Multicomponent Materials

Since several years, the Chair for Multicomponent Materials headed by Prof. Franz Faupel participates actively in three Collaborative Research Centers (SFBs) and has third party funds of about 2.5 million € from the German Research Foundation (DFG), the BMBF (Ministry for Education and Research), the AIF (Working Group Industrial Research) and others. The achievements presented in this report would have been impossible without the contributions of the 15 PhD students almost all supported by external sources. Concerning the scientific output, more than 20 publications were published in peer reviewed international journals in 2012. The work of the group continues to be highly cited. In 2012, work reported by members of the group got more than 500 citations in the Web of Science. Here, only a few aspects of the last year’s research can be discussed.

For more details we refer to our website http://www.tf.uni-kiel.de/matwis/matv/ and the papers listed below. More information on the different research topics are also given in previous Almanac editions which can be downloaded from our website.

Looking back on the year 2012, two very sad events have made all other things that happened far less important. In August 2012, Dr. Vladimir Zaporojtchenko, the head of the functional nanocomposites group, unexpectedly passed away in a heart attack. He was not only a great scientist, who stimulated the work of the Chair for Multicomponent Materials enormously, but also a kind friend and colleague whom one could always rely on. His memory will always be with us. Only a few days later, Dipl.-Ing. (FH) Rainer Kloth, who was in charge of our servers, software and electronics, had a severe stroke. Meanwhile, he recovered substantially, and we all hope to see him back to work in the not too far future.

Like in the year before, working in three Collaborative Research Centers, the group strongly benefited from the joint interdisciplinary work with partners ranging from fundamental physics and organic chemistry to electrical engineering and medicine. The Collaborative Research Center SFB 677 „Function by Switching” is now almost in the middle of the second funding period that started in 2011. There, the very successful work of the last years continues with good chances for a second extension. Many new results on formation of nanoparticles in plasmas were also obtained in our joint project „Plasma Processes for the Deposition of Nanostructured Composite Materials” within the Collaborative Research Center SFB TR 24 on complex plasmas together with the group of Prof. Kersten from the physics department of the CAU. Judging from the interesting results and large number of high-quality publications from all groups participation in the SFB TR24, we are optimistic with respect to its evaluation in 2013. The Collaborative Research Center SFB 855 on magneto-electric nanocomposites for medical applications also prepares for the evaluation in 2013 and can look back to a very productive last year. Much research of the Chair for Multicomponent Materials was also performed outside the three collaborative research centers, e.g., within the DFG priority program „Polymer-solid contacts: Interfaces and Interphases”, and several other projects. The group also performed investigations at large scale facilities particularly at the electron storage ring BESSY in Berlin and at the positron beam facility of the Research Reactor Garching. In addition, various projects were carried out with industry. Besides direct cooperation with companies, joint work with industry was performed within projects of the BMBF.

The group was strongly involved in teaching and took great effort to inspire pupils for materials science and engineering in various ways including visits to schools in Schleswig-Holstein.

Results

a) Nanocomposites for functional applications

A main activity of our group during the last years centers around functional nanocomposites, which consist of metallic nanoparticles embedded in an insulating matrix, either polymeric or ceramic in nature. The size of the nanoparticles is in between that of atoms and macroscopic materials and thus gives rise to new properties not observed in conventional materials which are explored in a broad range of applications ranging from high frequency magnetic materials to...
antimicrobial coatings. The nanocomposites are mostly deposited as thin films by vapor phase deposition methods, in particular evaporation and sputtering from solid targets. During the last year, plasma polymerization and physically enhanced chemical vapor deposition (PECVD) have also been employed in a joint project of the above mentioned Collaborative Research Center TR 24. This transregional collaborative research centre of the universities of Greifswald and Kiel addresses fundamentals of complex plasmas and their applications to nanoscience. As part of the TR 24, our group established a joint project with Prof. Kersten from the department of physics of the CAU, focusing on the use of plasma processes for the deposition of nanostructured composite materials. Very interesting results were obtained within this project. As reported in the Almanac 2011, a gas aggregation cluster source was used to deposit metal clusters with a very narrow size distribution. These clusters were successfully embedded into a plasma polymer created by an RF plasma from Hexamethyldisiloxane (HMDSO) monomer. It was demonstrated that by using two spatially separated plasma sources for the generation of the clusters and the deposition of the matrix, the clusters are not altered by the HMDSO plasma and that their filling factor in the composite can be varied over a broad range. This opens up a new path for the generation of functional nanocomposites.

The gas aggregation cluster source was also used in a joint project with Prof. Hynek Biederman from Prague University for the generation of TiO$_2$ nanoparticles which were obtained by reactive sputtering of titanium and exhibit interesting functional properties. In these investigations, a small amount of oxygen turned out to be crucial for nucleation and growth of the nanoparticles (Almanac 2011). Recently, we could show that the cluster deposition rate can be increased by more than an order of magnitude by operating the cluster source in a pulsed directed current (DC) mode (see Fig. 2). This huge increase in deposition rate is not only interesting from the application point of view but also casts new light on the fundamental mechanisms of reactive sputtering and nucleation of clusters.

Nanocomposites also play a key role in our projects within the Collaborative Research Center SFB 677 „Function by Switching“ which are now carried out jointly with Prof. Elbahri (see also his report) in the second funding period. Here,
the nanocomposites are combined with photoswitchable molecules. These so-called chromophores change their properties reversibly upon irradiation with light of two different wavelengths. Very interesting new electro-optical properties arise through interactions between chromophores and the so-called surface plasmon resonance of the metallic nanoparticles. These resonances are collective oscillations of the conduction electrons in the electrical field vector of electromagnetic radiation. Recently, new photoswitchable devices were developed which contain carbon nanotubes instead of metallic nanoparticles and allow light-induced conductivity switching. The switching mechanism is not fully understood yet but seems to be based on switchable electron transfer between the carbon nanotubes and the photoswitchable molecules such as azobenzene derivatives.

Concerning the Collaborative Research Center SFB 855 on magneto-electric nanocomposites for medical applications, our work has shown that in this case, layered composites are much more promising than particulate composites. As reported in the Almanac 2011, we developed a novel magnetic field sensor, which was presented to a wide readership in a Nature Research Highlight. Currently, various approaches ranging from new materials, over alternative read out and operation principles to active control are explored together with partners within the SFB 855. Moreover, magnetoelectric layered composites involving piezoelectric polymers appear to show great potential.

In several projects we explore the large specific surface area of the finely dispersed nanoparticles and the strong influence of the surface or interfacial energy on the material’s properties. This is particularly the case in antibacterial coatings with nanoparticles of silver and other noble metals where a high metal ion release rate is strived for because the antimicrobial activity originates from the released metal ions. This research is carried out in cooperation with Prof. Podschun from the Institute of Infection Medicine of the University Hospital Schleswig-Holstein/Campus Kiel. Toxicity of nanoparticles is investigated in cooperation with PD Röhl from the Institute for Toxicology and Pharmacology for Natural Scientists of the CAU. In addition, among other partners, we cooperate with Prof. Grundmeier from the Chemistry Department of the University at Paderborn in a joint DFG project addressing fundamental issues of silver ion release from nanocomposites.

Antimicrobial nanocomposites have been studied intensively with respect to their medical applicability, for example as functional coatings for implants. For such applications understanding of the so-called therapeutic window is essential in order to achieve a therapeutic effect without inflicting undesired damage to the treated organism. In a systematic study conducted in close cooperation with PD Dr. Röhl and Prof. Podschun much progress in the understanding of the therapeutic window in antimicrobial nanocomposites was achieved. It was found that the toxicity of silver for human cells and bacteria...
differs strongly for silver in solution and silver at surfaces, respectively. While in solution only a small therapeutic window exists in which silver is sufficiently toxic against bacteria but non-toxic to human cells, the situation is much more favorable at surfaces of silver containing nanocomposite coatings. Here, as reported already in the Almanac 2011, human cells grow essentially undisturbed up to fairly high silver loadings of the coatings, and the toxicity for human cells can roughly be estimated by the measured silver release of the coating into distilled water. Bacteria, on the other hand, were already killed at fairly low silver loadings. This at first sight surprising observation could be understood considering the different metabolisms of human cells and bacteria. Future work is now directed towards exploring the therapeutic window for various types of bacteria and human cells and different antibacterial surfaces. In addition, work performed in the field of antibacterial coatings aimed at controlling the release behavior of nanocomposites consisting of reactively sputtered TiO$_2$ and silver. In this work and other work carried out in the group on antibacterial coating based on a matrix deposited by plasma-enhanced chemical vapor deposition of HMDSO, care was taken to avoid direct exposure of Ag nanoparticles to the environment. This was achieved by effective encapsulation which only releases antibacterially active silver ions but no nanoparticles.

In connection with environmental effects of Ag nanoparticles, our recent work on so-called electrochemical Ostwald ripening in aqueous solution is very interesting. Due to their high surface tension, small nanoparticles are thermodynamically less favorable than larger ones and may give rise to particle coarsening. Our investigations show, that this well-known phenomenon in materials science may also take place in solution via exchange of silver ions. The effect is quite large and leads to a dissolution of the potentially more harmful smaller particles.

Reactively sputtered TiO$_2$ was also used in a BMBF project together with the Fraunhofer Institute Umsicht and several industrial partners for its photocatalytic properties which are here applied to water purification and waste water treatment.
The group also investigates various other functional properties of nanocomposites with metallic nanoparticles and an organic or ceramic matrix. Interested readers are referred to the attached list of publications and earlier Almanac editions. Concerning optical and plasmonic properties and so-called metamaterials, we refer to the Almanac chapter of Prof. Elbahri (see also Almanac 2011) who initiated some exciting new applications pursued together with our group.

Finally we mention that the nanoworkshop series „Polymer-Metal-Nanocomposites” which was initiated 2003 by Prof. Faupel in Kiel will proceed in 2013 with the 6th nanoworkshop in Toulouse. With preparations being in progress Prof. Faupel was already invited to give a plenary overview on functional nanocomposites.

b) Metallic glasses and glass forming melts

Metallic glasses are mixtures of metals and non-metals which can be employed in a vast range of applications from ultra-thin electronic housings to biodegradable implants. Although the appearance of metallic glasses resembles that of ordinary metals, their atomic structure differs completely. While the atoms in a conventional metal arrange in a periodic lattice, there is no such order in metallic glasses. This disordered state, which is similar to a frozen liquid, can be created by rapid quenching of a melt. However, only for certain mixtures of elements the glassy state will be accessible with technically reasonable cooling rates. During the last years, we investigated the diffusion behavior, glass forming ability, and the transition from the undercooled melt to the glassy state. Details were reported in the Almanac 2010 and previous editions.

Recently, we found very interesting deviations from the Stokes-Einstein relation in glass-forming Zr-Cu-Ni-Ti-Be melts. According to the Stokes-Einstein relation, all atoms are expected to participate in the Brownian motion with approximately the same mobility in the equilibrium melt far above the melting point. In contrast, the majority component Zr, which is also the largest atom of the alloy, proved to have a much lower mobility compared to the other components. This gives important clues to the excellent glass forming ability of this also technologically important bulk glass forming alloy.

c) Polymer-solid contacts

Within the DFG priority program „Polymer-solid contacts: Interfaces and Interphases” which was co-initiated by Prof. Faupel, we studied the structure and formation of interfaces between plastics and solid materials like metals and ceramics, which are important in many technological applications including polymer nanocomposites were solid nanoparticles are embedded in a polymer matrix. We refer to the Almanac 2010, our website, and the list of publications for more information.

Personnel

Head of the group: Prof. Dr. F. Faupel; Secretary: N. Gühlke (50%), Dipl.-Chem. S. Kastaun (50%)
Technical Staff: Dipl.-Ing. (FH) R. Kloth, Techn. C. Ochmann, Dipl.-Ing. (FH) S. Rehders
Scientific Staff:

- M.Sc. A. M. Ahadi 01.01.-31.12.2012 Fellowship Iran
  Nanoparticles from plasmas
- M.Sc. N. Alissawi 01.01.-31.12.2012 DF6
  Ag-ion transfer
- M.Sc. S. W. Basuki 01.01.-31.12.2012 DF6
  Diffusion in complex melts
- Dipl.-Phys. B. Gojdka 01.01.-31.12.2012 SFB 855, CAU
  Magneto-electric nanocomposites
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<tr>
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<tr>
<td>Dipl.-Phys. S. Harms</td>
<td>01.01.-31.03.2012</td>
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<td>M.Sc. B. Henkel</td>
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<td>M. Sc. M. Keshavarz Hedayati</td>
<td>01.01.-31.12.2012</td>
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<td>M.Sc. T. Koschine</td>
<td>01.01.-31.12.2012</td>
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<td>Dr. A. Kulkarni</td>
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<td>SFB 855, CAU</td>
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<td>Dipl.-Ing. K. Meurisch</td>
<td>01.01.-21.02.2012</td>
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<td>M.Sc. C. Ohrt</td>
<td>01.08.-31.12.2012</td>
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<td>Dr. O. Polonsky</td>
<td>01.11.-31.12.2012</td>
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<td>Prof. Dr. K. Rätzke</td>
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<td>Dipl.-Phys. V. Schneider</td>
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<td>SFB 677</td>
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<td>M.Sc. Y. M. Sisay</td>
<td>01.05.-31.07.2012</td>
<td>SFB 677 IGK</td>
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<td>Dr. T. Strunskus</td>
<td>01.01.-31.12.2012</td>
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<tr>
<td>M.Sc. J. Xiong</td>
<td>01.01.-31.12.2012</td>
<td>Fellowship China</td>
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<td>Dr. V. Zaporotchenko †</td>
<td>01.01.-31.08.2012</td>
<td>CAU</td>
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**Lectures, Seminars, and Laboratory Course Offers**

**Winter 2011/2012**

- **Einführung in die Vakuumtechnik**, 2 (+ 1) hrs Lecture (+ Exercises)/Week, V. Zaporotchenko †
- **Advanced Organic Materials**, 2 hrs Seminar/Week, F. Faupel
- **Übungen zur Physik I**, 2 hrs Seminar/Week,
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<tr>
<td>Thin Films</td>
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<td>Lecture (+ Exercises)/Week,</td>
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<td>Einführung in die Materialwissenschaft</td>
<td>2 hrs Lecture/Week,</td>
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<td>Werkstoffe - Metalle</td>
<td>2 hrs Lecture/Week,</td>
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<td>F. Faupel</td>
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<tr>
<td>Einführung in die Materialwissenschaft II</td>
<td>2 hrs Lecture/Week,</td>
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<td>Vakuum Technology</td>
<td>2 (+ 1) hrs Lecture (+ Exercises)/Week,</td>
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<td>V. Zaporojtchenko †</td>
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<tr>
<td>Seminar for Members Group for Nanocomposites</td>
<td>2 hrs Seminar/Week,</td>
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<td>V. Zaporojtchenko †</td>
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<td>K. Rätzke</td>
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<td>Seminar for Members of the Chair for Multicomponent Materials</td>
<td>2 hrs Seminar/Week,</td>
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<td>F. Faupel</td>
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<td>Summer 2012</td>
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<tr>
<td>Advanced Metallic Materials</td>
<td>2 hrs Seminar/Week,</td>
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<td>F. Faupel</td>
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<td>Functional Nanomaterials / Functional Nanocomposites</td>
<td>2 hrs Seminar/Week,</td>
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<td>V. Zaporojtchenko †</td>
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<td>Seminar for Members of the Chair for Multicomponent Materials and interested guests</td>
<td>2 hrs Seminar/Week,</td>
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<td>F. Faupel</td>
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<td>Übungen zur Physik II</td>
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<td>Solid State Physics 2</td>
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<td>Winter 2012/2013</td>
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<td>Übungen zur Physik I</td>
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Third-Party Funds


DFG, Ion transfer reactions at Ag-nanoparticle/polymer interfaces, 17.02.2010-31.12.2013 (190,424 Euro)

BMBF, Development of advanced materials and methods for water and sewage treatment by means of functional nanocomposites, 01.05.2010-30.04.2013 (221,004 Euro)


China Scholarship Council, Stipendium für Jian Xiong für 4 Jahre, 15.11.2010-15.11.2014 (48,000 Euro)

Iran Government, Stipendium für Amir Mohammad Ahadi für 3 Jahre, 25.11.2010-25.03.2014 (45,000 Euro)

DFG, Polymer-Solid contacts: Interfaces and Interphases: Verteilung des freien Volumens an Polymer-Festkörper Grenzflächen, 25.02.2011-25.02.2014 (257,800 Euro)

DFG, Structural Arrest in Multicomponent Glass-forming Zr-melts, 06.04.2011-06.04.2014 (278,450 Euro)

DFG SFB 677/2, Function by Switching: Photoswitchable Metal-Polymer Nanocomposites, 01.07.2011-30.06.2015 (363,220 Euro)

DFG SFB 677/2 IGK, Function by Switching: Intrgriertes Grauivertikelkolleg Ziele: Untersuchungen zum Schalten der elektrischen Leitung mit Multwall Carbon Nanotubes (MCNT) im Projekt C01, 01.05.-31.07.2012 (4.407 Euro)

Further Cooperation, Consulting, and Technology Transfer

University:

Prof. M. Bauer, F. Tuczek, O. Magnussen, Prof. W. Herges: Combination of switchable molecules and nanocomposites close to the percolation threshold (SFB „Function by Switching“)

Dr. U. Boucher, Spain, Aging of Nanocomposites

Dr. Peter Budd, Manchester School of Chemistry, The University of Manchester, Manchester UK, Polymer Membranes
Prof. Dr. A. Chandra, Dehli, India, Conductance and free volume in polymer electrolyte composites
Prof. Dr. G. Dollinger, Dr. W. Egger, Bundeswehr University, Munich, PLEPS at FRM II
Prof. Drusch, Food Processing Technology and Materials Science, TU Berlin, Encapsulation of food products
Prof. Dr. M. Elbahri, Institute for Material Science: several topics with hybrid organic/inorganic materials
Prof. Dr. M. Es-Souni, FH Kiel, Characterisation of Functional Materials
Prof. Dr. G. Grundmeier, Paderborn University, Silver Release from Nanocomposites
Prof. Dr. H. Herges, Organic Chemistry, Prof. Dr. F. Tuczek, Inorganic Chemistry, Kiel University, and other partners, NEXAFS investigations at BESSY, HZB Berlin
Dr. Chr. Hugenschmidt, TU Munich and FRM II, NEPOMUC
Dr. S. James, Belfast, Porous Liquids
Prof. Dr. C. Janiak, University Düsseldorf, Mixed Matrix Membranes
Prof. Dr. M. Kern, Dental Clinic, Kiel University, Antibacterial Coatings
Prof. R. Knöchel, Institute for Electrical Engineering and Information Technology, magnetic high frequency materials
Prof. Dr. P. Müller-Buschbaum, Technical University Munich, PALS-Thin Films and preparation of DFG proposal "Growth of sputtered metal on organic surfaces" with Dr. S. Roth (DESY)
Prof. Dr. R. Podschun, Institute for Infection Medicine, Kiel University, Antibacterial Coatings
Prof. Dr. E. Quandt, Inorganic Functional Materials, Faculty of Engineering, Functional magnetic nanocomposites
PD Dr. C. Röhl, Prof. Dr. J. Sievers, Institute for Toxicology and Pharmacology for Natural Scientists, Toxicological effects of metallic nanoparticles on human cells
Prof. Dr. C. Staudt, Düsseldorf, Block copolymers
Prof. Dr. Y. Yampolskii, A.V. Topchiev Institute of Petrochemical Synthesis, Laboratory of Membrane Gas Separation, Russian Academy of Sciences, Moskau, Positron annihilation and membrane polymers

Research Institutes:
Dr. D. K. Avasthi, Materials Science Group, Nuclear Science Centre New Delhi, India, High energy ion beam effects in polymer-metal nanocomposites
Prof. Dr. A. Meyer, Dr. Fan Yang, DLR, Köln, Diffusion in glass forming metallic melts
Dr. Thomas Neubert and Dr. Michael Vergöhl, Fraunhofer-Institute for Surface Engineering and Thin Films (IST), Braunschweig, Photocatalytically active TiO$_2$ coatings
Dr. G. Schneider, FRZ Jülich und FRM II, silica nanocomposites

Industry:
KHS Plasmax GmbH, Coatings on PET samples

Partners in BMBF project Nanopurification:
Fraunhofer Institute for Environmental, Safety and Energy Technology (UMSICHT), Oberhausen
Enviro Chemie GmbH, Roßdorf
Diploma, Bachelor and Master Theses

T. Eckert, Untersuchung der Silberionenfreisetzung aus Silber-Gold-Nanopartikeln auf PTFE, 07.02.2012
E. Gill, Identifikation und Charakterisierung potentieller Verschleißstellen an der variablen Turbinengeometrie und Verstellmechanismus verschiedener Diesel-Abgasturbolader, 15.09.2012
L. Kahle, Optimizing Interface Properties in Polymer-Based Magnetoelectric Composites, 16.11.2012
N. Karow, Oberflächenbeschichtung für eine Kryosonde, die für die minimalinvasive Kyochirurgie und Kryoanalgesie zum Einsatz kommt, 07.12.2012

Dissertations / Postdoctoral Lecture Qualifications

S. Harms, Freies Volumen an Polymer-Dünnschichten, Polymer-Festkörper-Grenzflächen und Polymer-Nanokompositen, 06.03.2012

Publications

Published in 2012

K. Yliniemi, B. Oskaya, N. Alissawi, V. Zaporojtchenko †, T. Strunskus, B. P. Wilson, F. Faupel, G. Grundmeier, Combined in situ electrochemical impedance spectroscopy - UV/Vis and AFM studies of Ag nanoparticle stability in perfluorinated films, Materials Chemistry and Physics, 134 (1), 302 - 308 (2012)


E. Kovacevic, J. Berndt, T. Strunskus, L. Boulendi, Size dependent characteristics of plasma synthesized carbonaceous...
Patent Applications


Presentations

T. Strunskus, *XPS and NEXAFS investigation of functionalized TATA molecules on Au(111) surfaces (Talk)*, Mitarbeiterseminar AG Magnussen (Institut für Angewandte und Experimentalphysik, CAU Kiel), Kiel, Germany, 13.01.2012


F. Faupel, *Curing and aging of adhesives studied by positron annihilation lifetime spectroscopy (Plenary Talk)*, 35th Adhesion Society Annual Meeting and Expo, New Orleans, United States of America, 26.-29.02.2012

C. Ohrt, *Investigation of interphases and mixing rules of α-PS lifetimes in polymer-nanocomposites (Talk)*, Treffen deutscher Positronengruppen, Dresden, Germany, 28.02.-01.03.2012


B. Gojdka, V. Zaporojtchenko †, T. Strunskus, T. Hrkac, J. Xiong, L. Kienle, F. Faupel, *New deposition concept for the precise tailoring of nanocomposites with a gas aggregation cluster source (Poster)*, DPG-Frühjahrstagung der


C. Ohrt, T. Koschine, S. Harms, K. Rätzke, F. Faupel, G. Schneider, L. Willner, D. Richter, *Investigation of interphases in polyethylene propylene (PEP)-silsesquioxane-nanocomposites by positron annihilation lifetime spectroscopy (Poster)*, 4th Jahrestreffen SPP 1369, Frankfurt / Main, Germany, 01.06.2012


V. Zaporojtchenko, *Functional Metal-Dielectric Nanocomposite Films Prepared by Integration of a Gas Aggregation Cluster Source into a Plasma Deposition Process (Talk)*, The International Conference ISMANAM 2012, Moskau, Russia, 17.-22.06.2012


Faupel, Formation of Nanoparticles for Deposition of Thin Film Coatings from a Gas Aggregation Cluster Source (Keynote Lecture), Materials Science Engineering (MSE 2012), Darmstadt, Germany, 25.-27.09.2012
F. Faupel, V. Zaporojtchenko \( ^\dagger \), T. Strunskus, Polymer Nanocomposites for functional Applications (Invited Plenary Talk), Fifth International Conference on Electroactive Polymers: Materials and Devices (ICEP-2012), Varanasi, India, 04.08.11.2012
F. Faupel, K. Rätzke, Dynamic arrest in mulicomponent glass forming alloys (Talk), Deutsch-Sino Workshop, Köln, Germany, 05.-09.11.2012
S. W. Basuki, K. Rätzke, F. Faupel, F. Yang, A. Meyer, \( ^{57}\text{Co} \) and \( ^{85}\text{Zr} \) diffusion in liquid \( Zr_{46.75}Be_{27.5}Ti_{8.25}Cu_{7.5}Ni_{10} \) (Talk), Deutsch-Sino Workshop, Köln, Germany, 05.-09.11.2012
F. Faupel, V. Zaporojtchenko \( ^\dagger \), T. Strunskus, Polymer Nanocomposites for functional Applications (Invited Talk), Nuclear Science Center Delhi, Delhi, India, 09.11.2012

**Further Activities and Events**

Selected Honorary Activities of Prof. Faupel:
- Coordinator of the North German Initiative Nanomaterials (NINa),
- Principle Editor of the *Journal of Materials Research*, edited by the Materials Research Society (MRS),
- Editor of the encyclopedia RÖMPP online, Thieme Chemistry,
- Member of the Advisory Board of *Diffusion and Defect Data*,
- Member of the DGM Scientific Advisory Board, German Material Research Society,
- Member of the Program Committee of the conference „Euro Intelligent Materials 2013“ (DGM),
- Member of the Program Committee of the DFG SPP 1369 Priority Program „Polymer-Solid Interfaces, Thin Films, and Interphases - from Molecular View to Continuum“, Member of the managing committee of the SFB885 „Magnetoelectric Composites - Future Biomagnetic Interfaces“, Member of the Societas Christiana Albertina,
- Member of the HWT (Hochschule-Wirtschaft-Transfer)-Jury of the ISH (Innovation Foundation Schleswig-Holstein),
- Member of the Steering Committee of the CAU Focal Point of Support „Nano and surface science“, Member of the Steering Committee Quality Management of the CAU,
- Member of KARE (Kiel Alliance of Research and Education),
- Member of the management board of the „Friends of the Faculty of Engineering“, Member of the International Advisory Committee of the 5th International Conference on Electroactive Polymers: Materials and Devices (ICEP-2012),
Member of the Program Committee of the International Conference Polymer Interphases in Research and Technology (2013),

In addition to the activities listed above, Prof. Faupel was involved in many evaluations for the German Science Foundation (DFG), scientific journals, and other Institutions in Germany and abroad.