät für Chemie und Mineralogie
  winter 05/06

T. Höche

- *Elektronenmikroskopie*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 05/06

S. Mändl

- *Physikalische Oberflächenmodifizierung von Werkstoffen der Medizintechnik*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 03/04

- *Lichtbogen und Laserablation zur Schichtabscheidung*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  summer 04

- *Oberflächenanalytik in Astronomie, Archäologie und Kunstgeschichte*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 04/05

- *Oberflächenflächenmodifizierung von modernen Leichtmetallen*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  summer 05

- *Plasmaphysik I: Plasmatechnologie*

Universität Leipzig, Fakultät für Physik und Geowissenschaften
winter 05/06

B. Rauschenbach

- *Physik dünner Schichten: Wachstum, Epitaxie, Struktur, Eigenschaften*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 03/04

- *Ionen-Festkörper-Wechselwirkung*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  summer 04

  Einführung in Nanophysik und Nanotechnologie - Teil I
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 04/05

- *Fundamentals of the Ion-Solid-Interaction*
  Nucl. Research Center New Delhi, India (compact lecture series)
  winter 05

- *Oberflächen- und Dünnschichtanalytik*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  summer 05

- *Physik dünner Schichten: Wachstum, Epitaxie, Struktur, Eigenschaften*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 05/06

E. Schubert

- *Beschichtung und Beschichtungstechnologien*
  HTWK Leipzig, Fakultät für Maschinenbau
  winter 05/06

Seminars

T. Höche and B. Rauschenbach

- *Materialwissenschaftliches Seminar*
  Universität Leipzig, Fakultät für Physik und Geowissenschaften
  winter 03/04, summer 04, winter 04/05, summer 05, winter 05/06

M.R. Buchmeiser

- *Seminar für Diplomanden/Dissertanten*
  Universität Leipzig, Fakultät für Chemie und Mineralogie
  summer 05, winter 05/06

Publications and Presentations

Publications in Journals and Books

Conference Proceedings

Contributed Presentations

Patent Applications and Patents

Publications and Presentations

Publications in Journals and Books

T. Arnold, S. Grabovski, A. Schindler and H.-E. Wagner
Spatially resolved mass spectrometry of reactive $Ar/SF_6/N_2$ plasma jets
Surface and Coatings Technology **200** (2005) 818-821

T. Arnold, S. Grabovsky, A. Schindler and H.-E. Wagner
Spatially resolved emission spectroscopic investigation of microwave-induced reactive low-power plasma jets
Plasma Sources Science and Technology **13** (2004) 309-314

B. Bantu, D. Wang, K. Wurst and M.R. Buchmeiser
Copper (I) 1,3-R2-3,4,5,6-Tetrahydropyrimidin-2ylidenes (R=Mesityl, 2-Propyl): synthesis, X-ray structures, immobilization and catalytic activity
Tetrahedron Symposium **61** (2005) 12145-12152

F. Bauer and R. Mehnert
UV curable acrylate nanocomposites: Properties and applications
Journal of Polymer Research **12** (2005) 483-491

F. Bauer, U. Decker, A. Dierdorf, H. Ernst, R. Heller, H. Liebe and R. Mehnert Preparation of moisture curable polysilazane coatings. Part I. Elucidation of low temperature curing kinetics by FT-IR spectroscopy
Progress in Organic Coatings **53** (2005) 183-190

F. Bauer, E. Bilz and A. Freyer
C-14 studies in xylene isomerization on modified H-ZSM-5
Applied Catalysis A **289** (2005) 2-9

F. Bauer, E. Bilz and A. Freyer
Selectivity improvement in xylene isomerization
Studies in Surface Sience and Catalysis **154** (2004) 2169-2178

F. Bauer, H. Ernst, D. Hirsch, S. Naumov, M. Pelzing, V. Sauerland and R. Mehnert
Preparation of scratch and abrasion resistant polymeric nanocomposites by monomer grafting onto nanoparticles. Part V. Application of mass spectroscopy and atomic force microscopy to the characterization of silane-modified silica surface
Macromolecular Chemistry and Physics **205** (2004) 1587-1593

F. Bauer, W.H. Chen, H. Ernst, S.J. Huang, A. Freyer and S.B. Liu
Selectivity improvement in xylene isomerization
Microporous and Mesoporous Materials **72** (2004) 81-89

F. Bauer, H.-J. Gläsel, E. Hartmann, H. Langguth and R. Hinterwaldner Functionalized inorganic/organic nanocomposites as new basic raw materials for adhesives and sealants
International Journal of Adhesion and Adhesives **24** (2004) 519-522

N. Bogdanski, H. Schulz, M. Wissen, H.-C. Scheer, J. Zajadacz and K. Zimmer
3D-Hot embossing of undercut structures - an approach to micro-zippers
Microelectronic Engineering **73-74** (2004) 190-195

R. Böhme, J. Zajadacz, K. Zimmer and B. Rauschenbach
Topography and roughness evolution of microstructured surfaces at laser-induced backside wet etching
Applied Physics A **80** (2005) 433-438

R. Böhme and K. Zimmer
The influence of the laser spot size and the pulse number on backside wet etching
Applied Surface Science **247** (2005) 256-261

R. Böhme and K. Zimmer
Low roughness etching of fused silica using an adsorbed layer
Applied Surface Science **239** (2004) 109-116

R. Böhme and K. Zimmer
Rapid Prototyping von diffraktiven und refraktiven mikrooptischen Elementen
Photonik **03** (2004) 58-61

R. Böhme, K. Zimmer and B. Rauschenbach
Laser backside etching of fused silica due to carbon layer ablation
Applied Physics A **82** (2005) 325-328

R. Böhme, D. Spemann and K. Zimmer
Surface characterization of backside-etched transparent dielectrics
Thin Solid Films **453** (2004) 127-132

Y. Bohne, N. Shevchenko, F. Prokert, J. von Borany, B. Rauschenbach and W. Möller
In situ characterization of phase formation during high-energy oxygen ion implantation in molybdenum
Nuclear Instruments and Methods in Physics Research B **240** (2005) 157-161

Y. Bohne, N. Shevchenko, F. Prokert, J. von Borany, B. Rauschenbach and W. Möller
In situ X-ray diffraction investigations during high-energy oxygen ion implantation in tramsition metals
Vacuum **76** (2004) 281-285

M. Bortenschlager, M. Mayr, O. Nuyken and M.R. Buchmeiser
Hydroformylation of 1-octene using rhodium-1,3-R2-3,4,5,6-tetrahydropyrimidin-2-ylidenes (R = 2-Pr, mesityl)
Journal of Molecular Catalysis A **233** (2005) 67-71

O. Brede, R. Hermann, N. Karakostas and S. Naumov
Ionization of the three isomeric hydroxybenzoates by free electron transfer: product distribution depends on the mobility of the phenoxyl group
Physical Chemistry Chemical Physics **6** (2004) 5184-5188

O. Brede, A. Maroz, R. Hermann and S. Naumov
Ionization of cyclic aromatic amines by free electron transfer: products are governed by femtosecond molecule dynamics
Journal of Physical Chemistry A **109** (2005) 8081-8087

O. Brede, R. Hermann, S. Naumov, A.K. Zarkadis, G.P. Perdikomatis and M.G. Siskos
Free electron transfer reflects rotational conformers of substituted aromatics: Reaction of benzyltrimethylsilanes with n-Butyl chloride parent radical cations
Physical Chemistry Chemical Physics **6** (2004) 2267-2275

M.R. Buchmeiser
Zukunftstechnologie: Oberflächenveredelung mittels UV- und Elektronenstrahlhärtung
Kunststoff-Cluster-aktuell **5** (2005)

M.R. Buchmeiser
A Commentary on 'Bis(cyclopentadienyl)zirkon-Verbindungen und Aluminoxan als Ziegler-Katalysatoren für die Polymerisation und Copolymerisation von Olefinen' by W. Kaminsky, M. Miri, H. Sinn, R. Woldt (Makromol. Chem., Rapid Commun. 1983, 4, 417-421)
Macromolecular Rapid Communications **26** (2005) 1201-1207

M.R. Buchmeiser
Metathesis Polymerisation
Advances in Polymer Science, Volume 176, Ed. M.R. Buchmeiser, Springer, Berlin, Germany (2005)

M.R. Buchmeiser
Regioselective Polymerization of 1-Alkynes and Stereoselective Cyclopolymerization of α,ω–Heptadiynes
In: *Advances in Polymer Science*, Volume 176, Ed. M.R. Buchmeiser, 89-120. Springer, Berlin, Germany (2005)

M.R. Buchmeiser
Design and synthesis of supported catalysts on a molecular base
Catalysis Today **105** (2005) 612-617

M.R. Buchmeiser
In honor of Prof. Richard (Dick) R. Schrock on the occasion of his 60th birthday
Advanced Synthesis & Catalysis **347** (2005) 321

W.H. Chen, F. Bauer, E. Bilz, A. Freyer, S.J. Huang, C.S. Lai and S.B. Liu
Acidity characterization of H-ZSM-5 catalysts modified by pre-coking and silylation
Studies in Surface Science and Catalysis **154** (2004) 2269-2274

J. Dienelt, J. von Sonntag, K. Zimmer and B. Rauschenbach
Structuring of GaAs. I. Chemical dry etching: Temperature und chlorine pressure dependence of etch rates
Journal of Vacuum Science and Technology B **22** (2004) 1964-1969

J. Dienelt, K. Zimmer, J. von Sonntag, B. Rauschenbach and C. Bundesmann
Roughness and damage of a GaAs surface after chemically assisted ion beam etching with Cl_2/Ar^+
Microelectronic Engineering **78-79** (2005) 457-463

V. Drinek, K. Vacek, J. Pola, G. Yuzhakov, O. Solcová and S. Naumov
Characterization of deposits produced by TEA CO_2 pulsed laser ablation of silicon mono- and dioxide
Journal of Non-Crystal Solids **351** (2005) 116-123

E. Eiper, K.J. Martinschitz, J.W. Gerlach, J.M. Lackner, I. Zizak, N. Darowski and J. Keckes
X-ray elastic constants determined by the combination of $\sin^2\Psi$ and substrate-curvature methods
Zeitschrift für Metallkunde **96** (2005) 1069-1073

E. Eiper, A. Hofmann, J.W. Gerlach, B. Rauschenbach and J. Keckes
Anisotropic intrinsic and extrinsic stresses in epitaxial wurtzitic GaN thin film on gamma-$LiAlO_2$(100)
Journal of Crystal Growth **284** (2005) 561-566

E. Erdem, R. Böttcher, H.-J. Gläsel, E. Hartmann, G. Klotzsche and D. Michel
Size effects in Ba(Pb)TiO_3 nanopowders by EPR and NMR
Advances in Solid State Phys. **45** (2005) 351-361

E. Erdem, R. Böttcher, H.-J. Gläsel, E. Hartmann, G. Klotzsche and D. Michel
Size effects in $BaTiO_3$ nanopowders studied by EPR and NMR
Ferroelectrics **316** (2005) 43-49

E. Erdem, R. Böttcher, H.-J. Gläsel and E.Hartmann
Structural analysis of $PbTiO_3$ nanoparticles by multi-frequency EPR
Magnetic Resonance in Chemistry **43** (2005) 174-182

F. Frost, R. Fechner, B. Ziberi, D. Flamm and A. Schindler
Large area smoothing of optical surfaces by low-energy ion beams
Thin Solid Films **459** (2004) 100-105

F. Frost, R. Fechner, D. Flamm, B. Ziberi, W. Frank and A. Schindler
Ion beam assisted smoothing of optical surfaces
Applied Physics A **78** (2004) 651-654

F. Frost, B. Ziberi, T. Höche and B. Rauschenbach
The shape and ordering of self-organized nanostructures by ion sputtering
Nuclear Instruments and Methods in Physics Research B **216** (2004) 9-19

J.A. García, R. Martínez, B. Lerga, G.G. Fuentes, R.J. Rodríguez and S. Mändl
Tribological improvements of ion implanted technological alloys: Plasma immersion vs. conventional ion implantation
Surface and Coatings Technology **200** (2005) 573-578

C. Gatschelhofer, C. Magnes, T.R. Pieber, F.M. Sinner and M.R. Buchmeiser
Evaluation of ring-opening metathesis polymerization (ROMP)-derived supports
Journal of Chromatography A **1090** (2005) 81-89

J.W. Gerlach and T. Höche
Multiple-textured gallium nitride prepared by ion beam assisted molecular beam epitaxy
physica status solidi A **202** (2005) 2361-2367

J.W. Gerlach, T. Höche, F. Frost and B. Rauschenbach
Ion beam assisted MBE of GaN on epitaxial TiN films
Thin Solid Films **459** (2004) 13-16

R. Günther, C. Elsner, H.-J. Hofmann and F. Bordusa
On the rational design of substrate mimetic: The function of docking approaches for the prediction of protease specificities
Organic & Biomolecular Chemistry **2** (2004) 1442-1446

T.S. Halbach, J.O. Krause, O. Nuyken and M.R. Buchmeiser
Stereoselective Cyclopolymerization of Polar Hepta-1,6-diynes by Novel, Taylor-Made Ruthenium-Based Metathesis Catalysts
Macromolecular Rapid Communications **26** (2005) 784-790

T.S. Halbach, J.O. Krause, O. Nuyken and M.R. Buchmeiser
Controlled Stereoselective Cyclopolymerization of Polar Hepta-1,6-diynes Using RuX 2(NHC)(=CHR) (NHC = 1,3-dimesityldihydroimidazolin-2-ylidene; X = Cl, CF 3COO; R = 2-(2-PrO)-C 6H 4; 2,4,5-(MeO) 3-C 6H 2) and RuCl 2(PCy 3) 2(NHC)(=CHPh)
Polymer Preprints (American Chemical Society, Division of Polymer Chemistry) **46** (2005) 615-616

T.S. Halbach, S. Mix, J.O. Krause, C. Sievers, D. Fischer, S. Maechling, S. Blechert, O. Nuyken and M.R. Buchmeiser
Novel ruthenium-based metathesis catalysts containing electron-withdrawing ligands: Synthesis, immobilization and reactivity
Journal of Organic Chemistry **70** (2005) 4687-4694

R. Hermann, T. Leichtner, S. Naumov and O. Brede
Femto- and nanosecond photoionization of sterically hindered phenols in non-protic solvents antithetical product formation
Femtochemistry and Femtobiology **1** (2004) 219-294

T. Höche, R. Böhme, J.W. Gerlach, F. Frost, K. Zimmer and B. Rauschenbach
Semiconductor Nanowires Prepared by Diffraction-Mask-Projection Excimer-Laser Patterning
Nano Letters **4** (2004) 895-897

T. Höche, P. van Aken, M. Grodzicki, F. Heyroth, R. Keding and R. Uecker
Electron Energy Core-Loss Spectra of Incommensurately Modulated Crystalline and Glassy $Ba_2TiGe_2O_8$
Philosophical Magazine **84** (2004) 3117-3132

T. Höche, D. Ruthe and T. Petsch
Femtosecond-Laser Interaction with Mo/Si Multilayer Stack at Low Fluence
Applied Physics A **79** (2004) 961-963

T. Höche, F. Heyroth, M. Grodzicki and P.A. van Aken
High-Resolution Electron Energy-Loss Spectroscopy at Transition-Metals in Glasses
physica status solidi A **202** (2005) 2355-2360

N. Imlinger, K. Wurst and M.R. Buchmeiser
Rh(1,3-bis(2,4, 6-trimethylphenyl)-3, 4, 5, 6-tetrahydropyrimidin-2-ylidene)(COD) Tetrafluoroborate, an Unsymmetrical Rh-Homoazallylcarbene: Synthesis, X-ray Structure and Reactivity in Carbonyl Arylation and Hydrosilylation Reactions
Journal of Organometallic Chemistry **690** (2005) 4433-4440

N. Imlinger, K. Wurst and M.R. Buchmeiser
Novel Immobilized Hydrosilylation Catalysts Based on Rhodium 1,3-Bis(2,4,6-trimethylphenyl)-3, 4, 5, 6-tetrahydropyrimidin-2-ylidenes
Monatshefte für Chemie **136** (2005) 47-57

I. Janovský, S. Naumov, W. Knolle and R. Mehnert
Radiation-induced polymerisation of 2,3-dihydrofuran: free-radical or cationic mechanism?
Radiation Physics and Chemistry **72** (2005) 125-133

I. Janovský, W. Knolle, S. Naumov and F. Williams
EPR Studies of Amine Radical Cations, Part 1: Thermal and Photoinduced Rearrangements of n-Alkylamine Radical Cations to their Distonic Forms in Low-Temperature Freon Matrices
Chemistry - A European Journal **10** (2004) 5524-5534

R. Joshi, S. Naumov, S. Kapuur, T. Mukherjee, R. Hermann and O. Brede
Phenol radical cations and phenoxyl radicals in the electron transfer from the natural phenols sesamol, curcumin and trolox to the parent radical cations of 1-chlorobutane
Journal of Physical Organic Chemistry **17** (2004) 665-674

S. Kapoor and S. Naumov
On the origin of hydrogen in the formaldehyde reaction in alkaline solution
Chemical Physics Letters **387** (2004) 322-326

N. Karakostas, S. Naumov, M.G. Siskos, A.K. Zarkadis, R. Hermann and O. Brede
Free Electron Transfer from Xanthenyl- and Fluorenylsilanes (Me_3 or Ph_3) to Parent Solvent Radical Cations: Effects of Molecule Dynamics
Journal of Physical Chemistry A **109** (2005) 11679-11686

J. Keckes, S. Six, J.W. Gerlach and B. Rauschenbach
Temperature dependence of in-plane stresses in sublayers of Al/AlN/Al_2O_3(0001) structure
Journal of Crystal Growth **262** (2004) 119-123

H. Kersten, R. Wiese, M. Hannemann, A. Kapitov, F. Scholze, H. Neumann and R. Hippler
Plasma and ion beam characterization by non-conventional methods
Surface and Coatings Technology **200** (2005) 809-813

A. Kiesow, J. Meinhardt and A. Heilmann
Coronabehandlung von Polymerfolien - Nachweismethoden, Einflussfaktoren und Online-Kontrolle
Coating **37** (2004) 34-37

W. Knolle, S. Naumov, M. Madani and C. von Sonntag
Photochemistry of acrylates at 222 nm
Nuclear Instruments and Methods in Physics Research B **236** (2005) 195-200

W. Knolle, T. Scherzer, S. Naumov and M. Madani
Primary processes after 222 nm excitation of acrylates
Coating **37** (2004) 416-420

G. Leibiger, V. Gottschalch , N. Razek , A. Schindler and M. Schubert
Hydrogen implantation in InGaNAs studied by spectroscopic ellipsometry
Thin Solid Films **455-456** (2004) 231-234

S. Mändl, D. Manova, J.W. Gerlach, W. Assmann, H. Neumann and B. Rauschenbach
High temperature nitrogen plasma immersion ion implantation into molybdenum
Surface and Coatings Technology **180-181** (2004) 362-366

S. Mändl, G. Thorwarth, B. Stritzker and B. Rauschenbach
Two-dimensional texture and sheath evolution in metal plasma immersion ion implantation
Surface and Coatings Technology **200** (2005) 589-593

S. Mändl, J.W. Gerlach and B. Rauschenbach
Nitride formation in transition metals during high fluence and high temperature implantation
Surface and Coatings Technology **200** (2005) 584-588

S. Mändl, J.W. Gerlach and B. Rauschenbach
Surface modification of NiTi for orthopaedic braces by plasma immersion ion implantation
Surface and Coatings Technology **196** (2005) 293-297

S. Mändl, W. Attenberger, B. Stritzker and B. Rauschenbach
Disorder formation in rutile during ion assisted deposition
Surface and Coatings Technology **196** (2005) 76-80

S. Mändl, D. Manova, H. Neumann, M.T. Pham, E. Richter and B. Rauschenbach
Correlation between PIII nitriding parameters and corrosion behaviour of austenitic stainless steels
Surface and Coatings Technology **200** (2005) 104-108

S. Mändl, B. Fritzsche, D. Manova, D. Hirsch, H. Neumann, E. Richter and B. Rauschenbach
Wear reduction in AISI 630 martensitic stainless steel after energetic nitrogen ion implantation
Surface and Coatings Technology **195** (2005) 258-263

S. Mändl, D. Manova and B. Rauschenbach
Transparent AlN layers formed by metal plasma immersion ion implantation
Surface and Coatings Technology **186** (2004) 82-87

S. Mändl and B. Rauschenbach
Comparison of expanded austenite and expanded martensite formed after nitrogen PIII
Surface and Coatings Technology **186** (2004) 277-281

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Wear behaviour of martensitic stainless steels after PIII surface treatment
Surface and Coatings Technology **200** (2005) 137-140

D. Manova, S. Mändl and B. Rauschenbach
Evolution of surface morphology during ion nitriding of aluminium
Surface and Coatings Technology **180-181** (2004) 118-121

D. Manova, H. Neumann, S. Mändl and B. Rauschenbach
Three-dimensional effects for two-dimensional samples in plasma immersion ion implantation
Journal of Applied Physics **96** (2004) 934-936

D. Manova, Y. Bohne, J.W. Gerlach, S. Mändl, H. Neumann and B. Rauschenbach
Phase formation after nitrogen implantation into molybdenum
Nuclear Instruments and Methods in Physics Research B **240** (2005) 208-213

D. Manova, W. Attenberger, S. Mändl, B. Stritzker and B. Rauschenbach
Evolution of local texture and grain morphology in metal plasma immersion ion implantation & deposition of TiN
Journal of Vacuum Science and Technology A **22** (2004) 2299-2305

D. Manova, F. Scholze, S. Mändl, H. Neumann and B. Rauschenbach
Absolute dose calibration in PIII
Surface and Coatings Technology **186** (2004) 29-33

A. Maroz, R. Hermann, S. Naumov and O. Brede
Ionization of aniline and its N-methyl and N-phenyl substituted derivates by (free) electron transfer to n-butyl chloride parent radical cations
Journal of Physical Chemistry A **109** (2005) 4690-4696

T.G. Mayerhöfer, T. Höche and F. Schrempel
Infrared optical properties of Li- and Xe-irradiated KTP
Applied Physics A **78** (2004) 589-596

M. Mayr, R. Kröll, D. Wang, N. Schuler, S. Prühs, C.W. Lehmann, A. Fürstner and M.R. Buchmeiser
Monolithic Disk-Supported Metathesis Catalysts for Use in Combinatorial Chemistry
Advenced Synthesis & Catalysis **347** (2005) 484-492

R. Mehnert and A. Prager-Duschke
Das Vorimprägnat Teil IV: Ultrafin Carat - hohe Gebrauchsfestigkeit wissenschaftlich nachgewiesen
Material und Technik - Möbel **2** (2004) 18-19

R. Mehnert and H. Krannich
UV curable acrylate nanocomposites for functional coatings: Properties and applications
NanoS **1** (2004) 24-28

D.B. Naik, R. Hermann, T. Mukherjee, S. Naumov and O. Brede
Ionization of mercapto- and hydroxypyridines by free electron transfer to alkylchloride parent radical cations
Research on Chemical Intermediates **31** (2005) 113-133

S. Naumov, I. Janovský, W. Knolle and R.Mehnert
Role of distonic dimer radical cations in the radiation-induced polymerisation of vinyl ethers
Nuclear Instruments and Methods in Physics Research B **236** (2005) 461-467

S. Naumov, S. Kapoor, S. Thomas, S. Venkateswaran and T. Mukherjee
SERS of benzotriazole on Ag colloid: surface structure characterization using the DFT approach
Journal of Molecular Structure **685** (2004) 127-131

S. Naumov and C. von Sonntag
UV visible absorption spectra of alkyl-, vinyl-, aryl- and thiylperoxyl radicals and some related radicals in aqueous solution: a quantum-chemical study
Journal of Physical Organic Chemistry **18** (2005) 586–594

S. Naumov, I. Janovský, W. Knolle and R. Mehnert
On the radiation-induced polymerisation of 2,3-Dihydropyran
Macromolecular Chemistry and Physics **205** (2004) 1530-1535

S. Naumov, I. Janovsky, W. Knolle and R. Mehnert
Transformations of 5-membered heterocyclic radical cations as studied by low-temperature EPR and quantum chemical methods
Physical Chemistry Chemical Physics **6** (2004) 3933-3937

S. Naumov, I. Janovsky, W. Knolle, R. Mehnert and D.A. Turin
Low-temperature EPR and quantum chemical study of lactone radical cations and their transformations
Radiation Physics and Chemistry **73** (2005) 206-212

E. Reisz, C. von Sonntag and C.M. Davidescu
Oxidation of manganese (II) by ozone in neutral aqueous media in the presence of polyphosphate: Thermodynamic and kinetic aspects
Chemical Bulletin **49**, University of Timisoara, Romania (2004) 61-66

E. Reisz, C. von Sonntag and C.M. Davidescu
Oxidation of manganese (II) by ozone in strongly acidic media (pH=0): Thermodynamic and kinetic aspects
Chemical Bulletin **49**, University of Timisoara, Romania (2004) 55-60

D. Ruthe, K. Zimmer and T. Höche
Etching of $CuInSe_2$ thin films - comparison of femtosecond and picosecond laser ablation
Applied Surface Science **247** (2005) 447-452

T. Scherzer, W. Knolle, S. Naumov and L. Prager
Investigations on the photoinitiator-free photopolymerization of acrylates by vibrational spectroscopic methods
Macromolecular Symposia **230** (2005) 173-182

T. Scherzer, S. Müller, R. Mehnert, A. Volland and H. Lucht
In-line determination of the conversion in acrylate coatings after UV curing using near-infrared reflection spectroscopy
Nuclear Instruments and Methods in Physics Research B **236** (2005) 123-129

T. Scherzer, R. Mehnert and H. Lucht
In-line monitoring of the acrylate conversion in UV photopolymerization by near-infrared reflection spectroscopy
Macromolecular Symposia **205** (2004) 151-162

T. Scherzer, S. Müller, R. Mehnert, A. Volland and H. Lucht
In-line monitoring of the conversion in photopolymerized acrylate coatings on polymer foils using NIR spectroscopy
Polymer **46** (2005) 7072-7081

T. Scherzer and H. Langguth
Temperature Dependence of the Oxygen Solubility in Acrylates and its Effect on the Induction Period in UV Photopolymerization
Macromolecular Chemistry and Physics **206** (2005) 240-245

T. Scherzer
Photopolymerization of acrylates without photoinitiators using short-wavelength UV radiation: A study by real-time FTIR spectroscopy
Journal of Polymer Science Part A: Polymer Chemistry **42** (2004) 894-901

A. Schindler and B. Rauschenbach
Ultrapräzisions-Formgebung und Glättung im Nanometerbereich
Industrie Management **21** (2005) 49-52

A. Schindler, T. Hänsel, F. Frost, G. Böhm, W. Frank, A. Nickel, T. Arnold, R. Schwabe, S. Gürtler, S. Görsch and B. Rauschenbach
Modern Methods of Highly Precise Figuring and Polishing
Glass Science and Technology **78** (2005) 111

K. Schindler, M. Ziese, P. Esquinazi, H. Hochmuth, M. Lorenz, K. Zimmer and E.H. Brandt
A novel method for the determination of the flux-creep exponent from higher harmonic ac-susceptibility measurements
Physica C **417** (2005) 141-149

E. Schubert, S. Mändl, H. Neumann and B. Rauschenbach
Real-time in situ spectroscopic ellipsometry investigation of the amorphous to crystalline phase transition in Mo single layers
Applied Physics A **80** (2005) 47-50

E. Schubert, N. Razek, F. Frost, A. Schindler and B. Rauschenbach
GaAs surface cleaning by low-energy hydrogen ion bombardment at moderate temperatures
Journal of Applied Physics **97** (2005) 023511-1-8

E. Schubert, T. Höche, F. Frost and B. Rauschenbach
Nanostructure fabrication by glancing angle ion beam assisted deposition of silicon
Applied Physics A **81** (2005) 481-486

E. Schubert, F. Frost, B. Ziberi, G. Wagner, H. Neumann and B. Rauschenbach
Ion beam sputter deposition of soft x-ray Mo/Si multilayer mirrors
Journal of Vacuum Science and Technology B **23** (2005) 959-965

M.N. Schuchmann, S. Naumov, H-P. Schuchmann, J. von Sonntag and C. von Sonntag
4-Amino-3H-pyrimidin-2-one (isocytosine) is a short-lived non-radical intermediate formed in the pulse radiolysis of cytosine in aqueous solution
Radiation Physics and Chemistry **72** (2005) 243-250

K. Schwartz, C. Trautmann, A.S. El-Said, R. Neumann, M. Toulemonde and W. Knolle
Color-center creation in LiF under irradiation with swift heavy ions: Dependence on energy loss and fluence
Physical Review B **70** (2004) 184104

S. Sienz, J.W. Gerlach, T. Höche, A. Sidorenko, T.G. Mayerhöfer, G. Benndorf and B. Rauschenbach
Comparison of ion-beam-assisted molecular beam epitaxy with conventional molecular beam epitaxy of thin hexagonal gallium nitride films
Journal of Crystal Growth **264** (2004) 184-191

S. Sienz, J.W. Gerlach, T. Höche, A. Sidorenko and B. Rauschenbach
Ion-beam-assisted molecular-beam epitaxy: a method to deposit gallium nitride films with high crystalline quality
Thin Solid Films **458** (2004) 63-66

P. Tarabek, M. Bonifacic, S. Naumov and D. Beckert
Time resolved FT EPR identification of (E) and (Z) conformational isomers of glycyl radicals formed upon photoinduced oxidation of glycine esters in aqueous solutions
Journal Physical Chemistry A **108** (2004) 929-935

P. Thomsen-Schmidt, K. Hasche, G. Ulm, K. Herrmann, M. Krumrey, G. Ade, J. Stümpel, I. Busch, S. Schädlich, A. Schindler, W. Frank, D. Hirsch, M. Procop and U. Beck
Realization of thickness standards below 100 nm thickness
Applied Physics A **78** (2004) 645-649

P. van Aken, T. Höche, F. Heyroth, R. Keding and R. Uecker
Insights into oxygen-cation bonding in fresnoite-type structures from O K- and Ti L_{23}-electron energy-loss spectra and ab initio calculations of the electronic structure
Physics and Chemistry of Minerals **31** (2004) 543-552

J. von Sonntag, M. Getzmann, A. Braun and R. Mehnert
Nanokompositsynthese mit einer TORUSMILL für die Kratzfestbeschichtung flexibler Solarzellen
Coating, Klebstoffe-Lacke-Druckfarben **1** (2005) 16-17

J. von Sonntag, E. Mvula, K. Hildenbrand and C. von Sonntag
Photohydroxylation of 1,4-Benzoquinone in aqueous solution revisited
Chemistry - A European Journal **10** (2004) 440-451

J. von Sonntag
Mikrofalten für Nanokompositlacke
Ingenieur Nachrichten **2** (2004) 5

C. von Sonntag
The scientific œuvre of Christiane Ferradini (1924 - 2002): a brief introduction
Radiation Physics and Chemistry **72** (2004) 57-58

C. von Sonntag
Ionizing Radiation Damage to DNA
In: Encyclopedia of Molecular Cell Biology and Molecular Medicine Volume **7**, Ed. R.A. Meyers, Wiley-VCH, Weinheim, Germany (2005)

D. Wang, L. Yang, U. Decker, M. Findeisen and M.R. Buchmeiser
Polymerization of enantiomerically pure N-(Norborn-2-ene-5-carboxyl)-L-Phenylalanine Ethylester and N,N-(Norborn-2-ene-5,6-dicarbimido)-L-Valine Ethylester using Ruthenium 1,3-Dimesityl-3,4,5,6-tetrahydropyrimidin-2-ylidenes
Macromolecular Rapid Communications **26** (2005) 1757-1762

R.L. Withers, T. Höche, Y. Liu and R. Keding
Structural Studies on the Fresnoite type Compound $Rb_2V^{4+}V_2^{5+}O_8$
Journal of Solid State Chemistry **177** (2004) 3316-3323

A. Wójcik, S. Naumov, B. Marciniak, R. Hermann and O. Brede
Thiyl radical interaction with pyrimidine C5-C6 double bond
Journal of Physical Chemistry B **109** (2005) 15135-15144

Y. Zhang, D. Wang, K. Wurst and M.R. Buchmeiser
Polymerization of Phenylacetylene by novel Rh (I) and Ir (I) 1,3-R2-3,4,5,6-tetrahydropyrimidin-2-ylidenes (R= Mesityl, 2-Propyl): Influence of structure on activity and polymer structure
Journal of Organometallic Chemistry **690** (2005) 5728-5735

Y. Zhang, D. Wang, K. Wurst and M.R. Buchmeiser
Ring-opening polymerization of cyclohexene oxide by a novel dicationic palladium catalyst
Designed Monomers and Polymers **8** (2005) 571-588

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Ripple pattern formation on silicon surfaces by low-energy ion-beam erosion: Experiment and theory
Physical Review B **72** (2005) 235310

B. Ziberi, F. Frost, M. Tartz, H. Neumann and B. Rauschenbach
Importance of ion beam parameters on self-organized pattern formation on semiconductor surfaces by ion beam erosion
Thin Solid Films **459** (2004) 106-110

B. Ziberi, F. Frost, B. Rauschenbach and T. Höche
Highly ordered self-organized dot patterns on Si surfaces by low-energy ion beam erosion
Applied Physics Letters **87** (2005) 033113

M. Ziese, R. Höhne, A. Billero, H.-C. Semmelhack, P. Esquinazi and K. Zimmer
Size and shape dependence of the exchange-bais field in exchange-coupled ferrimagnetic bilayers
The European Physical Journal B **45** (2005) 223-230

K. Zimmer, R. Böhme and B. Rauschenbach
Adsorbed layer etching of fused silica by excimer laser with nanometer depth precision
Microelectronic Engineering **78-79** (2005) 324-330

K. Zimmer and R. Böhme
Precise etching of fused silica for micro optical applications
Applied Surface Science **243** (2004) 417-422

K. Zimmer and R. Böhme
Precise etching of fused silica for refractive and diffractive micro optical applications
Optics and Lasers in Engineering **43** (2005) 1349-1360

K. Zimmer, R. Böhme and B. Rauschenbach
Laser etching of fused silica using an adsorbed toluene layer
Applied Physics A **79** (2004) 1883-1885

Conference Proceedings

F. Bauer, H.-J. Gläsel, E. Hartmann, H. Ernst, V. Sauerland and R. Mehnert
Surface characterization of modified inorganic nanoparticles for UV curable nano-composites
Proceedings DECHEMA Conference on Surface and Interface-Engineering at the Nanoscale, 31. Frankfurt, Germany (2005)

F. Bauer, H. Ernst, E. Bilz and A. Freyer
C-14 Tracer studies in xylene isomerization
Proceedings 16. Deutsche Zeolith-Tagung. Dresden, Germany (2004)

F. Bauer, E. Bilz and A. Freyer
Selectivity improvement in xylene isomerization
Proceedings 14th International Zeolite Conference, 772-773. Cape Town, USA (2004)

F. Bauer, E. Bilz, W.H. Chen, A. Freyer and S.B. Liu
C-14 tracer studies in skeletal isomerization of n-butene
Proceedings 17. Deutsche Zeolith-Tagung, D1. Giessen, Germany (2005)

F. Bauer, U. Decker, H. Langguth, R. Mehnert and R. Hinterwaldner
Functionalized inorganic/organic nanocomposites as new basic raw materials for adhesives and sealants
Proceedings 4th European Congress on Adhesive and Sealant Raw Materials, 43-50. Nürnberg, Germany (2005)

F. Bauer, H. Ernst, E. Bilz and A. Freyer
C-14 Toluene tracer studies in xylene isomerization
Proceedings Congress Isotopcat. Poitiers, France (2004)

F. Bauer, U. Decker, H.-J. Gläsel, M. Pelzing, V. Sauerland and R. Mehnert
UV curable acrylate nanocomposites and their application as scratch resistant coatings
Proceedings European Coatings Conference Parquet Coatings III. Berlin, Germany (2004)

F. Bauer, R. Flyunt, K. Czihal, H.-J. Gläsel, E. Hartmann and R. Mehnert
Nano/micro particle reinforced polyacrylates for flooring applications
Proceedings RadTech Europe 2005. Barcelona, Spain (2005)

C. Blawert, E. Morales, W. Dietzel, S. Jin, E. Ghali and S. Mändl
Corrosion Properties of the Skin of High Pressure Die Cast AZ91 Alloy
Proceedings International Symposium on Light Metals, Ed. J.-P. Martin, Metallurgical Society Toronto (2005) 109-126

R. Böhme and K. Zimmer
Direct laser etching of optical glasses for flexible fabrication of micro-optical structures
Proceedings OPTO Kongress, 25-31. Nürnberg, Germany (2004)

R. Böhme and K. Zimmer
Laser Backside Etching of Transparent Material for the Fabrication of Diffractive and Refractive Topographic Features
Proceedings Congress on Micro System Technologies 2005, 63-70. München, Germany (2005)

W. Bondzio, J. Meinhardt, R. Mehnert and P. Köhler
Metallische und nichtmetallische dünne Schichten für dreidimensionale Elektrodensysteme auf Polyimid
Proceedings 12. Neues Dresdner Vakuumtechnisches Kolloquium, 43-48. Dresden, Germany (2004)

R. Brunner, R. Steiner, K. Rudolf, H.-J. Dobschal, R. Fechner and A. Schindler
Deep-UV microscopy based on a hybrid diffractive/refactive lens system
Proceedings Conference Diffractive Optics and Micro-Optics, DSuC3. Optical Society of America, Rochester, USA (2004)

W.H. Chen, F. Bauer, E. Bilz, A. Freyer, S.J. Huang, C.S. Lai and S.B. Liu
Acidity characterization of H-ZSM-5 catalysts modified by pre-coking and silylation
Proceedings 14th International Zeolite Conference, 802-803. Cape Town, USA (2004)

R. Fechner, A. Schindler, D. Hirsch, T. Gase, R. Weigelt and M. Helgert
Fabrication of masters for an embossing technology of diffractive optics and of subwavelength structures by RIBE proportional transfer
Proceedings 10th Microoptics Conference (MOC 04), F-16. Jena, Germany (2004)

F. Frost, H. Takino, R. Fechner, A. Schindler, N. Ohi and K. Nomura
Ion beam polishing of diamond-turned metal surfaces
Proceedings Autumn Conference of the Japanese Society for Precision Engineering 2005, G05. Kyoto, Japan (2005)

J.W. Gerlach, Y. Bohne, S. Mändl, B. Rauschenbach, W. Assmann, F. Grüner and M. Schubert
Enrichment Effects During Ion Beam Sputter Deposition of Mg Alloys
Jahresbericht 2004, 65. Beschleunigerlabor Garching, Germany (2005)

H.-J. Gläsel, S. Rummel, E. Hartmann, R. Mehnert and W. Böhlmann
Strahlengehärtete Nanokomposit-Schutzbeschichtungen
Proceedings Polymerwerkstoffe - P2004, 473. Halle, Germany (2004)

H.-J. Gläsel, A. Weller-Matthes, E. Hartmann, E. Erdem, R. Böttcher and J. Banys
Synthesis of ferroelectric nanopowders and radiation cured composites
Proceedings International Nanotechnology Symposium - Nanofair 2004, PD7. Karlsruhe, Germany (2004)

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann
Radiation cured protective nanocomposite coatings
Proceedings International Nanotechnology Symposium - Nanofair 2004, PF9. Karlsruhe, Germany (2004)

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
Innovative metalorganic nanofillers for protective polymeric coatings
Proceedings International Nanotechnology Symposium - Nanofair 2005, 65-68. Dresden, Germany (2005)

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
New metalorganic nanofillers for radiation and thermal curing of polymeric protective coatings
Proceedings Transferworkshop: Nanokomposite 2005, 28. Dresden, Germany (2005)

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
Innovative metallorganische Nanofüllstoffe für strahlengehärtete polymere Schutzbeschichtungen
Proceedings 13. Neues Dresdner Vakuumtechnisches Kolloquium, 187-191. Dresden, Germany (2005)

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann
Nanokomposit-Beschichtungen mit verbesserten oberflächenmechanischen Eigenschaften
Proceedings Innovationsforum Spezialchemikaliensynthese für HighTech-Produkte, PB10. Wolfen, Germany (2004)

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann
Radiation cured protective nanocomposites
Proceedings DECHEMA Conference on Surface and Interface-Engineering at the Nanoscale, 34. Frankfurt, Germany (2005)

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
Aluminium-organic nanofillers for preparing polymeric coatings of advanced surface mechanical properties
Proceedings Conference Chemical Nanotechnology Talks VI, 67. Frankfurt, Germany (2005)

R. Grgalaitis, J. Banys, S. Lapinskas, E. Erdem, R. Böttcher H.-J. Gläsel and E. Hartmann
Dielectric investigations and theoretical calculations of size effects in lead titanate nanocrystals
Proceedings 3th International Material Symposium, 355-359. Lisabon, Portugal (2005)

T. Hänsel, A. Nickel, A. Schindler and H.-J. Thomas
Ion beam figuring surface finishing of X-ray and synchrotron beam line optics using stitching interferometry for the surface topology measurement
Proceedings Conference on Optical Fabrication and Testing. Optical Society of America, Rochester, USA (2004)

O. Kahle, H.-J. Gläsel, C. Uhlig, E. Hartmann and M. Bauer
Bruchmechanische und Nano-TGA/TMA-Charakterisierung von Acrylat-Nanokompositen
Proceedings Conference Materials Week, S4-6. München, Germany (2004)

A. Kiesow, N. Teuscher, A. Heilmann and J. Meinhardt
Corona treatment on polyethylene films at differenz ambient conditions - surface characterization and plasma diagnostics
Proceedings 2nd International Workshop on Cold Atmospheric Pressure Plasmas: Sources and Applications, 267. Bruges, Belgium (2005)

H. Leiter, R. Killinger, E. Bonelli, S. Scaranzin, F. Scortecci, M. Capacci, M. Materassi, N. Kutufa, H. Neumann, M. Tartz and D. Feili
The 'New Grid Systems for Ion Engines' Technology Project - Results and Conclusion
Proceedings 29th International Electric Propulsion Conference, IEPC-05-132. Princeton, USA (2005)

H. Leiter, L. Biagioni, F. Scortecci, M. Tartz, G. Noci and D. Feili
The New Grid System for Ion Engines technology Project - A Status Review
Proceedings 41th Joint Propulsion Conference, AIAA-2005-4409. Tucson, USA (2005)

A. Matthes, H.-J. Gläsel, E. Hartmann, E. Erdem, R. Böttcher, V. Brüser and H. Kersten
Synthese ferroelektrischer polymerer Nanokomposite
Proceedings 13. Neues Dresdner Vakuumtechnisches Kolloquium, 207-211. Dresden, Germany (2005)

A. Matthes, H.-J. Gläsel, E. Hartmann, R. Böttcher, E. Erdem, V. Brüser and H. Kersten
Synthesis of ferroelectric polymeric nanocomposites
Proceedings International Nanotechnology Symposium - Nanofair 2005, 225-228. Dresden, Germany (2005)

A. Matthes, H.-J. Gläsel, E. Hartmann, E. Erdem and R. Böttcher
Template route for preparing ferroelectric polymeric nanocomposites characterisation by means of EPR and standard techniques
Proceedings Conference Chemical Nanotechnology Talks VI, 54. Frankfurt, Germany (2005)

S. Mändl, D. Manova, D. Hirsch, H. Neumann and B. Rauschenbach
Comparison of hardness enhancement and wear mechanisms in low temperature nitrided austenitic and martensitic stainless steel
Materials Research Society Symposia Proceedings **843**, T3.9.1-T3.9.5 (2005)

S. Naumov, I. Janovsky and W. Knolle
Oh the radiation-induced polymerisation of cyclic and aliphatic vinyl ethers
Proceedings 10th International Conference on Radiation Curing - RadTech Asia, 607-613. Shanghai, China (2005)

B. Rauschenbach, F. Frost, B. Ziberi and T. Höche
Low-energy ion bombardment induced nanostructures on surfaces
Proceedings 17th International Conference Ion-Surface Interactions, 42-47. Moscow, Russia (2005)

T. Scherzer, R. Mehnert and H. Lucht
Process control of UV and EB curing of acrylates by In-line NIR reflection spectroscopy
Proceedings e|5 UV & EB Technology Expo & Conference. Charlotte, USA (2004)

T. Scherzer, R. Mehnert, A. Volland and H. Lucht
Process and quality control during UV curing of acrylate coatings using near-infrared reflection spectroscopy
Proceedings 10th International Conference on Radiation Curing - RadTech Asia, 575-582. Shanghai, China (2005)

T. Scherzer, S. Müller, R. Mehnert, A. Volland and H. Lucht
Process Control in UV Curing with NIR Spectroscopy
Proceedings RadTech Europe 2005 Conference. Barcelona, Spain (2005)

A. Schindler, F. Frost, A. Nickel, T. Hänsel and B. Rauschenbach
Ion beam smoothing of surfaces
Proceedings 1st Vienna International Conference on Micro- and Nano-Technology, 367-374. Vienna, Austria (2005)

A. Schindler, T. Hänsel, F. Frost, A. Nickel, R. Fechner and B. Rauschenbach
Recent achievements on ion beam techniques for microoptics fabrication
Proceedings 10th Microoptics Conference (MOC 04), K-7. Jena, Germany (2004)

A. Schindler, T. Hänsel, F. Frost, A. Nickel, R. Fechner and B. Rauschenbach
Recent achievements on ion beam techniques for optic fabrication
Proceedings Conference on Optical Fabrication and Testing. Optical Society of America, Rochester, USA (2004)

M. Schubert, A. Kasic, T. Hofmann, V. Gottschalch, J. Off, F. Scholz, E. Schubert, H. Neumann, I. Hodgkinson, M. Arnold, W. Dollase and C.M. Herzinger
Generalized ellipsometry of complex mediums in layered systems
Proceedings SPIE **4806** 'Complex Mediums III: Beyond linear isotropic Dielectrics', Eds. A. Lakhtakia, G. Dewar and M. W. McCall, (2004) 264-276

E. Schubert
Chirale dreidimensionale Festkörper-Nanostrukturen
NanoSpotlight 2 (2005) 6

D.M. Seeger, C. Blawert, W. Dietzel, Y. Bohne, S. Mändl and B. Rauschenbach
Comparison of as-Cast and Plasma Deposited Commercial Magnesium Alloys
Magnesium Technology 2005, Eds. N.R. Neelameggham, H.I. Kaplan and B.R. Powell, The Minerals, Metals & Materials Society (2005) 323-328

S. Stojanović, F. Bauer, H.-J. Gläsel and R. Mehnert
Scratch and Abrasion Resistant Polymeric Nanocomposites - Preparation, Characterization and Applications
Materials Science Forum 453-454 (2004) 473-479

M. Tartz, J.H. Peters and H. Neumann
Grid performance models using Design of Experiments (DoE) methods
Proceedings 29th International Electric Propulsion Conference, IEPC-05-139. Princeton, USA (2005)

M. Tartz, D. Manova, H. Neumann, H.J. Leiter and J. Esch
Sputter investigation of ion thruster grid materials
Proceedings 41th Joint Propulsion Conference, AIAA-2005-4414. Tucson, USA (2005)

M. Tartz, E. Hartmann and H. Neumann
Evolution of extraction grid erosion with operation time
Proceedings 40th Joint Propulsion Conference, AIAA-2004-3787. Ft. Lauderdale, USA (2004)

M. Tartz, H. Neumann, B. Fritsche, H.J. Leiter and J. Esch
Investigation of sputter behaviour of ion thruster grid materials
Proceedings 40th Joint Propulsion Conference, AIAA-2004-4114. Ft. Lauderdale, USA (2004)

M. Tartz, H. Neumann, H.J. Leiter and J. Esch
Pyrolytic graphite and carbon-carbon sputter behaviour under xenon ion incidence
Proceedings 29th International Electric Propulsion Conference, IEPC-05-143. Princeton, USA (2005)

C. von Sonntag, A. Kolch, J. Gebel, K. Oguma and R. Sommer
The photochemical basis of UV disinfection
Proceedings European Conference on UV Radiation, Effects and Technologies, 6.1. Karlsruhe, Germany (2004)

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Dot pattern formation on Si surfaces by low-energy ion beam erosion
Materials Research Society Symposia Proceedings **849**, KK 6.2 (2005)

K. Zimmer and R. Böhme
Laser etching of fused silica for diffractive and refractive optics
Proceedings 10th Microoptics Conference (MOC 04), 9. Jena, Germany (2004)

Contributed Presentations

Talks

T. Arnold
Massenspektroskopische Untersuchungen am reaktiven $Ar/SF_6/N_2$-Plasmajet
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

T. Arnold
Massenspektroskopische Untersuchungen am reaktiven Plasmajet
5. Workshop der DFG-Forschergruppe TSUPOB, Großbothen, Germany, 14.-15.05. 2004

T. Arnold
Untersuchungen zur Plasma-Oberflächen-Wechselwirkung beim Ätzen von Si mit einem $Ar/SF_6/O_2$-Plasmajet
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

T. Arnold
Untersuchungen zur Plasma-Oberflächen-Wechselwirkung beim Ätzen von Silizium mit einem $Ar/SF_6/O_2$-Plasmajet
Universität Leipzig, Physikalisches Institut, Leipzig, Germany, 18.10.2005

T. Arnold
Investigations on Plasma-Surface-Interactions during Ar/SF_6 Plasma Jet Etching of Silicon
Osaka University, Center for Atomistic Fabrication Technology, Osaka, Japan, 07.11.2005

T. Arnold and M. Watanabe
Basic Research on PCVM
Osaka University, Center for Atomistic Fabrication Technology, Osaka, Japan, 24.11.2005

F. Bauer, E. Bilz and A. Freyer
Selectivity improvement in xylene isomerization
14th International Zeolite Conference, Cape Town, USA, 25.-30.04.2004

F. Bauer
Isodewaxing on zeolite catalysts
Engelhard-Sasol, Hamburg, Germany, 19.01.2005

F. Bauer
Functionalized inorganic/organic nanocomposites as new basic raw materials for adhesives and sealants
4th European Congress on Adhesive and Sealant Raw Materials, Nürnberg, Germany, 27.04. 2005

F. Bauer
Mechanistic studies with C-14 labeled substances
Université de Poitiers, Poitiers, France, 06.07.2004

F. Bauer
Spektroskopische Untersuchung der reaktiven Teilchenfunktionalisierung
Meilensteintreffen des Bundesministeriums für Bildung und Forschung, Ober-Ramstadt, Germany, 09.09.2004

F. Bauer, H. Ernst, E. Bilz and A. Freyer
C-14 toluene tracer studies in xylene isomerization
Congress ISOTOPCAT, Poitiers, France, 05.-11.07.2004

F. Bauer
Nano/micro particle reinforced polyacrylates for flooring applications
RadTech Europe 2005, Barcelona, Spain, 18.-20.10.2005

F. Bauer
Latest development and trends in UV curing
Congress on Utilization of Ultraviolet and Electron Radiation in Plastic Processing, Zlin, Czechia, 13.-14.09.2004

F. Bauer
UV radiation and technology
Congress on Utilization of Ultraviolet and Electron Radiation in Plastic Processing, Zlin, Czechia, 13.-14.09.2004

F. Bauer
UV curable acrylate nanocomposites and their application as scratch resistant coatings
European Coatings Conference Parquet Coatings III, Berlin, Germany
25.-26.11.2004

F. Bauer
C-14 toluene tracer studies in xylene isomerization
National Taiwan University, Taipei, Taiwan, 05.11.2004

F. Bauer
MALDI-TOF- MS studies of coke on zeolites
National Taiwan University, Taipei, Taiwan, 05.11.2004

C. Blawert, E. Morales, W. Dietzel, S. Jin, E. Ghali and S. Mändl
Corrosion Properties of the Skin of High Pressure Die Cast AZ91 Alloy
Conference of Metallurgists 2005, Calgary, Canada, 21.-24.08.2005

R. Böhme and K. Zimmer
Direct laser etching of optical glasses for flexible fabrication of micro-optical structures
OPTO-Konferenz, Nürnberg, Germany, 25.-27.05.2004

R. Böhme, T. Otto and K. Zimmer
In situ reflectivity investigations of solid/liquid interface during laser backside etching
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

R. Böhme and K. Zimmer
The influence of the laser spot size and the pulse number on laser-induced back-side wet etching
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 24.-28.05. 2004

R. Böhme and K. Zimmer
Direct laser etching of transparent materials: High quality surface patterning and figuring for micro-optical applications
7th International Conference on Correlation Optics, Chernivtsi, Ukraine, 06.-09.09.2005

R. Böhme and K. Zimmer
Laser backside etching of transparent material for the fabrication of diffractive and refractive topographic features
Congress on Micro System Technologies 2005, München, Germany, 05.-06.10.2005

Y. Bohne and S. Mändl
Abscheidung von Magnesiumlegierungen mit Ionenstrahlzerstäubung
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

W. Bondzio, J. Meinhardt, R. Mehnert and P. Köhler
Metallische und nichtmetallische dünne Schichten für 3-dimensionale Elektrodensysteme auf Polyimid
12. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 14.-15.10.2004

R. Böttcher, E. Erdem, H.-J. Gläsel and E. Hartmann
Size effects in perowskitic ferroelectric nanopowders
XXI International Conference on Radio- and Microwave Spectroscopy (RAMIS 2005), Poznan, Poland, 24.-28.04.2005

O. Brede and S. Naumov
If the molecules are dancing: Free electron transfer in non-polar media
Conference on Free reactions in solution (FRIS2005), Chester, UK, 18.-22.09.2005

O. Brede and S. Naumov
Mesomerism versus molecular dynamics. An approach for bimolecular electron transfer reaction
Gordon Research Conference on Radiation Chemistry, Waterville, USA, 21.06.2004

O. Brede and S. Naumov
Femtochemistry of little men
International Symposium on Ultrafast Accelerators for Pulse Radiolysis, New York, USA, 25.-28.06.2004

R. Brunner, R. Steiner, K. Rudolf, H.-J. Dobschal, R. Fechner and A. Schindler
Deep-UV microscopy based on a hybrid diffractive/refactive lens system
Conference Diffractive Optics and Micro-Optics, Optical Society of America, Rochester, USA, 10.-13.10.2004

M.R. Buchmeiser
Surface modification of polymers
7th Austrian Polymer Meeting, Graz, Austria, 04.-06.07.2005

M.R. Buchmeiser
Polymer-modifizierte Oberflächen: Von der Forschung zur industriellen Produktion
Oberflächentage 2005 der Arbeitsgemeinschaft Oberflächentechnik, Innsbruck, Austria, 21.-23.09.2005

M.R. Buchmeiser
Supported, well-defined metathesis catalysts
16th International Symposium on Olefin Metathesis and Related Chemistry, Poznan, Poland, 07.-12.08.2005

M.R. Buchmeiser
Design and synthesis of supptorted catalysts on a molecular base
5th International School on Molecular Catalysis, Poznan, Poland, 12.-16.08.2005

M.R. Buchmeiser
Übergangsmetallkatalysierte Herstellung funktioneller Polymermodifizierter Oberflächen
Hamburger Makromolekulares Symposium: Übergangsmetallkatalysierte Synthese und Charakterisierung von Polyolefinen, Hamburg, Germany, 10.-12.10.2005

M.R. Buchmeiser
Synthese und Trägerung neuer Übergangsmetall-Katalysatoren für C-C- und C-X-Verknüpfungsreaktionen
Technische Universität Berlin, Institut für Chemie, Berlin, Germany, 04.02.2005

M.R. Buchmeiser
Trends und Entwicklungen in der Oberflächentechnik und Oberflächenmodifizierung von Kunststoff-Teilen
Kunststoff-Cluster Oberösterreich, Linz, Austria, 06.04.2005

M.R. Buchmeiser
Synthese, Immobilisierung und Anwendung neuer Übergangsmetallkomplexe N-heterozyklischer Carbene
Universität Bayreuth, Fachbereich Chemie, Bayreuth, Germany, 12.01.2005

M.R. Buchmeiser
Funktionale Polymer-modifizierte Oberflächen: Synthese, Charakterisierung und Anwendung
Berufungsvortrag, Montanuniversität Leoben, Loeben, Austria, 07.02.2005

M.R. Buchmeiser
(Heterogen-) Katalyse, Übergangsmetall- und strahleninduzierte Polymerisation: Vom Funktionspolymer zur funktionellen Oberfläche
BASF AG, Ludwigshafen, Germany, 10.06.2005

M.R. Buchmeiser
Polymermodifizierte Oberflächen
Institut für Niedertemperatur-Plasmaphysik, Greifswald, Germany, 30.09.2005

M.R. Buchmeiser
Funktionale Polymere und Polymeroberflächen
Bayer AG, Leverkusen, Germany, 06.05.2005

C. Elsner and M.R. Buchmeiser
Nanocoating and Surface Structuring
1st Korea-Germany Advanced Plasma Research Collaboration Workshop, Seoul/Gangwon-Du, Korea, 22.-23.09.2005

E. Erdem, A. Weller, R. Böttcher, H.-J. Gläsel and E. Hartmann
Size effects in lead titanate nanopowders by multifrequency EPR spectroscopy
3rd European EPR Summer School, Wiesbaden, Germany, 17.-24.07.2005

E. Erdem, R. Böttcher, A. Weller, H.-C. Semmelhack, H.-J. Gläsel and E. Hartmann
Size effects in $PbTiO_3$:Cr^{3+} nanopowders studied by multi-frequency EPR and dielectric measurements
46th Rocky Mountain Conference on Analytical Chemistry, Denver, USA, 01.-05.08.2004

E. Erdem, R. Böttcher, A. Weller, H.-J. Gläsel and E. Hartmann
Multi-frequency EPR of $PbTiO_3$: Cr^{3+} nanopowdwers
1st EENC/AMPERE Joint Meeting, Lille, France, 06.-11.09.2004

E. Erdem, R. Böttcher, A. Weller, H.-J. Gläsel and E. Hartmann
Size effects in chromium doped $PbTiO_3$ nanopowders
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

E. Erdem, R. Böttcher, A. Weller, H.-J. Gläsel, E. Hartmann and J. Banys
Size effects in $PbTiO_3$ nanopowders
International Conference on Structure and Spectroscopy, Vilnius, Lithuania, 23.-26.09.2004

E. Erdem, R. Böttcher, A. Weller, H.-J. Gläsel and E. Hartmann
Ferroelectric polymeric nanocomposites
7th European Conference on Advanced Materials and Processes, Lausanne, Switzerland, 06.-10.09.2004

J. Fahlteich, E. Schubert, B. Rauschenbach and T. Höche
Einfluss der Substrattemperatur und der Substratvorstrukturierung auf das 3D-Nanostrukturwachstum bei der Ionenstrahl-Sputterabscheidung mit GLAD
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany
04.-09.03.2005

M. Flury, N. Lyndin, S. Tonchev, R. Fechner, A. Schindler and O. Parriaux
High top hat diffraction efficiency grating for femtosecond pulse compression
11th Microoptics Conference (MOC 05), Tokio, Japan, 30.10.-2.11.2005

R. Flyunt, O. Makogon, S. Naumov and K.-D. Asmus
Formation and reactions of halogenated peroxyl and alkoxyl radicals derived from halogenated methanes
European Young Investigators Conference on Radiation Chemistry, Gniezno, Poland, 07.-12.06.2005

R. Flyunt, O. Makogon, S. Naumov and K.-D. Asmus
Reactive fates of halogenated peroxyl and alkoxyl radicals and hydroperoxides
24th Miller Conference on Radiation Chemistry, La Londes les Maures, France, 10.-15.09.2005

F. Frost, B. Ziberi, F. Fechner, A. Schindler and B. Rauschenbach
Ion beam smoothing of surfaces
348. Wilhelm and Else Heraeus Seminar 'Ions at Surfaces: Patterns and Processes', Bad Honnef, Germany, 19.-23.06.2005

F. Frost
Selbstorganisierte Nanostrukturen durch Ionenstrahlerosion: Strukturentstehung und Musterbildung
Workshop der DFG-Forschergruppe 'Architektur von nano- und mikrodimensionalen Strukturelementen', Wörlitz, Germany, 05.-06.10.2004

F. Frost, H. Takino, R. Fechner, A. Schindler, N. Ohi and K. Nomura
Smoothing of diamond turned metal surfaces by means of ion beams
Japanese Society for Precision Engineering Autumn Conference 2005, Kyoto, Japan, 15.-17.09.2005

F. Frost, B. Ziberi and B. Rauschenbach
Ionenstrahl-induzierte Musterbildung auf Halbleiteroberflächen: Aktueller Stand und Ausblick
Workshop 'Ionenstrahlphysik und –technologie', Leipzig, Germany, 11.-12.04.2005

F. Frost
Nanostrukturierung von Festkörperoberflächen durch niederenergetische Ionen: Musterbildung und Oberflächenglättung
Universität Göttingen, I. Physikalisches Institut, Göttingen, Germany, 12.07.2004

F. Frost and B. Ziberi
Der Einfluss rückgestreuter Primärionen und zerstäubter Targetatome auf die Entwicklung der Oberflächentopographie bei der Ionenstrahlerosion von Silizium
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03. 2005

F. Frost
Pattern formation on semiconductor surfaces by low energy ion beam erosion
International Symposium 'Windows to Complexity', Münster, Germany, 04.-06.04.2005

F. Frost and B. Ziberi
Ionenstrahlglättung von Si-Oberflächen: Grundlagen und Anwendungen
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

F. Frost
Selbstorganisierte Nanostrukturen und ultraglatte Oberflächen: Von Nano zu Makro durch niederenergetische Ionen
Universität Münster, Fachbereich Physik, Münster, Germany, 21.07.2004

J.A. Garcia, R. Martínez, R.J. Rodríguez, B. Lerga, A. Medrano and S. Mändl
Tribological improvements of ion implanted technological alloys: Plasma immersion vs. conventional ion implantation
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

J.W. Gerlach, S. Sienz, T. Höche, A. Hofmann and B. Rauschenbach
Ionenstrahlgestützte Deposition von Galliumnitrid
Workshop 'Ionenstrahlphysik und –technologie', Leipzig, Germany, 11.-12.04.2005

J.W. Gerlach, A. Hofmann, T. Höche and B. Rauschenbach
Ion beam assisted molecular beam epitaxy of wurtzitic gallium nitride on lithium aluminate substrates
13th International Congress on Thin Films (ICTF 13) / 8th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures (ACSIN 8), Stockholm, Sweden, 19.-23.06.2005

J.W. Gerlach, S. Sienz, T. Höche, G. Benndorf and B. Rauschenbach
Positive influence of simultaneous ion beam irradiation on thin film properties during molecular beam epitaxy of hexagonal gallium nitride films
21st International Conference on Atomic Collisions in Solids, Genua, Italy, 04.-09.07.2004

J.W. Gerlach
Der Ionenstrahl als Werkzeug für die Modifikation von Oberflächen und Schichten
Erich Schmid Institut für Materialwissenschaft, Leoben, Austria, 06.10.2005

H.-J. Gläsel, E. Hartmann, J. von Sonntag, R. Schubert, S. Stojanović, L. Prager, F. Osterod, H. Liebe, R. Mehnert and M.R. Buchmeiser
Kratzfest- und Barriereschichten nach Maß
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

H.-J. Gläsel, S. Rummel, E. Hartmann, R. Mehnert and W. Böhlmann
Strahlengehärtete Nanokomposit-Schutzbeschichtungen
Polymerwerkstoffe - P2004, Halle, Germany, 29.09.-01.10.2004

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
Innovative metalorganic nanofillers for protective polymeric coatings
4th. International Nanotechnology Symposium - Nanofair 2005, Dresden, Germany, 29.-30.11.2005

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann
Nanokomposit-Beschichtungen mit verbesserten oberflächenmechanischen Eigenschaften
Innovationsforum Spezialchemikaliensynthese für HighTech-Produkte, Wolfen, Germany, 25.-26.11.2004

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann
Radiation-cured protective nanocomposite coatings
3rd International Nanotechnology Symposium - Nanofair 2004, Karlsruhe, Germany, 22.-24.11.2004

H.-J. Gläsel, S. Rummel, E. Hartmann, R. Mehnert and W. Böhlmann
Strahlengehärtete Nanokomposit-Schutzbeschichtungen
Frühjahrstagung der, Berlin, Germany, 04.-09.03.2005

R. Grgalaitis, J. Banys, E. Erdem, R. Böttcher, H.-J. Gläsel and E. Hartmann
Dielectric investigations and theoretical calculations on size effects in lead titanate nanocrystals
3rd International Material Symposium, Lisabon, Portugal, 20.-23.03.2005

S. Guder, P. Choungthong, S. Mändl, R. Bader, D. Winkelmair and E. Werner
Verschleißerscheinungen und Abriebmessungen an mechanisch und thermochemisch modifizierten Implantatoberflächen
Internationale Biomechanik- und Biomaterialtage, München, Germany, 08.-09.07.2005

I. Gurrappa and S. Mändl
High Temperature Corrosion Characteristics of Titanium Base Alloys at Elevated Temperatures
National Symposium on Electrochemical Science Technology, Bangalore, India, 22.-23.07.2005

T. Halbach, J.O. Krause, D. Wang, U. Anders, O. Nuyken and M.R. Buchmeiser
Poly(2-oxazoline)-immobilized Ru-catalysts: Nanoreactors for the living stereoselective Cyclopolymerization of 1,6-Heptadiynes in aqueous medium
Europolymer Conference 2005 'Polymers in Nanoscience and Nanotechnology', Lago di Garda, Italia, 29.05.-03.06.2005

T. Halbach, J.O. Krause, O. Nuyken and M.R. Buchmeiser
Controlled stereoselective cyclopolymerization of polar hepta-1,6-diynes using RuX_2(NHC)(=CHR)(NHC=1,3-dimesityldihydroimidazolin-2-ylidene;X=CI, CF_3COO; R=2-(2-PrO)-C_6H_4; 2,4,5-$(MeO)_3$-C_6H_2) and $RuCI_2(PCy_3)_2$(NHC)(=CHPh)
229th American Chemical Society National Meeting, San Diego, USA, 13.-17.03.2005

T. Hänsel, A. Nickel, A. Schindler and H.-J. Thomas
Ion beam figuring surface finishing of X-ray and synchrotron beam line optics using stitching interferometry for the surface topology measurement
Conference on Optical Fabrication and Testing, Optical Society of America, Rochester, USA, 10.-13.10.2004

D. Hirsch
Flugzeitsekundärionenmassenspektroskopie
Universität Leipzig, Wilhelm-Ostwald-Institut für Physikalische Chemie, Leipzig, Germany, 25.04.2005

D. Hirsch
Flugzeitsekundärionenmassenspektroskopie
Universität Leipzig, Arbeitskreis Festkörperchemie, Leipzig, Germany, 25.01. 2005

T. Höche
Elektronenenergieverlustspektroskopie an Übergangsmetallen in kristalliner, fehlgeordneter und amorpher Materie
Leibniz-Institut für Festkörper- und Werkstoffforschung, Institut für Festkörperanalytik und Strukturforschung, Dresden, Germany, 02.03.2005

T. Höche, F. Heyroth, P.A. van Aken and F. Schrempel
Transition-metal co-ordination in amorphous matter analysed by highly resolved $L_{2,3}$ ELNES spectroscopy
5th International Electron Energy Loss Spectroscopy Workshop (EDGE 2005), Grundlsee, Austria, 01.-05.05.2005

T. Höche
Electron energy-loss near-edge structure of transition metals in crystalline, disordered, and amorphous matter
Microscopy Conference (MC 2005), Davos, Switzerland, 28.08.-02.09.2005

T. Höche
Ortsaufgelöste Bestimmung der Koordination und Wertigkeit von Übergangsmetallen aus hochaufgelösten Elektronenenergieverlustspektren
Gesellschaft Deutscher Chemiker - Ortsverband Leipzig, Leipzig, Germany, 21.10.2004

T. Höche
Hochaufgelöste Elektronenenergieverlustspektroskopie an Gläsern
Fachausschusssitzung FA I (Physik und Chemie des Glases) der Deutschen Glastechnischen Gesellschaft, Würzburg, Germany, 09.03.2005

T. Höche
Tiefenaufgelöste Untersuchung der atomistischen Struktur durch Ionenimplantation amorphierter Schichten
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

T. Höche
Möglichkeiten und Grenzen analytischer Transmissionselektronenmikroskopie
Universität Leipzig, Fakultät für Physik und Geowissenschaften, Leipzig, Germany, 13.01.2004

T. Höche and T. Petsch
Femtosekunden-Laserablation zur TEM-Zielpräparation
AMD Saxony LLC @ Co. KG, Department Material Analysis, Dresden, Germany, 06.01.2004

T. Höche, F. Heyroth, R. Keding and P.A. van Aken
Untersuchung der Titan-Koordination in Gläsern anhand der kantennahen Ti-$L_{2,3}$-Kantenfeinstruktur in Elektronenenergieverlustspektren
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

T. Höche
Elektronenenergieverlustspektroskopie an Verbindungen mit der Fresnoit-Struktur
Friedrich-Schiller-Universität Jena, Institut für Festkörperphysik, Jena, Germany, 16.04.2004

N. Imlinger, M. Mayr and M.R. Buchmeiser
Novel N-Heterocyclic carbene complexes of Rh and Ir based on 1,3-R2-Tetrahydropyrimidin-2-ylidenes: Synthesis, structure and catalytic activity
229th American Chemical Society National Meeting, San Diego, USA, 13.-17.03.2005

S. Jankuhn, E. Hartmann, F. Scholze and H. Neumann
PIC simulation of broad-beam ion sources - magnetic field input
12th International Congress on Plasma Physics (ICPP2004), Nice, France, 25.-29.10.2004

S. Jankuhn, E. Hartmann, H. Neumann, F. Scholze and M. Tartz
Modellierungsansatz für eine DC-Heißkatodenplasmaanregung
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.03.-04.03.2004

S. Jankuhn, E. Hartmann, H. Neumann and F. Scholze
Beschreibung von Ionenquellenplasmen, ionenoptischen Prozessen am Multiaperturgittersystem und Neutralisationseffekten am Substrat mit Hilfe des Codes XOO-PIC
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

O. Kahle, H.-J. Gläsel, C. Uhlig, E. Hartmann and M. Bauer
Bruchmechanische und Nano-TGA/TMA-Charakterisierung von Acrylat-Nanokompositen
Conference Materials Week, München, Germany, 21.-23.09.2004

H. Kersten, R. Wiese, H. Neumann and F. Scholze
Plasma and ion beam characterization by non-conventional methods
4th International Space Propulsion Conference, Chia Laguna, Italy, 02.-04.06.2004

H. Kersten, R. Wiese, M. Hannemann, A. Kapitov, F. Scholze, H. Neumann and R. Hippler
Plasma and ion beam characterization by non-conventional methods
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

W. Knolle
Electron beam (EB) and UV induced polymerisation: Industrial application and basic research
Russian Academy of Science, Institute of Synthetic Polymer Materials, Moscow, Russia, 28.04.2004

W. Knolle, S. Naumov, M. Madani and C. von Sonntag
Photochemistry of acrylates after 222 nm excitation
International Conference on Ionizing Radiation and Polymers - IRaP'04, Houffalize, Belgium, 25.-30.09.2004

W. Knolle, I. Janovský, S. Naumov, R. Mehnert and V.I. Feldman
Low-temperature EPR investigation of organic radical cations
Workshop of Department High Energy Chemistry, Moscow State University, Moscow, Russia, 27.04.2004

H. Leiter, L. Biagioni, F. Scortecci, M. Tartz, G. Noci and D. Feili
The New Grid System for Ion Engines Technology Project - A Status Review
41th Joint Propulsion Conference, Tucson, USA, 10.-13.07.2005

S. Mändl
Oberflächenbehandlung von Metallen zur Verbesserung der Biokompatibilität mittels Plasma-Immersions-Ionenimplantation
5. Workshop 'Funktionelle Oberflächen für die Medizintechnik', Erfurt, Germany, 11.10.2005

S. Mändl
PIII treatment of Ti alloys and NiTi for medical applications
8th International Workshop on Plasma Based Ion Implantation & Deposition, Chengdu, China, 18.-22.09.2005

S. Mändl
Radiation-Enhanced-Diffusion bei der Plasma-Immersions-Ionenimplantation?
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

S. Mändl
SIMS zur Analyse von tribologischen PVD-Schichten
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

S. Mändl, Y. Bohne, J.W. Gerlach, W. Assmann and B. Rauschenbach
Complementary information from RBS, ERDA and SIMS for analysis of modern magnesium alloys
17th International Conference on Ion Beam Analysis, Sevilla, Spain, 26.06.-01.07.2005

S. Mändl, D. Manova, H. Neumann, M.T. Pham, E. Richter and B. Rauschenbach
Correlation between PIII nitriding parameters and corrosion behaviour of austenitic stainless steels
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

S. Mändl
Untersuchung der Einsatzmöglichkeiten von modernen Plasma- und Ionentechnologien zur Entwicklung von korrosionsbeständigeren Magnesiumlegierungen und Magnesiumschichtsystemen
22. Sitzung des GfKORR-Arbeitskreises 'Korrosion und Korrosionsschutz von Aluminium und Magnesium', Geesthacht, Germany, 13.04.2005

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Improved wear resistance of martensitic stainless steel
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

D. Manova, H. Zachmann, S. Mändl, H. Neumann and B. Rauschenbach
Interplay of ion nitriding and metallurgical pretreatments
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

D. Manova, J.W. Gerlach, H. Neumann, W. Assmann and S. Mändl
Phase formation in Ti after high fluence/high temperature nitrogen implantation
14th International Conference on Ion Beam Modification of Materials, Monterey, USA, 05.-10.09.2004

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Plasma immersion ion implantation of martensitic stainless steel
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

M. Mayr, S. Lubbad, R. Kröll, J.O. Krause, O. Nuyken and M.R. Buchmeiser
Design and synthesis of supported catalysts on a molecular base
2nd International Conference on Structured Catalysts and Reactors (ICOSCAR-2), Delft, Netherlands, 16.-19.10.2005

R. Mehnert
Potentiale des Wissenschafts-Parkes Leipzig
Wirtschaft trifft Wissenschaft, Leipzig, Germany, 10.11.2004

R. Mehnert, S. Stojanović and A. Wacker
Neue Materialien zur Herstellung von dichten SiO_2-Schichten auf chemischem Wege
12. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 14.-15.10.2004

R. Mehnert
Kinetik der UV-Härtung
Wacker Chemie AG, Burghausen, Germany, 16.09.2004

R. Mehnert
UV-vernetzbare Acrylat-Nanokomposite: Eigenschaften und Anwendungen
5. Wörlitzer Workshop 'Funktionelle Schichten, Schichten aus Nanopartikeln - Abscheidung aus Dispersionen, Flammen und Plasmen', Wörlitz, Germany, 03.06.2004

R. Mehnert
Funktionalisierte Oberflächen
Workshop 'Hochwertige Oberflächen von und auf Kunststoffformteilen, insbesondere für den Automobilbau', Leipzig, Germany, 29.04.2004

R. Mehnert
UV-vernetzte Acrylat-Nanokomposite für Beschichtungen
Nano Coatings Days, St. Gallen, Switzerland, 14.-15.09.2004

J. Meinhardt, D. Hirsch and R. Mehnert
Praktische Erfahrungen bei XPS-Messungen von Kunststoffen - Voraussetzungen und Grenzen
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

J. Meinhardt
Untersuchungen an Polymeroberflächen mittels Photoelektronenspektroskopie
Workshop 'Oberflächenmodifizierung durch Coronabehandlung', Fraunhofer-Institut für Werkstoffmechanik, Halle, Germany, 03.02.2004

D. Michel, R. Böttcher, E. Erdem, G. Klotzsche, W. Böhlmann, H.-J. Gläsel and E. Hartmann
Size effects in $BaTiO_3$ nanopowders and of $BaTiO_3$ in nanoporous materials
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

S. Naumov, I. Janovský and W. Knolle
On the radiation-induced polymerisation of cyclic and aliphatic vinyl ethters
10th International Conference on Radiation Curing - RadTech Asia, Shanghai, China, 23.-26.05.2005

H. Neumann, M. Tartz, B. Fritsche, H.J. Leiter and J. Esch
Investigation of sputter behaviour of graphite materials for ion thruster grids
4th International Space Propulsion Conference, Chia Laguna, Italy, 02.-04.06.2004

H. Neumann, M. Tartz and E. Hartmann
Evolution of extraction grid erosion with operation time
4th International Space Propulsion Conference, Chia Laguna, Italy, 02.-04.06.2004

H. Neumann
Neue Niederenergiebreitstrahlionenquellen- und Anlagenkonzepte zur Abscheidung von Präzisionsschichten
13. Treffen des Arbeitskreises 'Ausrüstungen, Materialien und Dienstleistungen für die Halbleiterindustrie', Dresden, Germany, 27.01.2004

H. Neumann, F. Scholze, M. Tartz, M. Nestler, R. Weller and T. Blum
Modelling, construction and testing of scalable broad beam sources with different possibilities of ion beam profile control and its applications in thin film processing
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

H. Neumann, F. Scholze, M. Tartz, A. Schindler, R. Wiese, M. Nestler and T. Blum
Broad beam ion sources and some surface processes
32nd European Physical Society Conference on Plasma Physics, Taragona, Spain, 27.06.-01.07.2005

H. Neumann, J. Dienelt, M. Nestler, E. Schubert, F. Scholze, M. Schulze and B. Rauschenbach
EUV maskblank ion beam deposition - a new concept and first results
48th Annual Technical Conference and Smart Materials Symposium of the Society of Vacuum Coaters, Denver, USA, 25.-28.04.2005

H. Neumann, H. Kersten, R. Wiese, M. Hannemann, F. Scholze and M. Tartz
Ion beam and plasma characterization by non conventional methods
International Conference on Metallurgical Coatings and Thin Films (ICMCTF 2005), San Diego, USA, 02.-06.05.2005

H. Neumann, F. Scholze, B. Faust, B. Dathe, M. Tartz, S. Jankuhn, L. Pistol, J. Dienelt and E. Hartmann
Ionenquellenentwicklung am IOM
Workshop Ionenstrahlphysik und -technologie, Leipzig, Germany, 11.-12.04.2005

L. Prager, M. Lenk, R. Mehnert and R. Schubert
Application of Xe_2*-excimer sources on industrial coating technologies
Workshop IOM - IPIT (Rep. Korea), Leipzig, Germany, 28.10. 2004

L. Prager.
Physical matting with Xe_2*-excimer sources: Basics, equipment, results
Workshop at Berrywood sas, Meaulne, France, 24.03. 2004

L. Prager
Irradiation tools at the Institute of Surface Modification
1st Korea-Germany Advanced Plasma Research Collaboration Workshop, Seoul/Gangwon-Du, Korea, 22.-23.09.2005

L. Prager, M. Lenk, R. Mehnert and R. Schubert
Einsatz von VUV-Excimerstrahlern bei industriellen Beschichtungsverfahren
160. Seminar der Physikalisch-Technischen Bundesanstalt, Berlin, Germany, 18.05.2004

L. Prager and R. Schubert
Strukturierung von Oberflächen strahlenhärtbarer Lacke mittels 172 nm Excimer-Lampen
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

B. Rauschenbach, A. Schindler, T. Hänsel and R. Schwabe
Ionenstrahlgestützte Ultrapräzisionsbearbeitung von Oberflächen
Internationale Fachmesse für Vakuumtechnik und Vakuumanwendungen, Magdeburg, Germany, 25.-27.05.2004

B. Rauschenbach, A. Schindler, T. Hänsel, F. Frost and R. Schwabe
Ultraprecision surface smoothing by low-energy ion beams
International Workshop Oxide Thin Films, Göttingen, Germany, 22.-24.07.2004

B. Rauschenbach
Möglichkeit und Grenzen von Innovationen in den neuen Bundesländern
Forschungs- und Innovationsfachgespräch, Berlin, Germany, 16.06.2004

B. Rauschenbach, E. Schubert, T. Höche and H. Neumann
Ion beam assisted deposition of multilayer X-ray mirrors for the extreme ultraviolet lithography
16th International Vacuum Congress (IVC-16), Venice, Italy, 28.06.-02.07.2004

B. Rauschenbach, A. Schindler, F. Frost, A. Nickel and T. Hänsel
Ion beam assisted smoothing of surfaces
1st Vienna International Conference on Micro-and Nanotechnology, Vienna, Austria, 09.-11.03.2005

B. Rauschenbach, E. Schubert, F. Frost and T. Höche
Low-energy ion assisted structure evolution on surfaces
15th International Summer School on Vacuum, Electron and Ion Technologies, Burgas, Bulgaria, 12.-16.09.2005

B. Rauschenbach
Ion beam assisted deposition, fundamentals and application
India Institute for Technology, New Delhi, India, 23.02.2005

B. Rauschenbach
Synthese von Nanostrukturen und dünnen Schichten durch niederenergetische Ionenbestrahlung
Universität Göttingen, Fakultät für Physik, Göttingen, Germany, 12.12.2005

B. Rauschenbach, E. Schubert and F. Frost
Low energy ion beam induced nanostructure generation on surfaces
Annual Dutch Vacuum Society Meeting 2005 , Utrecht, Netherlands, 21.-23.04.2005

B. Rauschenbach, E. Schubert, F. Frost and T. Höche
Nanostructure evolution on surfaces by low-energy ion bombardment
Indo-German Workshop on Synthesis and Modification of Nano-Structured Materials by Energetic Ion Beams, New Delhi, India, 20.-24.02.2005

B. Rauschenbach, E. Schubert, F. Frost and T. Höche
Nanostrukturen durch Ionenstrahlen
Technischen Universität Chemnitz, Institut für Physik, 08.06.2005

B. Rauschenbach
Oberflächen, dünne Schichten und niederenergetische Ionen
Justus-Liebig-Universität Giessen, Institut für Physik, 16.02.2004

B. Rauschenbach, E. Schubert, T. Höche and H. Neumann
Multilayer X-ray mirrors for the EUV lithography prepared by ion beam sputter deposition
Material Research Society Fall Meeting (MRS), Boston, USA, 29.11.-03.12.2004

B. Rauschenbach, F. Frost, B. Ziberi and T. Höche
Low-energy ion bombardment induced nanostructures on surfaces
17th International Conference on Ion-Surface Interaction, Moscow, Russia, 25.-29.05.2005

N*. Razek, E. Schubert, D. Hirsch, A. Schindler, and B. Rauschenbach*
Cleaning and smoothing of Ge surfaces by low-energy hydrogen ion beam irradiation at moderate substrate temperature
16th International Vacuum Congress (IVC-16), Venice, Italy, 28.06-01.07.2004

N. Razek, A. Schindler, D. Hirsch and B. Rauschenbach
Oxide and carbon contamination removal from semiconductor surfaces using low-energy hydrogen ion beam etching
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

J. Reinhardt
Wirkung von Gamma-Strahlung auf lebende und leblose Materie
Studientagung: Tierische Holzschädlinge, Bekämpfung und Prävention, Graz, Austria, 25.06.2004

D. Ruthe, K. Zimmer, A. Braun, T. Höche and J. Hänel
Low damage processing of thin films on flexible substrates by ultra-short pulse lasers
Pro-Flex Workshop, Dresden, Germany, 20.-21.09.2004

D. Ruthe and K. Zimmer
Femtosecond Laser Structuring of Thin Films for Photovoltaic Applications
Femtomat 2004, Bad Kleinkirchheim, Austria, 25.-28.02.2004

T. Scherzer, R. Mehnert and H. Lucht
Process control of UV and EB curing of acrylates by in-line NIR reflection spectroscopy
e|5 UV & EB Technology Expo & Conference, Charlotte, USA, 02.-05.05.2004

T. Scherzer, R. Mehnert, A. Volland and H. Lucht
Process and quality control during UV curing of acrylate coatings using near-infrared reflection spectroscopy
10th International Conference on Radiation Curing - RadTech Asia 2005, Shanghai, China, 23.-26.05.2005

T. Scherzer, W. Knolle, S. Naumov and L. Prager
Investigations on the photoinitiator-free photopolymerization of acrylates by vibrational spectroscopic methods
16th European Symposium in Polymer Spectroscopy (ESOPS-16), Kerkrade, Netherlands, 29.05.-01.06.2005

T. Scherzer, R. Mehnert, A. Volland and H. Lucht
In-line determination of the conversion in acrylate coatings after UV and EB curing using near-infrared reflection spectroscopy
International Conference on Ionizing Radiation and Polymers - IRaP'04, Houffalize, Belgium, 25.-30.09.2004

A. Schindler
Ultra precision surface machining by ion beams and plasma engineering
Lawrence Livermore National Laboratory, Center for Precision Engineering, Livermore, USA, 14.06.2004

A. Schindler
Ion beam and plasma jet surface finishing for high performance optics fabrication
Congress on OPTATEC 2004, Frankfurt, Germany, 25.06.2004

A. Schindler, T. Hänsel, F. Frost, A. Nickel, R. Fechner and B. Rauschenbach
Recent achievements on ion beam techniques for microoptics fabrication
10th Microoptics Conference (MOC 04), Jena, Germany, 01.-03.09.2004

A. Schindler, T. Hänsel, A. Nickel, H.-J. Thomas, H. Lammert, F. Siewert, T. Schlegel and T. Zeschke
Recent achievements in ion beam finishing of SR beam-line optics
2nd workshop on metrology for X-ray optics, Grenoble, France, 01.-02.04.2004

A. Schindler, T. Hänsel, F. Frost, A. Nickel, R. Fechner and B. Rauschenbach
Recent achievements on ion beam techniques for optic fabrication
Conference on Optical Fabrication and Testing, Optical Society of America, Rochester, USA, 10.-13.10.2004

F. Scholze, H. Neumann and M. Zeuner
Konzept für einen induktiv gekoppelten HF-Plasmabrückenneutralisator
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

E. Schubert
Ion beam assisted techniques in modern thin film nano architecture
University of Nebraska-Lincoln, Lincoln, USA, 16.11.2005

E. Schubert
Chirale Silizium-Nanostrukturen mit GLAD
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

E. Schubert
Sculptured thin films fabricated by GLAD
Jahrestagung der fachübergreifenden Arbeitsgruppe Halbleiter - FAHL-Academia, Wörlitz, Germany, 27.09.2005

E. Schubert, T. Höche, F. Frost and B. Rauschenbach
Nanostructure growth by ion beam assisted glancing angle deposition
International Conference on Metallurgical Coatings and Thin Films, San Diego, USA, 02.-06.05.2005

E. Schubert, J. Fahlteich and B. Rauschenbach
Ionenstrahl-gestützte Darstellung von chiralen Nanostrukturen aus Silizium
Workshop 'Ionenstrahlphysik und –technologie', Leipzig, Germany, 11.-13.04. 2005

E. Schubert, J. Fahlteich, T. Höche, B. Rauschenbach, G. Wagner and M. Schubert
Chiral silicon nanostructure growth by glancing angle deposition
13th International Congress on Thin Films (ICTF 13) / 8th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures (ACSIN 8), Stockholm, Sweden, 19.-23.06.2005

R. Schubert, U. Decker and R. Mehnert
Stickstoff-inertisierte UV-Härtungsanlagen - neuere Technik für bessere Oberflächenqualität und effektive Produktion -
Paper Technology Specialists–Symposium: Haftetiketten, München, Germany, 26.02.2004

D.M. Seeger, C. Blawert, W. Dietzel, Y. Bohne, S. Mändl and B. Rauschenbach
Comparison of as-cast and plasma deposited commercial magnesium alloys
134th Annual Meeting & Exhibition of the Minerals, Metals & Materials Society (TMS 2005), San Francisco, USA, 13.-17.02.2005

S. Sienz
Der Einfluss eines niederenergetischen Ionenstrahls bei der Molekularstrahlepitaxie von dünnen GaN-Schichten
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

A. Tarraf, M. Nestler, H.-U. Poll, D. Roth, J. Dienelt, H. Neumann, M. Kramer, E. Schubert, B. Rauschenbach, M. Schulze, V. Daneker, S. Irmer, F. Römer, J. Daleiden and H. Hillmer
Innovative concept for implementing particle free EUVL masks by novel dual ion beam sputter deposition systems
Photomask and Next-Generation Lithography Mask Technology XII, Yokohama, Japan, 13.-15.04.2005

M. Tartz, H. Neumann, D. Manova, H.J. Leiter and J. Esch
Untersuchung der Sputtereigenschaften von Extraktionsgittermaterial
XII. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

M. Tartz, S. Jankuhn, F. Scholze, E. Hartmann and H. Neumann
Möglichkeiten der Strahlprofilsteuerung von Breitstrahlionenquellen
XI. Workshop 'Oberflächentechnologien mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 02.-04.03.2004

M. Tartz, D. Manova, H. Neumann, H.J. Leiter and J. Esch
Sputter investigation of ion thruster grid materials
41th Joint Propulsion Conference, Tucson, USA, 10.-13.07.2005

M. Tartz, J.H. Peters and H. Neumann
Grid performance models using Design of Experiments (DoE) methods
29th International Electric Propulsion Conference, Princeton, USA, 31.10.-04.11.2005

M. Tartz, H. Neumann, B. Fritsche, H.J. Leiter and J. Esch
Investigation of sputter behaviour of ion thruster grid materials
40th Joint Propulsion Conference, Ft. Lauderdale, USA, 11.-14.07.2004

M. Tartz, E. Hartmann and H. Neumann
Evolution of extraction grid erosion with operation time
40th Joint Propulsion Conference, Ft. Lauderdale, USA, 11.-14.07.2004

M. Tartz, H. Neumann, H.J. Leiter and J. Esch
Pyrolytic graphite and carbon-carbon sputter behaviour under xenon ion incidence
29th International Electric Propulsion Conference, Princeton, USA, 31.10.-04.11.2005

J. von Sonntag
Strahlengehärtete Funktionsschichten auf Polycarbonat und Sondersubstraten
Bayer Material Sciences AG, Leverkusen, Germany, 07.04.2005

J. von Sonntag
UV curing plain and structured coatings as sub-and superstrate for vacuum web coatings
Proflex, Dresden, Germany, 20.-21.09. 2004

J. von Sonntag and M.R. Buchmeiser
Forschung am IOM
Bayer Material Sciences AG, Leverkusen, Germany, 07.04.2005

J. von Sonntag
Wie nicht beschichtet - physikalische Mattierung mit 172 nm
BASF AG, Ludwigshafen, Germany, 11.05.2004

J. von Sonntag and M.R. Buchmeiser
Forschung am IOM
Gerstel GmbH & Co. KG, Mülheim an der Ruhr, Germany, 08.04.2005

J. von Sonntag
Forschung am Leibniz-Institut für Oberflächenmodifizierung IOM e. V.
Mitteldeutsche Jobbörse der Gesellschaft Deutscher Chemiker, Leipzig, Germany, 27.04.2005

D. Wang, M. Mayr, N. Imlinger, R. Kröll, S. Lubbad and M.R. Buchmeiser
Immobilisierte Übergangsmetallkatalysatoren für (enantioselektive) C-C- und C-Si-Kupplungen
Österreichische Chemietage, Leoben, Austria, 19.-21.09. 2005

L. Yang, M. Mayr, R. Kröll and M.R. Buchmeiser
Novel metathesis catalysts and immobilization strategies
229th American Chemical Society National Meeting, San Diego, USA, 13.-17.03.2005

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Pattern formation on Si and Ge surfaces by low-energy ion beam erosion
348. Wilhelm and Else Heraeus Seminar 'Ions at Surfaces: Patterns and Processes', Bad Honnef , Germany, 19.-23.06.2005

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Ripple and dot pattern formation on silicon surfaces by low-energy ion beam erosion
Material Research Society Fall Meeting (MRS), Boston, USA, 29.11.-03.12.2004

B. Ziberi and F. Frost
Ionenstrahlinduzierte Selbstorganisation auf Si- und Ge-Oberflächen
XII. Workshop 'Oberflächentechnologie mit Plasma- und Ionenstrahlprozessen', Mühlleithen, Germany, 16.-18.03.2005

B. Ziberi, F. Frost and B. Rauschenbach
Ion induced pattern formation on Ge and Si surfaces
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

*B. Ziberi, F. Frost, T. Höche and B. Rauschenba*ch
Spontaneous pattern formation on Si surfaces by ion beam erosion
European Material Research Society Spring Meeting (E-MRS), Strasbourg, France, 24.-28.05.2004

B. Ziberi, F. Frost and B. Rauschenbach
Formation of large-area nanostructures on Si and Ge surfaces during low-energy ion beam erosion
American Vacuum Society 52nd International Symposium and Exhibition, Boston, USA, 29.10.-04.11.2005

B. Ziberi, F. Frost and B. Rauschenbach
Self-organized pattern formation on Si surfaces by ion beam erosion
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

K. Zimmer
Präzise Bearbeitung von Oberflächen mit gepulster Laserstrahlung für optische Anwendungen?
JENOPTIK GmbH, Jena, Germany, 15.03.2004

K. Zimmer and R. Böhme
Laserätzen dielektrischer Materialien zur Mikrostrukturierung
Ferdinand-Braun-Institut für Höchstfrequenztechnik, Berlin, Germany, 08.10.2004

K. Zimmer, T. Rudolph, D. Ruthe, R. Böhme, J. Zajadacz and B. Rauschenbach
Microstructuring of surfaces for life science
4. Biotechnologie-Tage an der Universität Leipzig, Leipzig, Germany, 03.06.2005

K. Zimmer and R. Böhme
Influence of the kind of absorbing liquid on fundamentals and application at laser-induced backside wet etching
European Conference on Lasers and Electro-Optics (CLEO/Europe) / European Quantum Electronics Conference (EQEC) 2005, München, Germany, 13.-16.06.2005

K. Zimmer
Enhancement of the MWCNT growth at laser modified surface sites
Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology - Hellas (FORTH), Heraklion, Greece, 27.10.2005

K. Zimmer
Mikro- und Nanostrukturierung am IOM Leipzig
Kooperationsbörse 'Mikro- und biosensorische Messtechnik', Endress + Hauser Conducta GmbH, Waldheim, Germany, 22.06.2005

Posters

T. Arnold, S. Grabowski, A. Schindler and H.-E. Wagner
Reactive plasma etching of Si - Gas flow models and mass spectrometry
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

T. Arnold, S. Grabovski, A. Schindler and H.-E. Wagner
Spatially resolved mass spectrometry of reactive $Ar/SF_6/(N_2)$plasma jets
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

F. Bauer, E. Bilz, W.H. Chen, A. Freyer and S.B. Liu
C-14 tracer studies in skeletal isomerization of n-butene
17. Deutsche Zeolith-Tagung, Giessen, Germany, 02.-04.03.2005

F. Bauer, E. Bilz, W.H. Chen, H. Ernst, A. Freyer and S.B. Liu
C-14 tracer studies in conversion of aromatics
ConNeCat-Partnering-Event, Frankfurt, Germany, 24.05.2004

F. Bauer, H. Ernst, E. Bilz and A. Freyer
C-14 tracer studies in xylene isomerization
16. Deutsche Zeolith-Tagung, Dresden, Germany, 03.-05.03.2004

F. Bauer, H.-J.Gläsel, E. Hartmann, G. Knölle, P. Remmert, A. Herbst and R. Mehnert
Modification of water-based silica nanoparticles for scratch resistant coatings
ConNeCat-Partnering-Event, Frankfurt, Germany, 14.07.2004

F. Bauer, E. Bilz, H.-J. Gläsel, E. Hartmann, G. Knölle, P. Remmert, A. Herbst and R. Mehnert
Water-based surface-modified nanoparticles for polymer reinforcement
DECHEMA Conference on Surface and Interface-Engineering at the Nanoscale, Frankfurt, Germany, 07.-09.03.2005

J. Bauer, V. Gottschalch, G. Wagner, H. Herrnberger and D. Hirsch
MOVPE-Darstellung freistehender GaAs-Nanodrähte
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

F. Bauer, H.-J. Gläsel, E. Hartmann, H. Ernst, V. Sauerland and R. Mehnert
Surface characterization of midified inorganic nanoparticles for UV curable nano-composites
DECHEMA Conference on Surface and Interface-Engineering at the Nanoscale, Frankfurt, Germany, 07.-09.03.2005

F. Bauer, H.-J. Gläsel, G. Knölle, P. Remmert, A. Herbst and R. Mehnert
Water-based, modified silica nanoparticles for polymer reinforcement
ConNeCat-Partnering-Event, Frankfurt, Germany, 14.07.2004

R. Böhme, M. Ehrhardt, T. Rudolph, D. Ruthe, K. Zimmer and S. Pissadakis
Backside etching of fused silica with ultra-short laser pulses at the interface to absorbing liquid
8th International Conference on Laser Ablation (COLA 05), Banff, Canada, 11.-16.09.2005

R. Böhme, D. Hirsch and K. Zimmer
Laser etching of transparent materials at a backside surface adsorbed layer
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

Y. Bohne, D.M. Seeger, C. Blawert, W. Dietzel, S. Mändl and B. Rauschenbach Influence of ion energy on properties of Mg-alloy thin films formed by ion beam sputter deposition
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

Y. Bohne, N. Shevchenko, F. Prokert, J. von Borany, B. Rauschenbach and W. Möller
In situ X-ray diffraction investigations during high-energy oxygen ion implantation in transition metals
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

Y. Bohne, N. Shevchenko, F. Prokert, J. von Borany, H. Reuther, A. Mücklich, B. Rauschenbach and W. Möller
In situ characterization of phase formation during high-energy oxygen ion implantation
8th European Conference on Accelerators in Applied Research and Technology (E-CAART-8), Paris, France, 20.-24.09.2004

Y. Bohne, S. Mändl, B. Rauschenbach, D.M. Seeger, C. Blawert and W. Dietzel Abscheidung von technischen Magnesiumlegierungen mit Ionenstrahlzerstäubung
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

O. Brede, A.Moroz and S. Naumov
Free electron transfer involving aromatic amines
Gordon Research Conference on Radiation Chemistry, Waterville, USA, 20.-25.06.2004

W.H. Chen, F. Bauer, E. Bilz, A. Freyer, S.J. Huang, C.S. Lai and S.B. Liu
Acidity characterization of H-ZSM-5 catalysts modified by pre-coking and silylation
14th International Zeolite Conference , Cape Town, USA, 25.-30.04.2004

J. Dienelt, H. Neumann, F. Scholze, E. Schubert, J.W. Gerlach, M. Nestler, A. Tarraf, M. Schulze and B. Rauschenbach
EUV mask blank deposition by ion beam sputtering for industrial application
Annual Dutch Vacuum Society Meeting 2005, Utrecht, Netherlands, 21.-23.04.2005

J. Dienelt, J. von Sontag, K. Zimmer and B. Rauschenbach
Ion beam enhanced chemical etching of GaAs
21st International Conference on Atomic Collisions in Solids, Genua, Italy, 04.-09.07.2004

J. Dienelt, H. Neumann, F. Scholze, M. Kramer, E. Schubert, B. Rauschenbach, M. Nestler, A. Tarraf and M. Schulze
Ion beam technology as a solution for EUC lithography ?
15th International Summer School on Vacuum, Electron and Ion Technologies, Burgas, Bulgaria, 12.-16.09.2005

J. Dienelt, K. Zimmer, J. von Sonntag, B. Rauschenbach and C. Bundesmann
Roughness and damage of a GaAs surface after chemically assisted ion beam etching with Cl_2/Ar^+
30th International Micro- and Nano-Engineering Conference (MNE 2004), Rotterdam, Netherlands, 19.-22.09.2004

J. Dienelt, K. Zimmer, J. von Sonntag and B. Rauschenbach
Rauheit und Schädigung einer GaAs-Oberfläche nach dem chemisch unterstützten Ionenstrahlätzen mit Cl_2/Ar^+
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

J. Dienelt, H. Neumann, F. Scholze, E. Schubert, B. Rauschenbach, M. Nestler and M. Schulze
A new IBAD tool concept for particle minimized EUV mask blank deposition
326. Wilhelm and Else Heraeus Seminar 'XUV Technology and Applications', Bad Honnef, Germany, 07.-09.06.2004

J. Dienelt, H. Neumann, F. Scholze, E. Schubert, B. Rauschenbach, M. Nestler, A.-Taraf and M. Schulze,
In situ ellipsometry and beam profile controlled linear ion beam source screening for the IBD EUV mask blank deposition
30th International Micro- and Nano-Engineering Conference (MNE 2004), Rotterdam, Netherlands, 19.-22.09.2004

J. Dienelt, H. Neumann, M. Kramer, F. Scholze, B. Rauschenbach, M. Nestler, A. Tarraf and M. Schulze
A new EUV mask blank deposition tool
31th International Micro- and Nano-Engineering Conference (MNE 2005), Vienna, Austria, 19.-22.09.2005

C. Elsner and J. Zajadacz
UV moulding for continuous high throughput fabrication of 3D-micro- and nano-structures on flexible substrates
Conference Chemical Nanotechnology Talks VI, Frankfurt, Germany
29.-30.09.2005

R. Emmler, H. Bauch, R. Flyunt and R. Mehnert
Entwicklung kratz- und abriebfester Beschichtungen für Holzoberflächen auf der Basis von lösemittelarmen Nanokomposit-Lacken
Domotex Asia 2005, Shanghai, China, 22.-24.03.2005

R. Emmler, H. Bauch, R. Flyunt and R. Mehnert
Entwicklung kratz- und abriebfester Beschichtungen für Holzoberflächen auf der Basis von lösemittelarmen Nanokomposit-Lacken
Domotex 2005, Hannover, Germany, 15.-18.01.2005

R. Emmler, H. Bauch, R. Flyunt and R. Mehnert
Entwicklung kratz- und abriebfester Beschichtungen für Holzoberflächen auf der Basis von lösemittelarmen Nanokomposit-Lacken
The European Coating Show, Nürnberg, Germany, 26.-28.04.2005

R. Fechner, A. Schindler, D. Hirsch, T. Gase, R. Weigelt and M. Helgert
Fabrication of masters for an embossing technology of diffractive optics and of sub-wavelength structures by RIBE proportional transfer
10th Microoptics Conference (MOC 04), Jena, Germany, 01.-03.09.2004

R. Flyunt, O. Makogon, S. Naumov and K.-D. Asmus
Radiation chemistry of halogenated methanes in aqueous solutions. Model systems to study the reactive fates of halogenated alkoxyl radicals. Part 1
European Young Investigators Conference on Radiation Chemistry, Gniezno, Poland, 07.-12.06.2005

R. Flyunt, O. Makogon, S. Naumov and K.-D. Asmus
Radiation chemistry of halogenated methanes in aqueous solutions. Model systems to study the reactive fates of halogenated alkoxyl radicals. Part 2
24th Miller Conference on Radiation Chemistry, La Londes les Maures, France, 10.-15.09.2005

F. Frost, B. Ziberi and B. Rauschenbach
Smoothing of Si surfaces by low-energy ion beam erosion
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

F. Frost, B. Ziberi and B. Rauschenbach
Curvature dependent surface relaxation on Si by low-energy ion beam erosion
Material Research Society Fall Meeting (MRS), Boston, USA, 29.11.-03.12.2004

J.W. Gerlach and S. Mändl
Correlation between RBS, reflectometry and ellipsometry data for TiO_2 films deposited on Si
14th International Conference on Ion Beam Modification of Materials (IBMM 2004), Monterey, USA, 05.-10.09.2004

J.W. Gerlach, A. Wolfsteller and B. Rauschenbach
Hyperthermal deposition of thin titanium nitride films
13th International Congress on Thin Films (ICTF 13) / 8th International Conference on Atomically Controlled Surfaces, Interfaces and Nanostructures (ACSIN 8), Stockholm, Sweden, 19.-23.06.2005

H.-J. Gläsel, E. Hartmann, R. Mehnert and M. R. Buchmeiser
Innovative organometallic nanofillers for protective polymeric coatings
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

H.-J. Gläsel, E. Hartmann, R. Mehnert and M. R. Buchmeiser
Aluminium-organic nanofillers for preparing polymeric coatings of advanced surface mechanical properties
Conference Chemical Nanotechnology Talks VI, Frankfurt, Germany
29.-30.09.2005

H.-J. Gläsel, E. Hartmann, F. Bauer, R. Mehnert, O. Kahle and M. Bauer Nanomodification routes for scratch resistant polymer coatings
ConNeCat-Partnering Event, Frankfurt, Germany, 14.07.2004

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann
Radiation cured protective nanocomposite coatings
3rd International Nanotechnology Symposium - Nanofair 2004, Karlsruhe, Germany, 22.-24.11.2004

H.-J. Gläsel, S. Rummel, E. Hartmann, F. Bauer, R. Mehnert and W. Böhlmann Radiation cured protective nanocomposite coatings
DECHEMA Conference on Surface and Interface-Engineering at the Nanoscale, Frankfurt, Germany, 07.-09.03.2005

H.-J. Gläsel, E. Hartmann, A. Weller, F. Bauer and R. Mehnert
Radiation cured nanocomposites of enhanced surface mechanical properties
7th European Conference on Advanced Materials and Processes, Lausanne, Switzerland, 06.-10.09.2004

H.-J. Gläsel, E. Hartmann, R. Mehnert and M. Buchmeiser
Innovative metallorganische Nanofüllstoffe für strahlengehärtete polymere Schutzbeschichtungen
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

H.-J. Gläsel, A. Weller, E. Hartmann, E. Erdem, R. Böttcher and J. Banys
Synthesis of ferroelectric nanopowders and radiation cured composites
3rd International Nanotechnology Symposium - Nanofair 2004, Karlsruhe, Germany, 22.-24.11.2004

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
New metalorganic nanofillers for radiation and thermal curing of polymeric protective coatings
Transferworkshop 2005 der TU Dresden: Nanokomposite, Dresden, Germany, 23.09.2005

H.-J. Gläsel, E. Hartmann, R. Mehnert and M.R. Buchmeiser
Innovative metalorganic nanofillers for radiation cured polymeric protective coatings
Nanoeurope Nano Coating Days, St. Gallen, Switzerland, 13.-15.09.2005

V. Gottschalch, G. Leibiger, G. Benndorf and D. Hirsch
Intrinsische C-Dotierung von AlGaAs
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

V. Gottschalch, G. Leibiger, J. Bauer, G. Benndorf, H.-C. Semmelhack, G. Wagner, D. Hirsch and J. Kovac
MOVPE Wachstum von $B_xGa_{1-x}P$ auf (001) GaP Substraten
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

T. Hänsel, A. Nickel, A. Schindler and H.-J. Thomas
Ion beam surface finishing of X-ray and SR-optics using (stitching) interferometry for the surface topology measurements
2nd workshop on metrology for X-ray optics, Grenoble, France, 01.-02.04.2004

T. Höche, F. Heyroth, P.A. van Aken and M. Grodzicki
Effect of incommensurate structural modulations in Fresnoite framework structures on high-resolution ELNES spectra
5th International Electron Energy Loss Spectroscopy Workshop (EDGE 2005), Grundlsee, Austria, 01.-05.05.2005

T. Höche, J.W. Gerlach, F. Heyroth, M. Reibold, H. Kirmse and W. Neumann
Why is selective carbon coating of TEM samples so effective?
5th International Electron Energy Loss Spectroscopy Workshop (EDGE 2005), Grundlsee, Austria, 01.-05.05.2005

T. Höche, J.W. Gerlach, F. Heyroth
Why is selective carbon coating of TEM samples so effective?
Microscopy Conference (MC 2005), Davos, Switzerland, 28.08.-02.09.2005

A. Hofmann, J.W. Gerlach, T. Höche, F. Frost and B. Rauschenbach
Ion beam assisted molecular beam epitaxy of wurtzitic gallium nitride on lithium aluminate substrates
14th International Conference on Ion Beam Modification of Materials (IBMM 2004), Monterey, USA, 05.-10.09.2004

A. Hofmann, J.W. Gerlach, T. Höche, F. Frost and B. Rauschenbach Ionenstrahl-gestützte Molekularstrahlepitaxie von wurtzitischem Galliumnitrid auf Lithiumaluminat-Substraten
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

S. Jankuhn, J. Vogt and T. Butz
Ionenstrahlanalyse des Elementgehaltes am Schenkelhals historischer Skelette
35. Jahrestagung der Deutschen Gesellschaft für Medizinische Physik, Leipzig, Germany, 22.-25.09.2004

S. Jankuhn, F. Scholze, E. Hartmann and H. Neumann
Simulation of gridded broad beam ion sources for ultra-precise surface processing
11th International Conference on Ion Sources (ICIS), Caen, France, 12.-16.09.2005

A. Kiesow, N. Teuscher, A. Heilmann and J. Meinhardt
Corona treatment on polyethylene films at different ambient condition - surface characterization and plasma diagnostics
2nd International Workshop on Cold Atmospheric Pressure Plasmas: Sources and Applications , Bruges, Belgium, 30.08.-02.09.2005

M. Kitzing, J.W. Gerlach, M. Schubert, W. Assmann, S. Mändl and B. Rauschenbach
Nickelsegregation nach Sauerstoff-Ionenimplantation in NiTi
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

W. Knolle, S. Naumov, F. Williams and I. Janovský
Intramolecular transformations of radical cations of unsaturated amines. A low temperature EPR study
24th Miller Conference on Radiation Chemistry, La Londe les Maures, France, 10.-15.09.2005

W. Knolle, S. Naumov, F. Williams and I. Janovsky
EPR and quantum chemical investigations on the radical cations of allylamine, propargylamine and 3-pyrroline
European Young Investigators Conference on Radiation Chemistry, Gniezno, Poland, 07.-12.06.2005

A. Köhler, J. W. Gerlach, F. Frost, B. Ziberi and B. Rauschenbach
Oberflächenrauheit und Schichtstruktur von Mo- und Si-Einfach- und Multilagen-Schichten
Gemeinsame Jahrestagung der Deutschen Gesellschaft für Kristallographie und der Deutschen Gesellschaft für Kristallwachstum und Kristallzüchtung, Jena, Germany, 15.-19.03.2004

T. Lutz, J.W. Gerlach and S. Mändl
Diffusion, phase formation and segregation effects in Ti_6Al_4V after oxygen PIII
8th International Workshop on Plasma Based Ion Implantation & Deposition, Chengdu, China, 18.-22.09.2005

S. Mändl and B. Rauschenbach
Formation of transparent ZnO layers by MePIIID
14th International Conference on Ion Beam Modification of Materials (IBMM 2004), Monterey, USA, 05.-10.09.2004

S. Mändl, D. Manova, H. Neumann and B. Rauschenbach
Comparison of hardness enhancement and wear mechanisms in low temperature nitrided austenite and martensite
Material Research Society Fall Meeting (MRS), Boston, USA, 29.11.-03.12.2004

S. Mändl and B. Rauschenbach
Spatial control of grain orientation and texture in metal plasma immersion ion implantation and deposition
16th International Vacuum Congress (IVC-16), Venice, Italy, 28.06.-02.07.2004

S. Mändl, G. Thorwarth, B. Stritzker and B. Rauschenbach
Two-dimensional sheath evolution in metal plasma immersion ion implantation
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

S. Mändl and B. Rauschenbach
Influence of substrate size and pulse voltage on pulse rise time in plasma immersion ion implantation
14th International Conference on Ion Beam Modification of Materials (IBMM 2004), Monterey, USA, 05.-10.09.2004

S. Mändl and B. Rauschenbach
Combined deposition and implantation of Cu on Si using metal plasma immersion ion implanation
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

S. Mändl, J.W. Gerlach and B. Rauschenbach
Nitride formation in transition metals during high fluence and high temperature implantation
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

S. Mändl, A. Fleischer, D. Manova and B. Rauschenbach
Wear behaviour of NiTi shape memory alloy after oxygen-PIII treatment
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

S. Mändl, R. Sader, B. Rauschenbach
Improved osseointegration of titanium and nitinol alloys
2nd World Congress on Regenerative Medicine, Leipzig, Germany, 18.-20.05.2005

S. Mändl and J.K.N. Lindner
Oxygen depth profiling by resonant RBS in NiTi after oxygen plasma immersion ion implantation
17th International Conference on Ion Beam Analysis, Sevilla, Spain, 26.06.-01.07.2005

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Influence of annealing conditions on ion nitriding of martensitic stainless steel
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Comparison of low temperature nitrided austenitic and martensitic stainless steel
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

D. Manova, D. Hirsch, E. Richter, S. Mändl, H. Neumann and B. Rauschenbach Microstructure of nitrogen implantated stainless steel after wear experiments
14th International Conference on Surface Modification of Materials by Ion Beams, Kusadasi, Turkey, 04.-09.09.2005

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Influence of grain size on nitrogen diffusivity in austenitic stainless steel
8th International Workshop on Plasma Based Ion Implantation & Deposition, Chengdu, China, 18.-22.09.2005

D. Manova, S. Mändl and B. Rauschenbach
Incident ion fluence gradients on the frontside and backside of flat samples
8th Int. Workshop on Plasma Based Ion Implantation & Deposition, Chengdu, China, 18.- 22.09. 2005

D. Manova, Y. Bohne, J.W. Gerlach, S. Mändl, H. Neumann and B. Rauschenbach
Phase formation after nitrogen ion implantation into molybdenum
8th European Conference on Accelerators in Applied Research and Technology, Paris, France, 20.-24.09.2004

D. Manova, S. Mändl, H. Neumann and B. Rauschenbach
Wear behaviour of martensitic stainless steels after PIII surface treatment
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

D. Manova, G. Thorwarth, S. Mändl, H. Neumann, B. Stritzker and B. Rauschenbach
Variable lattice expansion in martensitic stainless steel after nitrogen ion implantation
14th International Conference on Ion Beam Modification of Materials (IBMM 2004), Monterey, USA, 05.-10.09.2004

A. Matthes, H.-J. Gläsel, E. Hartmann, E. Erdem, R. Böttcher, V. Brüser and H. Kersten
Synthese ferroelektrischer polymerer Nanokomposite
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

A. Matthes, H.-J. Gläsel, E. Hartmann, R. Böttcher, E. Erdem. V. Brüser and H. Kersten
Synthesis of ferroelectric polymeric nanocomposites
4th. International Nanotechnology Symposium - Nanofair 2005, Dresden, Germany, 29.-30.11.2005

A. Matthes, H.-J. Gläsel, E. Hartmann, E. Erdem and R. Böttcher
Preparation and characterisation of ferroelectric nanocomposites
Nanoeurope Nano Coating Days, St. Gallen, Switzerland, 13.-15.09.2005

A. Matthes, H.-J. Gläsel, E. Hartmann, E. Erdem and R. Böttcher
Ferroelectric polymeric nanocomposites from a template preparation route
Transferworkshop 2005 der TU Dresden: Nanokomposite, Dresden, Germany, 23.09.2005

A. Matthes, H.-J. Gläsel, E. Hartmann, E. Erdem and R. Böttcher
Template route for preparing ferroelectric polymeric nanocomposites characterisation by means of EPR and standard techniques
Conference Chemical Nanotechnology Talks VI, Frankfurt, Germany 29.-30.09.2005

M.G. Mayershofer, O. Nuyken and M.R. Buchmeiser
Binuclear transition metal alkylidene complexes as initiators for controlled cyclopolymerization
Forum of Molecular Catalysis, Heidelberg, Germany, 08.07.2005

M.G. Mayershofer, O. Nuyken and M.R. Buchmeiser
Bi- and trinuclear transition metal alkylidene complexes as initiators for controlled cyclopolymerization
6th International Symposium on Advanced Polymers via Macromolecular Engineering (APME-6), Istanbul, Turkey, 15.-19.08.2005

S. Naumov, I. Janovsky and W. Knolle
On the mechanism of the radiation-induced polymerisation of cyclic and aliphatic vinyl ethers
5th International Symposium on Molecular Mobility and Order in Polymer Systems, St. Petersburg, Russia, 20.-24.06.2005

S. Naumov, I. Janovský, W. Knolle and R. Mehnert
Role of distonic dimer radical cations in the radiation-induced polymerisation of vinyl ethers
International Conference on Ionizing Radiation and Polymers - IRaP'04, Houffalize, Belgium, 25.-30.09.2004

S. Naumov and C. von Sonntag
A quantum-chemical study of UV/VIS absorption spectra of alkyl-, vinyl-, aryl-, and thiylperoxyl radicals in aqueous solution
24th Miller Conference on Radiation Chemistry, La Londe les Maures, France, 10.-15.09.2005

S. Naumov and O. Brede
Indication of molecular oscillations during free electron transfer. Electron distribution in dependence on molecular vibrations
Gordon Research Conference on Radiation Chemistry, Waterville, USA, 20.-25.062004

S.P. Naumov, W. Knolle, S.S. Naumov, I. Janovsky and A. Pöppl
The dynamical behavior of radical cation of s-trioxane: Quantum chemical calculation and low-temperature EPR results
European Young Investigators Conference on Radiation Chemistry, Gniezno, Poland, 07.-12.06.2005

H. Neumann, F. Scholze, M. Tartz, J. Dienelt and H. Schlemm
Ion current density profile control of a scalable linear ion source and its application
11th International Conference on Ion Sources (ICIS), Caen, France, 12.-16.09.2005

J.H. Peters, M. Tartz and H. Neumann
Using design of experiments (DoE) methods to model beamlet properties
11th International Conference on Ion Sources (ICIS), Caen, France, 12.-16.09.2005

L. Prager, C. Elsner and M.R. Buchmeiser
Surface modifications using VUV photons from X_2* and Ar_2* excimer sources
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

L. Prager, C. Elsner, R. Schubert and M.R. Buchmeiser
Photo-processing of polymer surfaces by the use of VUV excimer lamps
Conference Chemical Nanotechnology Talks VI, Frankfurt, Germany, 29.-30.09.2005

B. Rauschenbach, H. Neumann, J. Dienelt, F. Scholze, E. Schubert, M. Nestler and M. Schulze
Particle minimized EUV mask blank deposition by ion beam sputtering
Material Research Society Fall Meeting (MRS), Boston, USA, 29.11.-03.12.2004

N. Razek, A. Schindler, V. Gottschalch and B. Rauschenbach
Ultrahigh vacuum direct bonding of III-V semiconductors at room temperature after cleaning with hydrogen ions
Frühjahrstagung der Deutschen Physikalischen Gesellschaft, Berlin, Germany, 04.-09.03.2005

N. Razek, A. Schindler V. Gottschalch, G. Wagner and B. Rauschenbach
UHV-Wafer bonding of heterostructure of semiconductors materials using low energy hydrogen ion beam surface cleaning
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

T. Rudolph, R. Böhme, D. Ruthe and K. Zimmer
Excimer laser-induced material modification to create nanometer high smooth patterns in glass using mask projection
8th International Conference on Laser Ablation (COLA 05), Banff, Canada, 11.-16.09.2005

T. Rudolph and K. Zimmer
Microstructuring of UV transparent ultra thin functionalised films on glass surfaces by excimer laser irradiation
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

D. Ruthe, K. Zimmer, T. Rudolph, R. Böhme and A. Braun
Femtosecond laser structuring for interconnection of thin film solar cells
8th International Conference on Laser Ablation (COLA 05), Banff, Canada, 11.-16.09.2005

D. Ruthe, K. Zimmer, T. Höche and A. Braun
Etching of $CuInSe_2$ thin films - comparison of femtosecond and picosecond laser ablation
European Materials Research Society Spring Meeting (E-MRS), Strasbourg, France, 31.05.-03.06.2005

R. Sader, S. Mändl, D. Krause and T. Keller
Die PIII-Implantation zur Verbesserung der Osseointegration von Nitinol-Legierungen
55. Jahrestagung der Arbeitsgemeinschaft für Kieferchirurgie, Bad Homburg, Germany, 20.-22.5.2004

T. Scherzer, S. Müller, R. Mehnert, A. Volland and H. Lucht
Process control in UV curing with NIR spectroscopy
RadTech Europe Conference 2005, Barcelona, Spain, 18.-20.10.2005

S. Scholz, H. Herrnberger, V. Gottschalch and D. Hirsch
MOVPE von AIIIBV-Verbindungen auf Ge-Substraten
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

F. Scholze and H. Neumann
Radio frequency plasma bridge neutralizer
29th International Electric Propulsion Conference, Princeton, USA, 31.10.-04.11.2005

E. Schubert, A. Köhler, J.W. Gerlach, F. Frost, G. Wagner, H. Neumann and B. Rauschenbach
Real time spectroscopic in situ ellipsometry monitoring of Mo/Si multilayer growth
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

E. Schubert, S. Mändl, H. Neumann and B. Rauschenbach
Real time spectroscopic ellipsometry study of Mo and Si single layer, and Mo/Si multilayer growth
9th International Conference on Plasma Surface Engineering, Garmisch-Partenkirchen, Germany, 13.-17.09.2004

E. Schubert, A. Köhler, J.W. Gerlach, F. Frost, G. Wagner, H. Neumann and B. Rauschenbach
Real time spectroscopic ellipsometry monitoring of Mo/Si multiplayer growth
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

R. Schubert, R. Blaue, M. Hinkefuß, R. Konieczny, L. Prager and C. Riedel
172 nm excimer-equipment from IOM and IOT
LABELEXPO Europe 2005, Brüssel, Belgium, 21.-24.09.2005

R. Schubert, R. Blaue, M. Hinkefuß, R. Konieczny, L. Prager and C. Riedel
Application of 172 nm excimer equipment from IOM and IOT
LABELEXPO Europe 2005, Brüssel, Belgium, 21.-24.09.2005

R. Schubert, M. Hinkefuß, R. Konieczny and C. Riedel
High-quality UV cured functional coatings only under inert-atmosphere
LABELEXPO Europe 2005 , Brüssel, Belgium, 21.-24.09.2005

R. Schubert, M. Hinkefuß and R. Mehnert
Hochwertige UV-Funktionsschichten nur unter Inertathmospäre
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

R. Schubert, M.R. Buchmeiser, R. Mehnert and L. Prager
Physical matting of UV curable coatings by 172 nm excimer UV radiation
LABELEXPO Europe 2005, Brüssel, Belgium, 21.-24.09.2005

D. Schumann, R. Mehnert and J. von Sonntag
Kompostierbare Verpackungen
Campustag der Universität Leipzig, Leipzig, Germany, 07.05.2005

S. Sienz, J.W. Gerlach, T. Höche, A. Sidorenko, T.G. Mayerhöfer, G. Benndorf and B. Rauschenbach
Elektrische und optische Eigenschaften von ionenstrahlgestützt hergestellten Galliumnitrid-Schichten
Frühjahrstagung des Arbeitskreises Festkörperphysik der Deutschen Physikalischen Gesellschaft, Regensburg, Germany, 08.-12.03.2004

S. Stojanović, L. Prager, M.R. Buchmeiser, F. Osterod, A. Dierdorf and H. Liebe
Herstellung von SiO_x-Schichten aus Polysilazanen als Gasbarriere für Kunststofffolien
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

J. von Sonntag and M.R. Buchmeiser
Von der Synthese zur Produktion
Kurzlehrgang Grundlagen und Verfahren der Beschichtungstechnik, Erlangen, Germany, 04.-06.10.2005

J. von Sonntag and M.R. Buchmeiser
Von der Synthese zur Produktion
Fachtagung Kunststoff-Cluster Oberösterreich, Kirchdorf, Austria, 06.04.2005

J. von Sonntag and M.R. Buchmeiser
Von der Synthese zur Produktion
Mitteldeutsche Jobbörse der Gesellschaft Deutscher Chemiker, Leipzig, Germany, 27.04.2005

J. von Sonntag, M. Fahland, K. Otte and M.R. Buchmeiser
Wet coating of vacuum coatings: Scratch resistant flexible solar cells
13. Neues Dresdner Vakuumtechnisches Kolloquium, Dresden, Germany, 13.-14.10.2005

A. Weller, H.-J. Gläsel, E. Hartmann, E. Erdem, R. Böttcher and J. Banys
Preparation of ferroelectric nanopowders and radiation-cured nanocomposites
International Nanotechnology Symposium - Nanofair 2004, Karlsruhe, Germany, 22.-24.11.2004

A. Weller, H.-J. Gläsel, E. Hartmann, E. Erdem and R. Böttcher
Ferroelektrische polymere Nanokomposite
Innovationsforum Spezialchemikaliensynthese für HighTech-Produkte, Wolfen, Germany, 25.-26.11.2004

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Spontaneous pattern formation on semiconductor surfaces by low-energy ion beam erosion
16th International Vacuum Congress (IVC-16), Venice, Italy, 28.06.-02.07.2004

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Self-organized nanostructures on semiconductor surfaces by low-energy ion beam erosion
International Conference NANO 2004, Wiesbaden, Germany, 20.-24.06.2004

B. Ziberi, F. Frost and B. Rauschenbach
Self-organized nanoscale patterns on Si and Ge surfaces during ion beam erosion
European Conference on Surface Science (ECOSS-23), Berlin, Germany, 04.-09.09.2005

B. Ziberi, F. Frost, T. Höche and B. Rauschenbach
Spontaneous pattern formation on III/V semiconductor surfaces by low-energy ion beam erosion
348. Wilhelm and Else Heraeus Seminar on Ions at Surfaces: Patterns and Processes, Bad Honnef, Germany, 19.-23.06.2005

K. Zimmer, R. Böhme and B. Rauschenbach
Etching of fused silica by excimer laser with nanometer depth precision
30th International Micro- and Nano-Engineering Conference (MNE 2004), Rotterdam, Netherlands, 19.-22.09.2004

K. Zimmer, R. Böhme, D. Ruthe, Th. Rudolph and B. Rauschenbach
Local growth of vertical aligned carbon nanotubes by laser-induced surface modification of coated silicon substrates
8th International Conference on Laser Ablation (COLA 05), Banff, Canada, 11.-16.09.2005

K. Zimmer, R. Böhme, J. Dienelt, D. Ruthe, Th. Rudolph and J. Zajadacz Anwendungen von Mikrostrukturierung und Oberflächenmodifizierung
1. Workshop Sächsisches Netzwerk 'Mikro- und biosensorische Messtechnik', Chemnitz, Germany, 02.03.2005

K. Zimmer and R. Böhme
Laser etching of fused silica for diffractive and refractive optics
10th Microoptics Conference (MOC 04), Jena, Germany, 01.-03.09.2004

Patent Applications and Patents

G. Böhm, W. Frank, A. Schindler
Verfahren zur Präzisionsbearbeitung der mittel- und langwelligen Oberflächenformen eines Werkstücks
Patent Application Germany 10 2005 026 334.8 (09.06.2005)

R. Böhme, K. Zimmer
Vorrichtung und Verfahren zum Laserabtrag transparenter Materialien
Patent Granted Germany DE10328534

S. Brand, M.R. Buchmeiser, A. Dierdorf, H. Liebe, R. Mehnert, F. Osterod, L. Prager, S. Stojanović
Verfahren zur Herstellung einer dünnen glasartigen Beschichtung auf Substraten zur Verringerung der Gaspermeation.
Patent Application Germany 2005DE310 (15.04.2005)

A. Braun, K. Zimmer
Verfahren zur Präzisionsbearbeitung von transparenten Materialien mit gepulster Laserstrahlung
Patent Granted Germany DE10328559

H.-J. Gläsel, E. Hartmann, R. Mehnert
Metallorganisches Nanopulver
Patent Application Germany 10 2005 032 353.7 (08.07.2005)

T. Hänsel, P. Seidel, A. Nickel, H.-J. Thomas, A. Schindler, I. Bucsi
Verfahren zur Steuerung der lokalen Ätz- oder Abscheiderate bei der Modifikation von Oberflächen mit gepulsten Ionenstrahlen
Patent Application Germany 10 2005 017 632.1 (15.04.2005)

R. Mehnert, R. Schubert, L. Prager, M. Hinkefuß, R. Blaue
Vorrichtung zur Durchführung eines Verfahrens zur Modifizierung von Oberflächen strahlenhärtbarer Farben und Lacke durch photochemische Mikrofaltung mittels kurzwelliger monochromatischer UV-Strahlung unter stabilen Bestrahlungs- und Inertisierungsbedingungen
Patent Application Germany (14.12.2005)

H. Möbus, V. Ptatschek, E. Bister, H.-J. Gläsel, E. Hartmann
Beschichtungsmasse enthaltend Nanopartikel, Verwendung der Beschichtungsmasse und Verfahren zur Herstellung von Beschichtungen
Patent Granted Europe WO 03/044099 A1

H. Neumann, H. Schlemm, F. Scholz
Steuerung und Regelung des Ionenstrahlprofils von Breistrahlionenquellen durch getaktete Beamletsteuerung
Patent Application Germany 10 2004 002 508.8 (17.01.2004)

A. Schmidt, N. Stothard, G. Mielsch, C. Elsner, L. Wennrich
Photokatalytisch aktive Titandioxid-Schichten mit Nanoporen
Patent Application Germany 10 2005 019 895.3 (29.04.2005)

K. Zimmer, R. Böhme
Verfahren zur Präzisionsbearbeitung von transparenten Materialien mit gepulster Laserstrahlung
Patent Granted Germany DE10328559

K. Zimmer, R. Böhme
Verfahren zum Abtrag von lichtdurchlässigen Materialien mit Laserstrahlung und Vorrichtung hierfür
Patent Application Germany 10 2005 055 174.2 (18.11.2005)