CPP 36: Poster: Nanoparticles and Composite Materials

Time: Wednesday 17:30–19:00 Location: Poster B2

CPP 36.1 Wed 17:30 Poster B2

Dielectric investigation of nanocomposites based on Poly(methyl methacrylate) and Polyhedral Oligomeric Silesquioxanes — •Purv Purohit and Andreas Schönhals — BAM Bundesanstalt für Materialforschung und -prüfung, Unter den Eichen 87, 12200 Berlin, Germany

Enhancement of polymer properties by use of different types of nanosized fillers is explored continuously from nearly past two decades. Polymer based nanocomposites have shown remarkable improvement in properties as compared to conventional scaled composites because of the length scale of interaction of the nanofillers with the polymer segments. Perseverant efforts are made to fully understand the structure-property relationship of such polymer based nanocomposites. Nanocomposites of Poly(methyl methacrylate) as matrix and MethacrylPOSS (MPOSS) as the nanofiller were prepared. The structure-property relationships of the nanocomposites were analyzed using dielectric spectroscopy. The change in the dynamic glass transition of the polymer with different concentrations of the nanofiller is investigated. Fourier transform infrared spectroscopy and differential scanning calorimetry were used to further investigate the properties of such nanocomposites.

CPP 36.2 Wed 17:30 Poster B2

Conformation and Dynamics of Poly-ethylene-propylene in polymer-silica nano composites — •Klaus Nusser[1,2], Susanne Neueder[1,2], Gerald Johannes Schneider[2], Wim Pyckhout-Hintzen[1], Lutz Willner[1], Aurel Radulescu[2], Vitaly Pipich[2], Olaf Holderer[2], Peter Falus[3], and Dieter Richter[1] — [1]IFF, Forschungszentrum Jülich GmbH, 52425 Jülich — [2]Jülich Centre for Neutron Science at FRM2, 85747 Garching — [3]IN 15, Institute Laue Langevin, 38000 Grenoble

Elastomer filler nano composites are widely used in everyday life. Especially the reinforcement of mechanical properties has been applied for a long time in rubber products. The microscopic mechanisms underlying the macroscopic property changes, however, have not been experimentally clarified yet.

We chose a bottom-up approach to gain more microscopic insight into these mechanisms, starting with a simple model system. The polymer component of the composite material was chosen to be polyethylene-propylene, the filler component silica.

Samples with different volume percent silica in the polymer matrix were investigated by means of Small Angle Neutron Scattering, yielding first insight into the microscopic structure of the polymer chains in the presence of the filler particles. The segmental dynamics was probed by means of Neutron Spin Echo spectroscopy.

CPP 36.3 Wed 17:30 Poster B2

Alignment of Magnetic Nanoparticles in Diblock Copolymer Films under External Magnetic Fields — •Hyeokmin Choe[1], Ezzeldin Metwalli[1], Peter Busch[2], and Peter Müller-Buschbaum[1] — [1]TU München, Physik-Department LS E13, James-Franck-Str. 1, 85747 Garching (Germany) — [2]Jülich Centre for Neutron Science at FRM II, Forschungszentrum Jülich GmbH, Lichtenbergstr. 1, 85747 Garching (Germany)

Block copolymers with embedded magnetic nanoparticles have attracted strong interest as a method to fabricate hybrid nanocomposites for wide potential applications in functional devices. Furthermore, controlled assembly of copolymers or hybrids to form aligned or patterned structures is an especially hot topic. Recently, controlled alignment of copolymers or hybrids by magnetic fields is emerging in many aspects, because the non-contacting alignment by magnetic fields is easier to handle and safer than that by electric fields. In this work, we have investigated the alignment of magnetic nanoparticles, which is maghemite, in poly(styrene-b-methylmethacrylate) diblock copolymer films. Films are prepared by solution casting. The external magnetic fields are applied to samples during the casting. We have studied both the influence of different concentrations of magnetic nanoparticles as well as external magnetic fields, and the effect of the different field direction, which means the external fields applied by parallel or perpendicular to the substrate. The structure and morphology of films have been characterized with optical microscopy, atomic force microscopy (AFM), and grazing incidence small angle neutron scattering (GISANS).

CPP 36.4 Wed 17:30 Poster B2

Chain Conformation of Polyethylene-propylene-POSS Nanocomposites — •Andreas Zitzelsberger[1,2], Klaus Nusser[1,2], Gerald Johannes Schneider[2], Wim Pyckhout-Hintzen[1], Lutz Willner[1], Aurel Radulescu[2], Vitaly Pipich[2], and Dieter Richter[1] — [1]IFF, Forschungszentrum Jülich GmbH, 52425 Jülich — [2]Jülich Centre for Neutron Science at FRM2, 85747 Garching

Elastomer-filler composite materials are technically very important and widely used. In particular, the reinforcing effect achieved by the addition of carbon black or silica fillers to a polymer matrix is commonly used to tune macroscopic properties. In contrast to that, plasticizer effects were found recently by adding very small particles. Though its technical significance both effects have not been understood in detail at the microscopic level.

We present recent results of Small Angle Neutron Scattering measurements on the chain conformation of polyethylene-propylene in the presence of nanoparticles (polyhedral oligomeric silsesquioxane) at different temperatures and various filler loadings.

CPP 36.5 Wed 17:30 Poster B2

Conformation and Dynamics of silica-polymer composites — •Gerald J. Schneider[1], Susanne Neueder[1], Klaus Nusser[1], Vitaly Pipich[1], Aurel Radulescu[1], Wim Pyckhout-Hintzen[1], Lutz Willner[1], Bela Farago[2], and Dieter Richter[1] — [1]Institut für Festkörperforschung, Forschungszentrum Jülich — [2]Institute Laue Langevin, Grenoble

Polymer based nano composites play a crucial role in various applications. The unique properties are not only of interest for the classical field of rubber technology. Meanwhile there are several new applications in the area of micro electronics e.g. such as organic batteries. Due to the blending of nano particles and polymers, composites are created which exhibit improved features, e.g. silica-rubber blends show improved tensile properties and silicate plastics are fire retardant. In order to develop new materials with desired features a precise knowledge of the morphology and dynamics at the microscopic length scale is essential. Although a lot of studies exist, up to now the relationship between the properties of nano particles and the macroscopic behavior of the blends, which makes these systems so indispensable for industrial applications, has not been understood.

We present recent results on the structure and dynamics of silica-polymer composites obtained by neutron scattering experiments and compare them with the results of dynamical mechanical measurements.

CPP 36.6 Wed 17:30 Poster B2

Investigation of Assembly formation of quantum dots and dyes on a single molecule particle level in thin liquid films — •Frank Gerlach, Daniela Täuber, Danny Kowerko, and Christian von Borczyskowski — nanoMA, TU-Chemnitz, Institut für Physik

Nanoparticles such as colloidal semiconductor quantum dots (QD) are widely used e.q. as labels in biophysical and medical applications. This has led to quite a number of studies, related to the formation of nanoassemblies formed by QD and dye molecules. The formation of assemblies is a - ligand controlled - sequence of attachments and detachments.

Here we use fluorescence and single molecule methods to explore these dynamics in thin liquid films on silica surfaces. This is a combined study on aggregate formation [1] and diffusion experiments [2].

[1] D. Kowerko, J. Schuster, N. Amecke, M. Abdel-Mottaleb, R. Dobrawa, F. Würthner, C. von Borczyskowski, PhysChemChemPhys, 2009 accepted

[2] D. Täuber, C. von Borczyskowski et al: Diff. Fund. Online Journal 2009 submitted

CPP 36.7 Wed 17:30 Poster B2

Effects of strain and stress amplification in filled polymer melts — •Jan Domurath, Marina Saphiannikova, and Gert Heinrich — Leibniz-Institut für Polymerforschung Dresden e.V., Hohe Strasse 6, 01069 Dresden

When hard filler particles are added to a polymer melt, it is usually assumed that its zero-shear viscosity and therefore the stress increase according to Einstein's or a similar formula. In some papers one finds an alternative approach in which the local strain field is increased according to these formulas. Although both approaches provide the same increase of the shear stress in the linear limit, it is possible that the second approach violates the energy conservation law as the macroscopic and microscopic dissipated energies are not equal anymore. While for the non-linear limit it becomes even less clear whether it is the strain or the stress that is increased by the presence of filler. In this contribution we show that it is necessary to increase both the strain and the stress as originally done by Einstein [1]. As hard filler particles cannot be deformed, the polymer melt experiences a higher microscopic deformation than the macroscopic strain. To satisfy the energy conservation law, the shear stress should also be increased [1, 2]. This combined approach enables us to describe the peculiar behaviour of the overshoot peak observed recently in filled LDPE melts [3].

[1] A. Einstein. Ann. d. Phys. 19, 289 (1906), 34, 591 (1911)
[2] A. Svistkov et al. J. Appl. Mech. Tech. Phys. 50, 493 (2009)
[3] F.R. Costa et al. Adv. Polym. Sci. 210, 101 (2008)

CPP 36.8 Wed 17:30 Poster B2

Precursor loaded PMMA-Colloids: A opportunity to structure arrays of non-closed-packed hexagonally ordered Pt-nanoparticles — •Fabian Enderle[1], Bernd Schüler[1], Alfred Plettl[1], Paul Ziemann[1], Eyk Schreiber[2], Ulrich Ziener[2], and Katharina Landfester[3] — [1]Institut für Festkörperphysik, Universität Ulm, D-89069 Ulm — [2]Institut für Organische Chemie III, Universität Ulm, D-89069 Ulm — [3]MPI für Polymerforschung, D-55128 Mainz

Platinum-precursor loaded colloidal polymethylmethacrylate (PMMA) particles are produced in aqueous solution by a miniemulsion and emulsion technique. The particles were deposited on top of a silicon substrate in a hexagonally ordered monolayer. Such layers were patterned by exposing the colloids to an electron beam or deep ultra violet photons. Then the exposed colloids were removed by a commercial remover. Results on both techniques will be reported and their principal limits discussed. After patterning a monolayer of PMMA spheres, an optimized plasma and annealing step in oxygen is applied to obtain Platinum nanoparticles which still exhibit the original lateral order. The deposited colloids and nanoparticles are analyzed by optical microscope, HRSEM and, due to the electron sensitivity of PMMA, also by AFM. Small precursor loaded PMMA particles show the same behaviour as small Polystyrene particles during the processing [1]. Large precursor loaded PMMA particles behave differently and require further development of the chemical and physical fabrication process.

[1] A. Manzke et al. Adv. Mater. 19, 1337 (2007)

CPP 36.9 Wed 17:30 Poster B2

Pt- and FePt- nanoparticles on the basis of emulsion techniques — •Achim Manzke[1], Stefan Wiedemann[1], Fabian Enderle[1], Alfred Plettl[1], Paul Ziemann[1], Eyk Schreiber[2], Ulrich Ziener[2], Nicolas Vogel[3], Katharina Landfester[3], Johannes Biskupek[4], and Ute Kaiser[4] — [1]Institut für Festkörperphysik, Universität Ulm, D-89069 Ulm — [2]Institut für Organische Chemie III, Universität Ulm, D-89069 Ulm — [3]MPI für Polymerforschung, D-55121 Mainz — [4]Materialwissenschaftliche Elektronenmikroskopie, Universität Ulm, D-89069 Ulm

Metal-precursor loaded colloidal polystyrene (PS) particles in aqueous solution are produced by an emulsion and miniemulsion technique, respectively [1]. We will report on colloids loaded with Pt- as well as with Fe- and Pt-complexes. After deposition of a hexagonally ordered monolayer of PS spheres on top of a silicon substrate, optimized plasma and temper sequences are applied to obtain metallic nanoparticles which still exhibit the original lateral order. The metal content within a colloid defines the size of the final particle, which could be varied between 6 and 14 nm, so far. The interparticle distance is determined by the diameter of the starting PS-particles and was varied between 80 and 250 nm. Different process steps are investigated by HRSEM, HRTEM and XPS giving insight in the plasma- and annealing process and demonstrating e.g. the crystalline structure of the Pt-nanoparticles.

[1] A. Manzke et al. Adv. Mater. 19, 1337 (2007)

CPP 36.10 Wed 17:30 Poster B2

Fluorescence intermittency of single CdSe/ZnS nanocrystals - local probes for silanol groups on silicon oxide — •Cornelius Krasselt[1], Robert Schmidt[1], Jörg Schuster[1,2], and Christian von Borczyskowski[1] — [1]Center for nanostructured materials and analytics nanoMA, TU Chemnitz — [2]now: Fraunhofer-Institute ENAS

Fluorescence intermittency, also known as blinking, appears to be a common feature of many different classes of individual emitters. It is characterized by inverse power law distributions for both the "on" and "off" times [1]. Meanwhile it is generally accepted, that this behaviour is due to trapping and detrapping of charges and correlates with the dielectric properties of the environment surrounding the nanocrystals [2].

To contribute to the current discussion of the physical nature of blinking we investigated the influence of static trap sites in the local surroundings of ZnS coated CdSe nanocrystals spincoated on thermally grown silicon oxide. Therefore we have modified the trap density by changing the amount of silanol groups either by annealing or hydroxylation of the silicon oxide. We found atypical distributions for the "on" time statistics which show deviations from the expected power law behaviour only seen at the beginning of the statistics. These deviations depend on the preparation of the silicon oxide and the amount of the silanol groups, allowing a qualitatively correlation between the density of these groups and the blinking of single CdSe/ZnS nanocrystals.

[1] F. Cichos et al.: COCIS 12 (2007), 272
[2] A. Issac et al.: Phys. Rev. B 71 (2005), 161302(R)

CPP 36.11 Wed 17:30 Poster B2

Optical characterization of dye doped silica nanoparticles — •Ines Trenkmann[1], Harald Graaf[1], Sangho Bok[2], Shubhra Gangopadhyay[2], and Christian von Borczyskowski[1] — [1]Chemnitz University of Technology, Institute of Physics, Germany — [2]University of Missouri, Dept. of Electrical and Computer Engineering, USA

Over the last years embedding single dye molecules in a solid state matrix became a matter of interest due to the improved mechanical, thermal and chemical stability. Therefore such hybrids became attractive for various applications such as solid-state dye lasers and chemical sensors [1, 2].

We used various ensemble and single-molecule techniques to analyze the optical properties of organosilicate nanoparticles (3 - 5 nm in diameter), which are marked with the fluorescent dye rhodamine 6G [3, 4]. Besides the fluorescence spectra and lifetime, fluorescence time traces for a large number of single particles were recorded. Thereby the distributions of the on- and off-times follow power-law statistics. Additionally we could observe different sub-groups which differ in the number of observed intensity levels. From this we assumed the average number of embedded dye to 2 - 3 molecules.

[1] García-Revilla, S., et al.: Opt. Mat. 31(2009) 1086]
[2] Wang, H, et al.: J. Phys. Chem. B 102(1998) 7231
[3] Trenkmann, I., et al.: Diffusion Fundamentals submitted
[4] Bok, S. et al.: unpublished results

CPP 36.12 Wed 17:30 Poster B2

Chemical functionalization of carbon nanotubes (CNTs) for preparation of the nanocomposites — •Anastasia Golosova[1,2], Rainer Jordan[2], Joseph Adelsberger[1], Alessandro Sepe[1], Martin Niedermeier[1], Sergio S. Funari[3], Peter Lindner[4], and Christine M. Papadakis[1] — [1]TU München, Physikdepartment E13, Garching — [2]TU München, Department Chemie, Lehrstuhl für Makromolekulare Chemie, Garching — [3]HASYLAB at DESY, Hamburg — [4]ILL, Grenoble, France

CNTs feature a special combination of mechanical, electrical, and thermal properties. In spite of many attempts to obtain CNT/polymer composite materials with extraordinary characteristics, the effective incorporation of CNTs within the surrounding matrix is still challenging. The reason is that, due to effective van der Waals attraction, CNTs form large agglomerates, which behave differently from individual CNTs. Direct chemical modification of CNTs with polymer grafts proved to be efficient to enhance their dispersion ability.

We are using self-initiated photografting polymerization to form stable polymer grafts from vinyl monomers. The procedure was found to be successful for the functionalization of single- and multi-walled CNTs with polystyrene and poly(4-vinylpyridine), which is confirmed by use of Raman spectroscopy and thermo-gravimetric analysis. AFM images show deagglomeration of the CNTs after the modification. SAXS (DESY, HASYLAB) and SANS (ILL, D11) experiments were performed in order to determine the dimensions of the native and modified CNTs and their behavior in solutions.

CPP 36.13 Wed 17:30 Poster B2

Towards Selective Functionalization of Diamonds — •Anke Lämmle, Bernhard Grotz, Rolf Reuter, Fedor Jelezko, and Jörg Wrachtrup — 3. Physikalisches Institut, Universität Stuttgart, Germany

In recent years diamonds have attracted high attention in several fields. Out of many colour centres that can be incorporated in diamond, the nitrogen-vacancy centre (NV) has let in particular nanodiamonds make inroads into such diverse fields like biology [1], magnetometry [2] and single photon plasmonics [3,4]. Using diamonds with NV centres is favorable because it combines an unmatched photostability with chemical inertness, biocompatibility and hardness. However further experiments require a deeper knowledge about surface functionalization and its impact on the NV centre itself. We discuss first steps that might lead to a selective functionalization of diamond surfaces and potential applications.

[1] C.-C. Fu et al, PNAS, 727-732 , Vol. 104, No. 3, 2007
[2] G. Balasubramanian et al, Nature 455, 648-651, 2008
[3] S. Schietinger et al, Nano Letters, Vol. 9, No.4, 1694-1698, 2009
[4] R. Kolesov et al, Nature Physics, Vol. 5, 470-474, 2009

CPP 36.14 Wed 17:30 Poster B2

Analytical and Numerical Studies of End-Modified Polymer Brushes — •Dirk Romeis[1,2] and Jens-Uwe Sommer[1,2] — [1]Leibniz-Institut für Polymerforschung Dresden e. V., Hohe Strasse 6, 01069 Dresden — [2]Institut für Theoretische Physik, Technische Universität Dresden, 01062 Dresden

We investigate the behavior of grafted polymers, where some of the polymers free ends are modified in size and interaction strength with the surrounding solvent. Recent simulation data [1] revealed remarkable localization effects of these end-groups in densely grafted brushes upon changing the solvent quality, respectively the temperature. Additionally, using the analytical self-consistent field approach for polymer brushes as provided in the limit of strongly stretched chains, we present a model to describe a mixed brush of hydrophobic and hydrophilic polymer chains.

[1] Merlitz, H. et. al. [*Phys.Rev.Lett.* **102**, *115702 (2009)*]

CPP 36.15 Wed 17:30 Poster B2

Preparation and characterization of nanolayered gold-polyelectrolyte composites — •Steffen Mitzscherling, Wolfram Leitenberger, Mareike Kiel, and Matias Bargheer — University of Potsdam, Germany

Composite materials made of gold nanoparticles and polyelectrolyte nanolayers can be prepared by spin-coating or layer-by-layer deposition. We have prepared stratified multilayer-films with a spatial period of 10 nm. The films show very low surface roughness (0.5 nm RMS) and the nanoparticle-layers are well separated by layers containing no gold. These samples were analyzed with X-ray reflectometry, AFM and absorption measurements in the UV-visible range. Bragg-peaks up to the fifth order demonstrate the periodic layering of the sample and AFM shows the packing density of gold particles in the plane. We compare the results obtained by spin-coating and layer-by-layer deposition and discuss the refractive index of the composite material.

CPP 36.16 Wed 17:30 Poster B2

Intaglio Printing of Nanoparticles using Nanostructured Wrinkled Substrates — •Stephanie Hiltl[1], Anne Horn[1], Andreas Fery[2], and Alexander Böker[1] — [1]Lehrstuhl für Makromolekulare Oberflächen und Materialien und DWI an der RWTH Aachen e.V., RWTH Aachen University, D-52056 Aachen, Germany — [2]Lehrstuhl für Physikalische Chemie II, Universität Bayreuth, D-95440 Bayreuth, Germany

In the present project we make use of wrinkled PDMS (Polydimethylsiloxane) substrates to guide the assembly of rod-like TMV (tobacco mosaic viruses) particles. Additionally, an effective method to print the particles from the wrinkles on plain substrates is established.

The nanostructured substrates are produced by oxidizing stretched PDMS with an air plasma, generating a hard oxide top layer. When the PDMS is relaxed the mechanical contrast between the hard top and the elastomeric bottom layer results in sinoidal structured surfaces. In order to assemble the viruses on the wrinkled PDMS surface, we use a simple spin coating technique. Regular virus stripes with variable line spacings are generated over large areas in a lithography free process [1]. Wrinkled substrates with pre-aligned TMV are used as "inked" stamps to transfer the virus on flat substrates. The distance of the virus stripes is determined by the wavelength of the stamp. A small amplitude (few tens of nanometers) is crucial for intaglio printing as the ink (virus) is situated in the grooves of the structure. The residual water film, from spin coating the virus, serves as transfer medium for the particles.

[1] Horn et al., Faraday Discuss., 2009, 143, 143-150

CPP 36.17 Wed 17:30 Poster B2

Time resolved spectroscopy and lifetime measurements of single semiconductor nanocrystals — •Robert Schmidt, Cornelius Krasselt, and Christian von Borczyskowski — TU Chemnitz, Institute of Physics, Department of Optical Spectroscopy and Molecular Physics (OSMP), nanoMA (Center for nanostructured Materials and Analytics)

The photoluminescence of single emitters like semiconductor quantum dots (QDs) shows intermittency, called blinking, which divides the intensity time traces into bright "on"-, dark "off"-and intermediate-states. The distribution of "off"-times shows power law behavior with an exponential decay. While the power law behavior of "off"-times is well understood, it is less evident for "on"-times.

We investigate the blinking-dynamics of CdSe/ZnS-nanocrystals using time resolved confocal microscopy, spectroscopy and lifetime measurements. The intensity time traces are analysed with special focus on intermediate intensities, by varying the threshold separating the on- and off- from intermediate-states. Further the intensity time traces are compared with spectral- and lifetime- time traces in order to obtain correlations between intensities, lifetimes and spectral positions. We will report new insights into the intrinsic dynamics of QD.

CPP 36.18 Wed 17:30 Poster B2

Optical investigations of plasmons generated in silver nanowires and their influence on the emission of dye molecules — •Florian Feil, Melari Davies, Christophe Jung, Angela Wochnik, Christina Scheu, Jens Michaelis, and Christoph Bräuchle — Department für Chemie und Biochemie, Ludwig-Maximilians-Universität München, Butenandtstrasse 11, 81377 München

In recent years there has been a growing interest in coupling of plasmons created in nanostructures such as particles and wires to luminescent particles such as dye molecules or quantum dots. In particular, silver is known for exhibiting plasmon resonances for particle sizes in the nanometer regime. Also the shape of the metal, e.g. the aspect ratio of silver nanowires, has a tremendous influence on the plasmonic properties. Therefore it is first important to characterize the nanowires themselves, because small defects can create local emitting entities. In this work, silver nanowires were synthesized and characterized using transmission electron microscopy (TEM) and fluorescence microscopy. They exhibit interesting fluorescence dynamics such as fluctuations in intensity during laser illumination as well as spectral dynamics. We were able to correlate these effects to the structure of the nanowires by overlaying fluorescence and TEM data. Very interestingly, synchronous emission at several micrometer separated positions of the nanowire could be observed, which requires coupling through the wire. These nanowires were then used to enhance the emission of single fluorescent dye molecules deposited in their vicinity.

CPP 36.19 Wed 17:30 Poster B2

Structure factor of the ferrofluid with chain aggregates: influence of an external magnetic field — •Elena Pyanzina[1], Sofia Kantorovich[1,2], Juan Cerda[2], and Christian Holm[2] — [1]Ural State University, Ekaterinburg, Russia — [2]ICP, University of Stuttgart, Stuttgart, Germany

We analyze the structure factor of a ferrofluid with strong interparticle magnetic dipole-dipole interaction. Results on mono- and bidisperse model systems in the presence of an external magnetic field are presented. The theoretical calculations are based on the explicit construction of radial distribution functions from the chain distributions obtained via density functional minimization. Data obtained via molecular dynamics simulations for the same model are provided for the verification of our analytical calculations.

CPP 36.20 Wed 17:30 Poster B2

The influence of particle size distribution on the ground-state structures in ferrofluid monolayers — •Victor Danilov[1], Taisia Prokopieva[1], Sofia Kantorovich[1,2], and Christian Holm[2] — [1]Ural State University, Ekaterinburg, Russia — [2]ICP, University of Stuttgart, Stuttgart, Germany

The study of ground state structures in magnetic fluids is of fundamental interest, as it provides the insight into the complex microstructer of the systems.

The analysis of the microstructure of ferrofluid monolayers at low temperatures with single defect particle, which we have carried out recently, is now extended to the generic bidisperse system. Earlier we showed that a single large defect tends to align "regular" particles along its magnetic field lines, the critical parameters at which the transition from a single ferroparticle ring into a complex structure occurs were found. The dependence of the system ground state structures on the number and size of numerous defects are studied by using of Monte Carlo simulations technique in combination with analytical approach and compared to the case of a single defect.

CPP 36.21 Wed 17:30 Poster B2

Auger release of a deeply trapped carrier in a quantum dot — •Thomas Hartmann[1], Peter Reineker[1], and Vladimir I. Yudson[2] — [1]Abteilung Theoretische Physik, Universität Ulm, 89069 Ulm — [2]Institute for Spectroscopy, Russian Academy of Sciences, Troitsk, Moscow region, 142190, Russia

For a quantum dot (QD) we have studied the transiton between the dark and the bright states on the basis of an Auger-induced release process of an electron deeply trapped in a QD shell. The importance of this release process mechanism in connection with the dark state termination has not been noticed before. The considered release mechanism originates from an elcectron-hole pair which is created by light irradiation and whose energy - after recombination - is transferred to the trapped electron via a Förster-like mechansism $\sim 1/r_0^6$, where r_0 is the distance between the QD center and the trap in the shell. The spatial distribution of deep traps over the QD results in a distribution of "off-times". For a homogeneous spatial distribution of traps and a Förster-like dependence of the trapping probability, the distribution of the "off-times" follows a power law $\sim 1/t_{\text{off}}^{3/2}$ with the exponent 3/2 observed experimentally in many QDs.

CPP 36.22 Wed 17:30 Poster B2

Femtosecond pump-probe spectroscopy of the dielectric function of a polymer matrix with embedded gold nanoparticles — •Mareike Kiel[1,2], Peter Gaal[1], Marc Herzog[1], Wolfram Leitenberger[1], Steffen Mitzscherling[1], Torsten Sievers[2], Helmuth Möhwald[2], and Matias Bargheer[1,2] — [1]Universität Potsdam, 14476 Potsdam — [2]Max-Planck-Institut für Kolloid- und Grenzflächenforschung, 14476 Potsdam

We investigate a multilayered compound system of polyelectrolytes and gold nanoparticles with femtosecond pump-probe spectroscopy. A 530nm pump beam excites the electronic system of the nanoparticles, which triggers a breathing mode by electron-phonon coupling and causes strong changes in the dielectric function of the compound material. Relative changes of transient absorption and reflection spectra are measured simultaneously with light in the visible and near infrared region. From this we directly obtain the changes in the real and imaginary part of the compound's dielectric function. By comparison of measurements at near infrared and visible probe wavelengths and application of analytical models, we can separate the contributions from interband and intraband absorption. We also decompose the static absorption spectra into its scattering, plasmon absorption and interference components.

CPP 36.23 Wed 17:30 Poster B2

Optical Detection of Charged Quantum Dots in Solution — •Nicole Amecke-Mönnighoff and Frank Cichos — Molecular Nanophotonics Group, University of Leipzig, Linnéstraße 5, 04103 Leipzig

The fluorescence properties of semiconductor Quantum Dots (QDs) are intensively studied due to many potential applications, which want to make use of their tunable emission wavelength, high quantum yield and photon statistics. Additionally some peculiarities like power-law blinking, lifetime-fluctuations and spectral diffusion can be found. Most of those can be explained by charges close to or in the dot center leading to Auger processes and the quantum confined stark effect. Charges can arise from ejection of electron or hole via tunneling leaving behind the counterpart. One of the main ideas is, thus, the development of an experimental method and setup for controlling and investigating those charges on the single particle level, while monitoring the particles' flourescence. We thus combine confocal microscopy with a setup of two electrodes in solution. When applying a voltage, we can measure the intensity and lifetime changes of the particles in different distances close to the electrode. What we surprisingly find is electrophoresis of a great part of QDs possessing a net positive charge, even though being dispersed in the non-polar solvent toluene. Furthermore they were still fluorescent and no measurable change in lifetime was detected, which is very interesting to the basic understanding of charges quenching a QDs fluorescence. Our goals now are determining this charge's origin, amount and precise location, including also that of the counter charge.