



# Participant Profile

for the  
**Turkish-German Strategy Workshop 2006**  
**TÜBİTAK Marmara Research Center,**  
**Istanbul- Gebze Turkey**  
**13 – 15 December 2006**



International Bureau (IB)  
of the Federal Ministry of  
Education and Research  
(BMBF)

## 1. Contact details and personal information

<b>Name:</b>	Prof. Rolf Hempelmann	<b>Phone:</b>	+49 681 302 4759
<b>Role/function<sup>1</sup>:</b>	University professor, working group leader, spokesman of SFB 277 (collaborative research center)	<b>Fax:</b>	+49 681 302 4759
<b>Institution:</b>	Saarland University	<b>E-Mail:</b>	r.hempelmann@mx.uni-saarland.de
<b>Department:</b>	Physical Chemistry	<b>Website:</b>	www.uni-saarland.de/fak8/hempelmann
<b>Address:</b>	Im Stadtwald - Bldg. B2 2	<b>Organisation type<sup>2</sup>:</b>	University
<b>Postcode and City:</b>	D-66123 Saarbrücken		

<sup>1</sup> **Role/function** e.g. working group leader, managing director, postdoc, PhD etc.

<sup>2</sup> **Organisation type** e.g. university, research institution, small and medium enterprise (SME), industry etc.

<b>Working Group:</b>	<input type="checkbox"/> 1 Material Technologies <input checked="" type="checkbox"/> 2 Biotechnology, Genomics and Food <input type="checkbox"/> 3 Energy <input type="checkbox"/> 4 Information and Communication Technologies <input type="checkbox"/> 5 Environmental Protection, Climate Change and Sustainable Development	
<b>Areas of activity:</b>	<input checked="" type="checkbox"/> research <input type="checkbox"/> technology development <input type="checkbox"/> demonstration	<input checked="" type="checkbox"/> training <input type="checkbox"/> dissemination <input type="checkbox"/> other:
<b>Keywords characterising your area of research:</b>	<p><b>Please choose the appropriate key words (max. 5) from the following list:</b>  <a href="http://www.cordis.lu/fp6/keywords">http://www.cordis.lu/fp6/keywords</a>          electrochemistry, fuel cell electrochemistry, nanotechnology, nanobiotechnology, soft matter and polymer physics</p>	



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**Expertise,  
technologies and  
infrastructures  
available in your  
institution:**

**Research activities / expertise:** Applied electrochemistry: preparative nanoelectrochemistry, electrocatalysis in fuel cells, electroenzymatics in biosensors; Colloid- / nano-chemistry: functionalized nanoparticles in kg quantities (pilot plant), ferrofluids, mesostructure and dynamics

**Methods:** electrochemical methods (high throughput **Cyclic Voltammetrie**, impedance spectroscopy), scattering methods (**Static and Dynamic Light Scattering**, **X-Ray Diffraction** (also in situ and at elevated temperatures), static and dynamic **Small Angle X-ray Scattering**, **QuasiElastic Neutron Scattering**, **Small Angle Neutron Scattering**)

**Key technologies:** preparative electrochemistry, (bio-)analytical electrochemistry, nanochemical engineering, light, X-ray and neutron scattering

**Infrastructures:** High throughput electrochemistry cells, 50 L pilot plant, instruments for light, X-ray and neutron scattering

## **Key publications:**

### **Patents**

R. Hempelmann, H. Natter, *Elektrochemische Herstellung amorpher und kristalliner Metalloxide mit Teilchengrößen im Nanometerbereich*, Ger. Offen. (2000), DE 198 40 842 A1 20000309

Ch. Schröder, H. Dolhaine, M. Roth, R. Hempelmann, *Verfahren zur Herstellung von Nanopartikeln*, PCT Int. Appl. (2000), WO 2000035577 A1

Ch. Kropf, U. Brüninghaus, A. Pastura, M. Meinders, P. Wülknitz, R. Hempelmann, M. Roth, *Feinteilige Suspensionen schwerlöslicher Calciumsalze und deren Verwendung in Zahnpflegemitteln*, Ger. Offen. (2000), DE 198 58 662 A1

M. Roth, R. Hempelmann, *Redispergierbare Metalloxide und -hydroxide mit Teilchengrößen im Nanometerbereich für magnetische Suspensionen und Ferrofluide*, Ger. Offen. (2000), DE 19923625 A1

R. Hempelmann, M.-S. Löffler, H. Schmitz, H. Natter, J. Divisek, *Verfahren zur Beschichtung einer Membran-Elektroden-Einheit mit Katalysator und Vorrichtung dafür*, DE 100 38 862.0, PCT Int. Appl. (2002), WO 2002013301 A1, Pt 01956381.6-2119

M. Bukowski, F. Endres, H. Natter, R. Hempelmann, *Verfahren zur elektrochemischen Abscheidung von Metallen, Legierungen und Halbleitern aus ionischen Flüssigkeiten und niedrig schmelzenden Salzmischungen*, Ger. Offen. (2002), DE 101 08 893 A1

H.-M. Sauer, E. Cura, S. Elgimiabi, R. Hempelmann, F. Meyer, S. Spiekermann, *Nanopartikel-Zubereitung, die Metallmischoxide als wärmeabsorbierende Additive für Klebstoffe enthalten*, PCT Int. Appl. (2003), WO 2003054102 A1 200307093

S. Elgimiabi, S. Spiekermann, E. Cura, H. M. Sauer, R. Hempelmann, *Adhesive plastic film containing superparamagnetic ferrite nanoparticles*, PCT Int. Appl. (2004), WO 2004056156 A1 20040701

### **Key publications**

H. Herrig, R. Hempelmann, *A Colloidal Approach to Nanometre-Sized Mixed Oxide Ceramic Powders*, Mater. Lett. **27**, 287 (1996)

H. Natter, M. Schmelzer, R. Hempelmann, *Nanocrystalline Nickel and Nickel-Copper-Alloys: Synthesis, Characterization and Thermal Stability*, J. Mater. Res. **13**, 1186 (1998)



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- Ch. Beck, W. Härtl, R. Hempelmann, *Size-Controlled Synthesis of Nanocrystalline BaTiO<sub>3</sub> by a Sol-Gel-Type Hydrolysis in Microemulsion-provided Nanoreactors*, J. Mater. Res. **13**, 3174 (1998)
- Ch. Beck, W. Härtl, R. Hempelmann, *Covalent Surface Functionalization and Self-Organisation of Silica Nanoparticles*, Angew. Chem. Int. Ed. Engl. **38**, 1297 (1999)
- Ch. Beck, W. Härtl, R. Hempelmann, *The Glass Transition of Charged and Hard Sphere Colloids*, J. Chem. Phys. **111**, 8209 (1999)
- H. Natter, M. Schmelzer, M.-S. Löffler, C. E. Krill, A. Fitch, R. Hempelmann, *Grain Growth Kinetics of Nanocrystalline Iron Studied in-situ by Synchrotron Real-Time X-Ray Diffraction*, J. Phys. Chem. B **104**, 2467 (2000)
- J. Wagner, W. Härtl, R. Hempelmann, *Characterization of monodisperse colloidal particles: a comparison between SAXS and DLS*, Langmuir **16**, 4080 (2000)
- M.-S. Löffler, B. Groß, H. Natter, R. Hempelmann, Th. Krajewski, J. Divisek, *Synthesis and Characterization of Catalyst Layers for Direct Methanol Fuel Cell applications*, Phys. Chem. Chem. Phys. **3**, 333 (2001)
- Ch. Lellig, J. Wagner, W. Härtl, R. Hempelmann, *Immobilized Highly Charged Colloidal Crystals: A New Route to 3 D Mesoscale Structured Materials*, Angew. Chem. Int. Ed. Engl. **41**, 102 (2002);
- Th. Agne, Z. Guan, X. M. Li, H. Wolf, Th. Wichert, H. Natter, R. Hempelmann, *Doping of the nanocrystalline semiconductor zinc oxide with the donor indium*, Appl. Phys. Lett. **83**, 1204 (2003)
- F. Endres, M. Bukowski, R. Hempelmann, H. Natter, *Electrodeposition of nanocrystalline metals and alloys from ionic liquids*, Angew. Chem. Int. Ed. Engl. **42**, 3428 (2003)
- T. Autenrieth, J. Wagner, R. Hempelmann, W. Härtl, A. Robert, G. Grübel, *Cobalt Ferrite- Silica Core-Shell Colloids: a Magnetic Yukawa System*, Appl. Organometal Chem. **18**, 520 (2004)
- C. Lellig, J. Wagner und R. Hempelmann, S. Keller, S. Lumma, W. Härtl, *Self-Diffusion of Rodlike and Spherical Particles in a Matrix of Charged Colloidal Spheres: A Comparison between FRAP and FCS*, J. Chem. Phys. **121**, 7022 (2004)
- S. Zain El Abedin, E. M. Mostafa, R. Hempelmann, H. Natter, F. Endres, *Additive free electrodeposition of nanocrystalline aluminium in a water and air stable ionic liquid*, Electrochemistry Communications **7**, 1116 (2005)
- R. Szamocki, St. Reculosa, S. Ravaine, P. N. Bartlett, A. Kuhn, R. Hempelmann, *Tailored mesostructuring and biofunctionalization of gold to give increased electroactivity*, Angew. Chem. Int. Ed. Engl. **45**, 1317 (2006)
- J. Gajdzik, R. Szamocki, H. Natter, G. W. Kohring, F. Giffhorn, R. Hempelmann, *Electroenzymatic reactions with sorbitol dehydrogenase on gold electrodes*, J. Solid State Electrochem. (2006), in print
- R. Szamocki, A. Velichko, F. Mücklich, S. Ravaine, P. Garrigues, N. Sojic, R. Hempelmann, A. Kuhn, *Macroporous ultramicroelectrodes for improved electroanalytical measurements*, Analytical Chemistry, submitted
- R. Hempelmann, *Quasielastic Neutron Scattering and Solid State Diffusion*, Oxford Series on Neutron Scattering in Condensed Matter, Clarendon Press, Oxford 2000



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## 2. Past and present research collaborations

Are you familiar  
with the European  
Framework  
Programme?

<input checked="" type="checkbox"/> <b>Yes</b>	<input type="checkbox"/> <b>No</b>
<input type="checkbox"/> with Framework Programme 5	
<input type="checkbox"/> with Framework Programme 6	
<input checked="" type="checkbox"/> with Framework Programme 7	

EU-projects you are  
involved in:

**Past projects**

**Present projects**

**Programme title / contract number / title / acronym / your function  
(coordinator / partner / contractor)**

COST Chemistry Action D19 "Chemical Functionality specific to the nanometer scale" (Chairman of the management committee)

Other international  
collaborations:

Name(s) and  
contact details of  
potential partners:

**If you would like to suggest the participation of particular partners from the partner country based on existing contacts or collaboration experience, you are welcome to indicate their names and contact details below:**

## 3. Presentation at the Workshop

I will give a presentation at the workshop (approx. 10 min.) to present my institution, my expertise, and my collaboration interests. The contents of my presentations is summarised below (max. 1 page).

By a combination of the Langmuir-Blodgett technique using colloidal particles and electrochemistry we synthesize highly ordered macroporous electrodes with precise control of the pore-size, the spatial arrangement of the pores and the number of pore layers. The whole inner surface can be completely covered with a monolayer of a complete biocatalytic chain consisting of mediator, cofactor, and enzyme. The current for the electroenzymatic oxidation of the substrate glucose with glucosedehydrogenase, e.g., on these modified electrodes is proportional to the number of hollow-sphere-layers and can easily be increased by more than one order of magnitude compared to a non-porous electrode.

The template synthesis using colloidal crystals is used to elaborate macroporous ultramicroelectrodes (UME) with an active surface area which is more than one order of magnitude higher compared to a classical disc UME as characterized by cyclic voltammetry. The electrochemical signal could be amplified by more than one order of magnitude. The electrode behaviour has also been characterized with respect to fast and slow redox reactions by cyclic and differential pulse voltammetry.

In general, this gain in signal is very interesting especially for the use of microelectrodes as biosensors or for biofuel cells as well as for preparative electroenzymatics.

**I agree with the publication of my data on the Workshop website!**

**PLEASE FILL IN THIS FORM UNTIL 22 SEPT. 2006 AND RETURN IT TO:**

Internationales Buero des BMBF  
[s.krummacher@fz-juelich.de](mailto:s.krummacher@fz-juelich.de);  
[Christian.schache@dlr.de](mailto:Christian.schache@dlr.de)

TÜBİTAK-Marmara Research Center  
[Sunullah.Ozbek@mam.gov.tr](mailto:Sunullah.Ozbek@mam.gov.tr);  
[Artac.Turker@mam.gov.tr](mailto:Artac.Turker@mam.gov.tr)