

## DF 12: Poster

Time: Wednesday 15:00–17:30

Location: P1

DF 12.1 Wed 15:00 P1

**Strontium titanate/barium titanate heterostructures grown by pulsed-laser deposition** — ●JAN ZIPPEL, TAMMO BÖNTGEN, MICHAEL LORENZ, RÜDIGER SCHMIDT-GRUND, and MARIUS GRUNDMANN — Universität Leipzig, Institut für Experimentalphysik II, Linéstraße 5, 04103 Leipzig

Recently, ferroelectric thin films such as BaTiO<sub>3</sub> (BTO) and SrTiO<sub>3</sub> (STO) have been attracted considerable attention due to their properties like ferroelectricity and piezoelectricity being suitable for applications in memories and sensors [1]. Differences in the electronic structure in combination with nearly no optical interface between STO and BTO and the probability to tune the optical properties for superlattices formed by STO and BTO is of interest for optical applications.

Here, we present the optimized growth of BTO and STO on STO (100) substrates using pulsed-laser deposition (PLD) with an in-situ reflection high energy electron diffraction (RHEED) system. The oxygen partial pressure ( $p(\text{O}_2)$ ), the substrate temperature ( $T_{\text{sub}}$ ) as well as the repetition rate of the laser and the energy density were varied in order to optimize both, the surface quality, controlled by atomic force microscopy (AFM) and the crystalline properties, checked by X-ray diffraction (XRD). The optical properties measured by spectral ellipsometry hardly depend on the crystalline structure. We were able to tune the index of refraction to a point, where optically nearly no difference between STO and BTO is observable at certain wavelength. [1] James F. Scott, Carlos A. Paz de Araujo, Science (1989), **246**, 1400-1405.

DF 12.2 Wed 15:00 P1

**Polarisation switching dynamics by Inhomogeneous Field Mechanism in ferroelectric polymers** — ●JÖRG SCHÜTRUMPF, SERGEJ ZHUKOV, YURI GENENKO, and HEINZ VON SEGGERN — Technische Universität Darmstadt, Darmstadt, Deutschland

The temporal behaviour of polarisation reversal in ferroelectric polymers like Polyvinylidene Fluoride (PVDF) cannot be satisfactory explained by simple models such as the classical Kolmogorov-Avrami-Ishibashi model for ferroelectric ceramics or by models considering stretched exponential laws. In the present contribution the Inhomogeneous Field Mechanism model recently proposed for PZT ceramics has been applied to polymer ferroelectrics for the first time. The model is based on the assumption that the switching volume is divided into many regions with independent dynamics, only determined by the local electric field. The local field values are randomly distributed over the ensemble of regions due to intrinsic inhomogeneities of the material. Therefore an inhomogeneous switching behaviour is induced by the varying local fields of each region. The electric field distribution can be directly extracted from the experimental data. The model satisfactorily describes virgin and fatigued samples over a broad time-field domain covering nine orders of magnitude of the poling time and electric field values from 50-200 kV/mm. In the same way we can conclude that the IFM model is adaptive to ferroelectric ceramics and semi-crystalline polymers at once.

DF 12.3 Wed 15:00 P1

**Surface modeling of SrO(SrTiO<sub>3</sub>)<sub>n</sub> Ruddlesden-Popper phases** — ●M. ZSCHORNAK<sup>1,2,3</sup>, S. GEMMING<sup>1</sup>, E. GUTMANN<sup>2</sup>, T. WEISSBACH<sup>2,4</sup>, H. STÖCKER<sup>2,3</sup>, T. LEISEGANG<sup>1,2</sup>, T. RIEDL<sup>5,6</sup>, M. TRÄNKNER<sup>5,6</sup>, T. GEMMING<sup>5</sup>, and D.C. MEYER<sup>3</sup> — <sup>1</sup>Ionenstrahlphysik u. Materialforschung, HZ Dresden-Rossendorf — <sup>2</sup>Strukturphysik, TU Dresden — <sup>3</sup>Experimentelle Physik, TU Bergakademie Freiberg — <sup>4</sup>Theoretische Physik, TU Bergakademie Freiberg — <sup>5</sup>IFW Dresden — <sup>6</sup>Werkstoffwissenschaft, TU Dresden

Strontium titanate (STO) is a preferred substrate material for functional oxide growth, whose surface properties can be adjusted through the presence of Ruddlesden-Popper (RP) phases. In this work<sup>[1]</sup>, density functional theory (DFT) is used to model the (100) and (001) surfaces of SrO(SrTiO<sub>3</sub>)<sub>n</sub> RP phases. Relaxed surface structures, electronic properties and stability relations have been determined. In contrast to pure STO, the near-surface SrO-OSr stacking fault can be employed to control surface roughness by adjusting SrO and TiO<sub>2</sub> surface rumpling, to stabilize SrO termination in an SrO-rich surrounding or to increase the band gap in the case of TiO<sub>2</sub> termination. RP thin films have been epitaxially grown on (001) STO substrates by chem-

ical solution deposition. In agreement with DFT results, the fraction of particular RP phases  $n = 1 - 3$  changes with varying heating rate and molar ratio Sr:Ti. This is discussed in terms of bulk formation energy. [1] M. Zschornak, S. Gemming, E. Gutmann, T. Weißbach, H. Stöcker, T. Leisegang, T. Riedl, M. Tränkner, T. Gemming, D.C. Meyer: Acta Materialia 58 4650 (2010).

DF 12.4 Wed 15:00 P1

**Preparation of nano-crystalline BaTiO<sub>3</sub> powder in a sol-precipitation process** — ●YANLING GAO, VLADIMIR SHVARTSMAN, and DORU C. LUPASCU — Institut für Materialwissenschaft, Universität Duisburg-Essen, Essen, Germany

We are trying to synthesize uniform-sized nanoparticles having a high dielectric permittivity to be used in conjunction with conducting polymer in order to alter the electric properties of the latter. For this purpose, the synthesis of hydrophobic nano-crystalline BaTiO<sub>3</sub> is investigated. Cubic and hydrophobic BaTiO<sub>3</sub> nanopowders with a size below 20 nm were directly synthesized by sol-precipitation under alkaline conditions at 100°C using the water - insoluble titanium (IV) isopropoxide oleate (Ti(OR)<sub>4-x</sub>(RCOO)<sub>x</sub>) precursor. The latter prepared by reacting titanium (IV) isopropoxide with oleic acid. The crystallinity and phase purity of the nanopowders were studied with X-ray diffraction spectrometry (XRD). The size and the microstructure of the BaTiO<sub>3</sub> nanopowder were analysed by Scanning Electron Microscopy (SEM). The XRD pattern of as-precipitated nanopowders showed weak and broad reflections characteristic of crystalline BaTiO<sub>3</sub> with evidence of the presence of BaCO<sub>3</sub>. The as-prepared nanopowders were calcined at 500°C/6hrs in air to obtain perovskite of BaTiO<sub>3</sub> phase. The obtained BaTiO<sub>3</sub> were further pressed into pellets and sintered at 950°C/4hrs in air to get dense ceramics. Dielectric properties of these ceramics are measured as a function of temperature.

DF 12.5 Wed 15:00 P1

**Ultrafast X-ray Diffraction with Synchrotron Pulses** — ●YEVGEN GOLDSHTEYN<sup>1</sup>, ROMAN SHAYDUK<sup>1</sup>, HENGAMEH NAVIRIAN<sup>1</sup>, MARC HERZOG<sup>2</sup>, PETER GAAL<sup>2</sup>, WOLFRAM LEITENBERGER<sup>2</sup>, and MATIAS BARGHEER<sup>1,2</sup> — <sup>1</sup>Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Hahn-Meitner-Platz 1, 14109 Berlin — <sup>2</sup>Institute of Physics and Astronomy, University Potsdam, Karl-Liebknecht-Strasse 24-25, 14476 Potsdam

The technique of time resolved X-ray diffraction with synchrotron pulses allows probing structural dynamics of matter with time resolution of approximately 100 ps. First time-resolved X-ray diffraction experiments at the EDR beamline at BESSY II have been performed on epitaxial La<sub>0.8</sub>Sr<sub>0.2</sub>MnO<sub>3</sub> (LSMO) and SrTiO<sub>3</sub> (STO) superlattices (SL) grown on single crystalline STO substrate. The heat transport in both the SL and the substrate has been studied on timescales of 50 ps to 4 μs. A Ti:Sa laser with 350 fs pulse duration is used to rapidly heat up the sample. Monochromatized X-ray pulses are used to measure SL diffraction peak profiles as a function of pump-probe delay. The peak shift is proportional to the strain in the SL caused by thermal expansion. The transient strain is detected with an accuracy of 10<sup>-7</sup> and compared to simulations.

In addition, this poster presents the conceptual upgrade of the EDR beamline, which aims at shortening the X-ray pulses down to 1 ps pulse duration. First tests of controlled shortening have been successfully performed at ESRF and SLS.

DF 12.6 Wed 15:00 P1

**Photoacoustic absorption spectroscopy in lithium niobate crystals** — ●NIKLAS WAASEM<sup>1</sup>, STEPHAN FIEBERG<sup>1</sup>, DANIEL HAERTLE<sup>1</sup>, FRANK KÜHNEMANN<sup>2</sup>, and KARSTEN BUSE<sup>1</sup> — <sup>1</sup>Physikalisches Institut, Bonn, Germany — <sup>2</sup>Physics Department of the German University, Cairo, Egypt

Lithium niobate is a highly transparent material that exhibits large non-linear optical coefficients, but for high-power applications even very small absorption coefficients can be a critical problem. Thus, determining the absorption spectra is a task of practical and scientific relevance. Existing methods of absorption spectroscopy fail either because they do not provide the necessary sensitivity of  $\alpha < 10^{-4} \text{ cm}^{-1}$  (grating absorption spectroscopy) or because of insufficient measuring speed needed for a wavelength scan (laser calorimetry). Therefore, we

use a photo-acoustic approach. A sample is locally illuminated with nanosecond laser pulses, which heat and expand the exposed region. The resulting acoustic pressure waves are detected by fast and extremely sensitive piezo transducers. The amplitude of the measured signal is proportional to the product of pulse energy and absorption coefficient.

DF 12.7 Wed 15:00 P1

**Impulsive Stimulierte Ramanstreuung: Prinzip und Anwendungen** — ●PETER GAAL, YEVGENI GOLDSTEYN, DANIEL SCHICK und MATIAS BARGHEER — Universität Potsdam Institut für Physik und Astronomie, Potsdam, Deutschland

Wir verwenden Impulsive Stimulierte Ramanstreuung (ISRS) zur Impuls-selektiven Anregung von Phonon-Polariton Moden in in oxidischen Materialien wie z.B. Lithium-Niobat oder Stronthium-Titanat und weisen diese durch Vierwellen-Mischprozesse nach. Durch die Überlagerung mehrerer Replika des gleichen Pumpimpulses wird in der Probe ein transientes Polarisationsgitter erzeugt, das mit einem Abtastimpuls ausgelesen wird. Wir diskutieren verschiedene Bereiche der Dispersionsrelation mit unterschiedlich starker Kopplung von Phononen- und Lichtcharakter. In Vorbereitung ultraschneller Röntgendiffraktionsexperimente bestimmen wir die k-Vektor-Selektivität der Anregung und geben eine Abschätzung für die erreichbare Phononenamplitude an.

DF 12.8 Wed 15:00 P1

**Photofunctional ruthenium sulfoxide compounds for molecular photonics** — ●VOLKER DIECKMANN, SEBASTIAN EICKE, KRISTIN SPRINGFELD, and MIRCO IMLAU — Department of Physics, University of Osnabrück, Barbarastr. 7, D-49069 Osnabrück, Germany

Ruthenium polypyridine sulfoxide compounds are promising photofunctional molecules, which comply with the key requirements of (ultra-)fast all-optical devices, e.g. in information and telecommunication industry. These small molecular compounds provide a fast phototriggered linkage isomerization located at the SO ligand into two structural metastable states. The isomerization is accompanied by a pronounced photochromism with a tremendous photosensitivity. An advantage of these compounds is their adaptability on the optical requirements (e.g. spectral sensitivity) by two possibilities: Substitution of ligands or modification of the (dielectric) environment of the complex. We highlight the optical properties of these sulfoxides in the view of material design for the field of nonlinear molecular photonics: This includes the possibility of tailoring the optical properties studied by linear and nonlinear optical spectroscopy. Dynamical control of light by optical recording of 2D-photonics structures is verified by a spatially modulated phototriggered linkage isomerism using a single-pulse two-beam interferometer. Our findings are discussed in the frame of pronounced photochromism and presence of refractive index changes accompanying the phototriggered isomerism. The latter is explained satisfactorily both by Kramers-Kronig-relation as well as Lorentz-Lorenz relation. Financial support by the DFG (GRK 695).

DF 12.9 Wed 15:00 P1

**Study of transient photocurrents in nominally pure LiNbO<sub>3</sub> depending on the reduction** — ●ANDREAS BUESCHER, HAUKE BRUENING, and MIRCO IMLAU — Department of Physics, University of Osnabrück, Barbarastr. 7, D-49069 Osnabrück, Germany

In thermally reduced, nominally pure LiNbO<sub>3</sub> the steady-state absorption is characterized by a broad absorption band at  $\lambda = 500$  nm due to the presence of stable (Nb<sub>Li</sub><sup>4+</sup>:Nb<sub>Nb</sub><sup>4+</sup>)-bipolarons. Upon illumination with intense pulse laser light in the blue green spectral range ( $\tau = 8$  ns,  $\lambda = 532$  nm) these bipolarons can be dissociated into metastable small free (Nb<sub>Nb</sub><sup>4+</sup>)-polarons and small bound (Nb<sub>Li</sub><sup>4+</sup>)-polarons. This mechanism is responsible for the strong photochromic properties of this material. Furthermore, but less often studied, these polarons contribute to the conductivity comparable to the features of extrinsic Fe-doping. We present first results of measurements to detect the transient photocurrents associated to bound polarons using a fast operational amplifier. Our study highlights the impact of the number density of optically generated small polarons, which can be controlled by the reduction pre-treatment. We discuss the results in the framework of optical and electrical properties of small polarons in LiNbO<sub>3</sub>.

\*Financial support by the DFG (project IM37/5-1) and DAAD (50445542) is gratefully acknowledged.

DF 12.10 Wed 15:00 P1

**Photostable imaging by second-harmonic-generating**

**nanoparticles** — ●THOMAS KÄMPFE, PHILIPP REICHENBACH, STEFAN GRAFSTRÖM, and LUKAS M. ENG — Institute for Applied Photophysics, University of Technology Dresden, 01062 Dresden

Fluorescence microscopy is a widespread and elaborate method in imaging. However, in practice several disadvantages, most notably bleaching and blinking, can be observed. Second-harmonic generation (SHG) in noncentrosymmetric nanocrystals with diameters up to 100 nm seem to be a promising alternative. These particles circumvent the mentioned constraints as no real transition is invoked and thereby no phototoxic or dark state can be excited.

Long-time stability as well as sufficient signal strength for standard microscopy techniques was obtained for barium titanate nanoparticles with tetragonal crystal structure. The SHG signal increases quadratically with the excitation intensity (typ.  $10^9$  W/cm<sup>2</sup>); these nanoparticles outshine all fluorescent markers at dye saturation. Moreover, the emitted second-harmonic radiation is spectrally sharp ( $\sim 6$  nm) so that the signal-to-noise ratio can be augmented by means of narrow bandpass filters. We present the experimental results on the nonlinear optical properties of single BaTiO<sub>3</sub> nanoparticles including the dependence on intensity, excitation wavelength and in-plane polarization as well as obtain the according crystal axis theoretically.

DF 12.11 Wed 15:00 P1

**Temperature dependence of x-ray diffuse scattering near T\* for Pb<sub>0.78</sub>Ba<sub>0.22</sub>Sc<sub>0.5</sub>Ta<sub>0.5</sub>O<sub>3</sub> relaxor.** — ●TIM PRÜSSMANN<sup>1</sup>, BERND J. MAIER<sup>1</sup>, BORIANA MIHAILOVA<sup>1</sup>, CARSTEN PAULMANN<sup>1</sup>, MARIN GOSPODINOV<sup>2</sup>, and ULRICH BISMAYER<sup>1</sup> — <sup>1</sup>Mineralogisch-Petrographisches Institut, Universität Hamburg, Germany — <sup>2</sup>Institute of Solid State Physics, Bulgarian Academy of Sciences, Sofia, Bulgaria

Synchrotron single-crystal x-ray diffraction was applied to the canonical relaxor Pb<sub>0.78</sub>Ba<sub>0.22</sub>Sc<sub>0.5</sub>Ta<sub>0.5</sub>O<sub>3</sub> (PBST) to study the development of polar nanoregions. The temperature evolution of x-ray diffuse scattering (XDS) along (110)<sup>\*</sup> was followed by the ratio of the intensity of the XDS  $I_{\text{diff}}$  to the intensity of the corresponding Bragg peak  $I_{\text{Bragg}}$ . By using  $I_{\text{diff}}/I_{\text{Bragg}}$  the thermodynamical character of the phase transformation near the intermediate temperature  $T^*$  associated with coupling of polar nanoregions was analysed. It is shown that the transformation process near  $T^*$  is not of second-order and is most likely of tricritical character.

DF 12.12 Wed 15:00 P1

**Supercritical and Subcritical Period Doubling Bifurcations - Influence of Near-Resonant and Resonant Perturbations** — ●SEBASTIAN LEMM, KAY BARZ, and MARTIN DIESTELHORST — Martin-Luther-Universität Halle-Wittenberg, Institut für Physik, von-Danckelmann-Platz 3, D-06120 Halle, Deutschland

Using different ferroelectrics as nonlinear capacitors in a series resonance circuit gives rise to different kinds of bifurcations. Both supercritical and subcritical period doubling bifurcations could be observed depending on the choice of the ferroelectric. Whereas triglycine sulphate (TGS) in the circuit caused supercritical period doubling bifurcations, we observed subcritical period doubling bifurcations when we used a relaxor ferroelectric lead magnesium niobate-lead titanate (PMN-PT). In both systems we investigated the influence of both near resonant and resonant perturbations on the bifurcations experimentally. We observed the shift of the bifurcation points under the influence of perturbation compared to the unperturbed bifurcation. The phenomena are discussed in the framework of the corresponding center manifold. It was predicted earlier that tuning the resonance circuit towards a period doubling bifurcation under the action of a near resonant or resonant perturbation, may yield an amplification of the perturbation in the vicinity of the bifurcation. This effect of small signal amplification was investigated with respect to its applicability as a detector for signals, which may be coupled into the circuit via the special properties of the ferroelectric materials.

DF 12.13 Wed 15:00 P1

**Thermal polarization noise of silver sodium nitrite** — ●JUMNA MEHLIS, ULRICH STRAUBE, MARTIN DIESTELHORST, JÖRN PETERSON, and HORST BEIGE — Institute of Physics, Martin-Luther-Universität Halle-Wittenberg, Germany

The thermal polarization fluctuations of ferroelectric crystals in the vicinity of the phase transition are discussed in detail in thermodynamic theories. These could be observed experimentally in a ferroelectric liquid crystal [1]. However, there is no publication about

the experimental proof of the polarization noise in solid ferroelectric crystals. For this reason it was our aim to prove the spontaneous fluctuations of the polarization field in a ferroelectric AgNa(NO<sub>2</sub>)<sub>2</sub>-crystal. This was achieved by measurements of the thermal current noise in short \* circuit of the single crystal. The noise current was made measurable with the help of a current - voltage amplifier. The thermal polarization and current noise power spectra of the silver sodium nitrite crystal could be described by the generalized Nyquist theorem. The possibility to determine the phase transition by noise measurements is discussed.

[1] I. Musevic, A. Kityk, M. Skarabot, and R. Blinc, Phys. Rev. 79, 1062-1065 (1997).

DF 12.14 Wed 15:00 P1

**Theoretical investigation of the ferroelectric transition in BaTiO<sub>3</sub> and LiNbO<sub>3</sub>** — ●SIMONE SANNA and WOLF GERO SCHMIDT — Lehrstuhl für Theoretische Physik, Universität Paderborn, 33095 Paderborn, Germany

Barium titanate (BaTiO<sub>3</sub>, BT) and lithium niobate (LiNbO<sub>3</sub>, LN) are the most important ferroelectric materials. The first is the prototypical ferroelectric oxide, as many features and properties caused by or related to ferroelectricity have been found for the first time in BT [1]. The second is one of the most important optic materials, being the equivalent in the field of optics, non-linear optics and optoelectronics to silicon in electronics [2]. Despite the extensive interest in BT and LN, the knowledge of the mechanisms underlying the ferroelectric phase transitions is rather poor. The nature of the phase transition itself (displacive or order-disorder) is still argument of debate [3]. In this contribution we report on our first-principles theoretical studies of the ferroelectric transition in the two systems. Total energy calculations, molecular dynamics and frozen-phonon calculations are used to understand the mechanisms driving the transition at microscopic level. The Curie temperatures are estimated by *ab initio* thermodynamics. Similarities and differences between the two systems are discussed. [1] R. Waser, *Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices* (Wiley- VCH, Weinheim, 2003). [2] A. Rüber, *Chemistry and Physics of Lithium Niobate* (North-Holland Publ. Company, Current Topics in Mat. Sci., 1978). [3] I. Inbar and R. E. Cohen, Phys. Rev. B 53, 1193 (1996).

DF 12.15 Wed 15:00 P1

**Eigenschaften des Hyperfeinfeldes für <sup>111</sup>In in Al<sub>2</sub>O<sub>3</sub> bei tiefen Temperaturen** — ●MICHAEL STEFFENS und REINER VIANDEN — HISKP, Universität Bonn, Nußallee 14-16, 53115 Bonn

In früheren Arbeiten [1,2] wurde der Elektronentransport in einem Isolator (Al<sub>2</sub>O<sub>3</sub>) bei hohen Temperaturen mit der Methode der gestörten  $\gamma$  -  $\gamma$ -Winkelkorrelation (PAC) untersucht. Dabei zeigte sich, dass der Einfluss des im Kristall vorliegenden Feldgradienten auf den PAC-Sondernern <sup>111</sup>In durch einen aus dem Zerfall des In zu Cd resultierenden "after effect"(AE) überlagert wurde. Der Rückgang des AE bei hohen Temperaturen konnte mit einer erhöhten Elektronenbe-

weglichkeit begründet werden.

In dieser Arbeit wurden die Messreihen um Messungen bei tiefen Temperaturen erweitert. Auch bei Proben temperaturen < 50 K kann ein Rückgang des AE-Einflusses beobachtet werden.

[1] J. Penner, R. Vianden, Hyperfine Interactions 158(1), 389 (2004)

[2] M. Steffens et al., Hyperfine Interactions (2010), in print

DF 12.16 Wed 15:00 P1

**Lattice dynamics of HgI<sub>2</sub>** — ●LYDIA NEMEC<sup>1,2</sup>, DIETER STRAUCH<sup>1</sup>, BRUNO DORNER<sup>3</sup>, DIETER SCHWARZENBACH<sup>4</sup>, PETER FISCHER<sup>5</sup>, and MARTIN BÖHM<sup>3</sup> — <sup>1</sup>Universität Regensburg, Regensburg, Deutschland — <sup>2</sup>current address: Fritz Haber Institut der Max Planck Gesellschaft, Berlin, Deutschland — <sup>3</sup>Institut Laue-Langevin, Grenoble, France — <sup>4</sup>Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland — <sup>5</sup>Paul Scherrer Institute, Villigen, Switzerland

We present a first principle study of the vibrational properties of tetragonal red mercury(II)iodide ( $\alpha$ -HgI<sub>2</sub>), an important material for X- and  $\gamma$ -ray detection at room temperature. Linear response theory within density-functional theory is used to calculate phonon frequencies and eigenvectors with special emphasis on vibrations in the [110]-plane. The full phonon band structure is investigated and compared with experimental data. We study the LO-TO splitting by calculating the dielectric constant and Born effective charges. The theoretical scattering intensities show fair agreement with experiment. Predictions are made for the scattering intensities in the [110]-direction, and data are provided for future neutron scattering experiments.

DF 12.17 Wed 15:00 P1

**Zum Mechanismus der elektrostatischen Aufladung von Polymeren** — ●FRANK SIMON<sup>1</sup>, VICTORIA ALBRECHT<sup>1</sup>, ANDREAS JANKE<sup>1</sup>, EDITH REINSCH<sup>2</sup> und URS PEUKER<sup>2</sup> — <sup>1</sup>Leibniz-Institut für Polymerforschung Dresden e.V., Hohe Straße 6, D-01069 Dresden — <sup>2</sup>Technische Universität Bergakademie Freiberg, Institut für Mechanische Verfahrenstechnik und Aufbereitungstechnik, D-09596 Freiberg

Die triboelektrische Aufladung von nichtleitenden Polymeren ist ein gut bekanntes und häufig beobachtetes Phänomen. Überraschend ist, daß die Mechanismen für die triboelektrische Aufladung weitgehend unbekannt sind. Gehen wir von der Annahme aus, daß beim Kontakt von zwei Stoßpartnern ein Elektronentransfer stattfindet, kann die Tendenz der funktionellen Gruppen eines Polymers zum Abgeben oder Aufnehmen von Elektronenpaaren genutzt werden, das Aufladeverhalten qualitativ zu beschreiben. Die Kontaktzone zweier sich berührender Polymeroberflächen beinhaltet jedoch eine Vielzahl solcher Gruppen. Diesen kooperativen Effekt konnten wir mittels rasterkraftmikroskopischer Untersuchungen visualisieren. Weiterhin ist bekannt, daß die Aufladung von Polymeren von der Umgebung abhängig ist. Wassermoleküle vermögen fixierte Ladungen zu mobilisieren und tragen zur Entladung bei. Dieses Abklingverhalten haben wir in Abhängigkeit der relativen Luftfeuchte und der Zeit untersucht. Die Kinetik des Entladeprozesses ist nicht nur abhängig von der molekularen Struktur des Polymers, sondern auch von Überstrukturen im polymeren Volumen.