

## Report from the 11<sup>th</sup> German Ferrofluid Workshop 2011



*Around 60 mainly German scientists met from 28<sup>th</sup> to 30<sup>th</sup> of September 2011 in the “Cloister Benediktbeuern” in Bavaria, Germany to hold the 11<sup>th</sup> Germany Ferrofluid Workshop”. Altogether 16 oral presentations were given and 34 posters presented. The annual meeting of leading experts in the field of ferrofluids and magnetic nanoparticles is organized by “The Ferrofluid Society Germany” ([www.ferrofluidverein.de](http://www.ferrofluidverein.de)) and found its home after taking place at different venues in the past in the*

*famous and beautiful cloister now. Chair of the workshop and “The Ferrofluid Society Germany” is Prof. Dr. Stefan Odenbach from the Technical University Dresden.*

**The first day** was dedicated to the description of new interesting physical effects in connection with magnetic particles or ferrofluids. [D. Heinrich](#) from the TU Berlin presented a method for the investigation of magnetic particle agglomeration in fluids by means of NMR. This enables the real time observation of the clustering process under different external conditions. [L. Sprenger](#) from the TU Dresden spoke about the investigation of thermomagnetic convection in ferrofluids driven by a temperature gradient in combination with a magnetic field. The presented setup enables the determination of the Soret coefficient for non-magnetised as well as for magnetized ferrofluids. [J. Dieckhoff](#) from the TU Braunschweig described a setup for the characterization of magnetic nanoparticles in a rotating magnetic field generated. The phase lag between rotating field and particle magnetization axis as function of frequency – measured by fluxgate sensors – can serve as a measure for the mean size and size distribution of the particles. In the last talk of this session [D. Eberbeck](#) from the PTB Berlin introduced new models for the analysis of X-ray diffractograms and magnetic relaxation curves to reproduce a bimodal particle size distribution which evidence the presence of particle clusters in ferrofluids, e.g. Resovist.

The afternoon session was opened by [P. Bender](#) from the University of Saarbrücken. He reported about his work regarding the characterisation of elastic properties of gelatine gels by using Ni nanorods as probes which enables the determination of the shear modulus of the gels. In the second talk [E. Roeben](#) from the University of Köln presented his work about the investigation of rheological properties of complex fluids by means of analysis of the magnetic behaviour of magnetic particles embedded in the matrix for static and dynamic magnetic fields. The magnetically determined parameters are in good accordance to values from conventional rheological methods. [S. Schrittwieser](#) from AIT Austria introduced a new biosensor concept combining magnetic and optical effects of magnetically and optically anisotropic noble

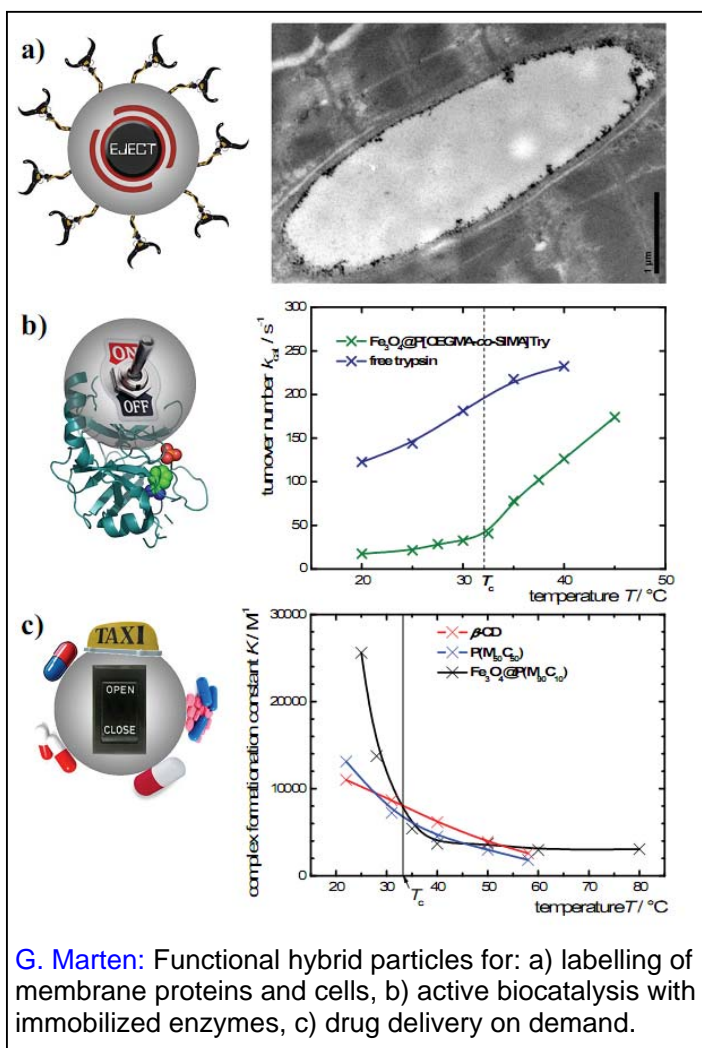
metal coated magnetic nanorods. The magnetic cores cause a rotation of the particles in a magnetic field and the shells are for an optical determination of the hydrodynamic diameter as a function of the binding of analyte molecules to the surface. In the last talk of the first day [S. Dutz](#) from UBC Vancouver / IPHT Jena presented a microfluidic chip for the sized dependent fractionation of magnetic microspheres basing on microfluidic Dean effect as well as magnetic gradients. The chip is able to run in continuous mode and allows the separation of a bimodal particle mix or the extraction of particles of certain size from a broad size distributed particle suspension which is of high interest for magnetically guided drug targeting. The first day was completed by a poster session in the cloister garden and the attendees enjoyed a beautiful fall evening with pretzels and local beer.

**The second day** traditionally starts with a half day mountain tour. This year the group hiked from Garmisch-Partenkirchen to the Kreuzeckalm under gorgeous weather conditions. After a Bavarian lunch buffet in an alpine hut [R. Weeber](#) from the University of Stuttgart gave the “mountain talk” – a free scientific presentation without any slides. He spoke about different simulation models for ferrogels. Main aspect of his presentation was the interaction between magnetic particles as well as the

transmission of a torque to the polymer net. To simulate this interaction mathematic 2D- and 3D-model were developed.

After return from the mountains to the cloister the annual “General Assembly of the Ferrofluidverein Deutschland e.V.” was held in a closed session followed by a second poster exhibition and a conference dinner with Bavarian delicacies.

**The last day** was dedicated to the nanoparticle fabrication and biological applications of them. At first, [F. Bähring](#) from the University Hospital Jena presented a standardized cell-based test tem for nanoparticles toxicity evaluation by using human brain microvascular endothelia cells.



**G. Marten:** Functional hybrid particles for: a) labelling of membrane proteins and cells, b) active biocatalysis with immobilized enzymes, c) drug delivery on demand.

This presentation was followed by a talk from [G. Marten](#), University Köln, about hybrid polymeric nanostructures consisting of magnetic cores and a polymer shell based on oligo(ethylene glycol) methylether methacrylate combined with a variety of possible comonomers for biofunctionalisation. By this way magnetic labelling of different cells, active biocatalysis, or drug delivery on demand can be realised. [S. Lyer](#) from the University Medical Center Erlangen spoke about their findings about the toxicity of Mitoxantrone bound to magnetic nanoparticles determined by a real time cell analysis by means of impedance measurements. These results are important for the planning of their in vivo drug targeting investigations. The first session was closed by [H. Rahn](#) from the University of Dresden. As a result of her work a novel semi-quantitative microCT analysis was demonstrated this reached an accuracy as not shown before. For this, suitable phantoms were developed and the measured grey values of those as well nanoparticles loaded tissue were analysed by means of self crated software with a new reconstruction algorithm.

In the second session [S. Behrens](#) from Karlsruhe Institute of Technology presented a “green” process for preparation of Co-based magnetic fluids. This synthesis is based on the use of room-temperature ionic liquids and enables the fabrication of a wide range of metal nanoparticles, e.g. Ru, Re, and Ir. [H Jiang](#) from the University of Köln described the synthesis of metallic cobalt nanoparticles. Usually, particles like these show a low stability against oxidation which causes a conversion to nonmagnetic phases. This oxidation was prevented by using polystyrene coating of the particles surfaces. In a second part he reported about superstructures in the particles patterns for fluids exposed to an external magnetic field. The last talk of the workshop was given by [K. Kavaliou](#) from the University of Magdeburg. They derived a mathematical model for studying the stability of dynamic magnetic fluid seals under the action of external pressure drop. Main objective of the work was to consider the influence of non-uniform particle distribution on the stability of the magnetic fluid seal for the dynamic case.

**The next and 12<sup>th</sup> “German Ferrofluid Workshop” will be held from 26<sup>th</sup> to 28<sup>th</sup> of September 2012 in the cloister of Benedikbeuern. For more information or to register please visit [www.mfd.mw.tu-dresden.de/ffworkshop](http://www.mfd.mw.tu-dresden.de/ffworkshop).**