

PROF

Stand und weiterer Verlauf FS1 Strategieprojekt 01.10.2002 bis 30.09.2006

und

Detailplanung von S01 Strategieprojekt 01.10.2006 bis 30.09.2009

**Josef Brenner, Ilse C. Kinnen-Gebeshuber,
Ralph Kolm, Andreas Merstallinger,
Herbert Störi, Wolfgang Werner**

Überblick

- **Projektteam**
- **Einleitung (Herbert Störi)**
- **Wissenschaftliche Erfolge FS1 (Ille Kinnen-Gebeshuber, Ralph Kolm, Josef Brenner)**
- **Finanzieller Status FS1 (Ernst Janotka)**
- **Publikationen FS1 (Ille Kinnen-Gebeshuber)**
- **Arbeitsplan 04/2006-09/2006 FS1**
- **Strategische Planung S01 (10/2006-09/2009)**

Projektteam FS1

- **Josef Brenner – Dissertant**
- **Donat Holzer – Summer Student**
- **Ille C. Kinnen-Gebeshuber – Senior Scientist, Project Manager**
- **Ralph Kolm – Dissertant**
- **Andreas Merstallinger – Key Researcher**
- **Herbert Störi – Key Researcher**
- **Wolfgang Werner – Key Researcher**

Wissenschaftliche Ergebnisse 1/15

- Hydroxichinolin-4, -6, -8, Toluol alleine
- Absorbierte Schichten
- Geriebene Schichten
- Schmierer unterschiedlich
- Unterschiedliche peaks, schauen unterschiedlich aus
- Winkelabhängigkeit

Wissenschaftliche Ergebnisse 2/15

- Rizinolsäure, Phosphahate

Wissenschaftliche Ergebnisse 3/15

- Optische Profilometerdaten von Ralph

Wissenschaftliche Ergebnisse 4/15

- Unsere Methode der I Messung ist komplex und dreidimensional (??)

Wissenschaftliche Ergebnisse 5/15

- Wir haben eine **geschlossene Flüssigkeitszelle** entwickelt, die die Untersuchung von **Proben verschiedener Größen und Formen** in unterschiedlichen tribologisch relevanten Umgebungen erlaubt (z.B. **flüssig, gasförmig**), insbesondere **bei extremen mechanischen und chemischen Bedingungen**.
- Das **Design** der Flüssigkeitszelle ermöglicht die **einfache Konstruktion zusätzlicher Probenhalter** für noch komplexere Proben.
- Die **Erweiterung** der Flüssigkeitszelle durch eine **Heizstation** und die Möglichkeit, die **Probenumgebung während der Messung zu verändern**.

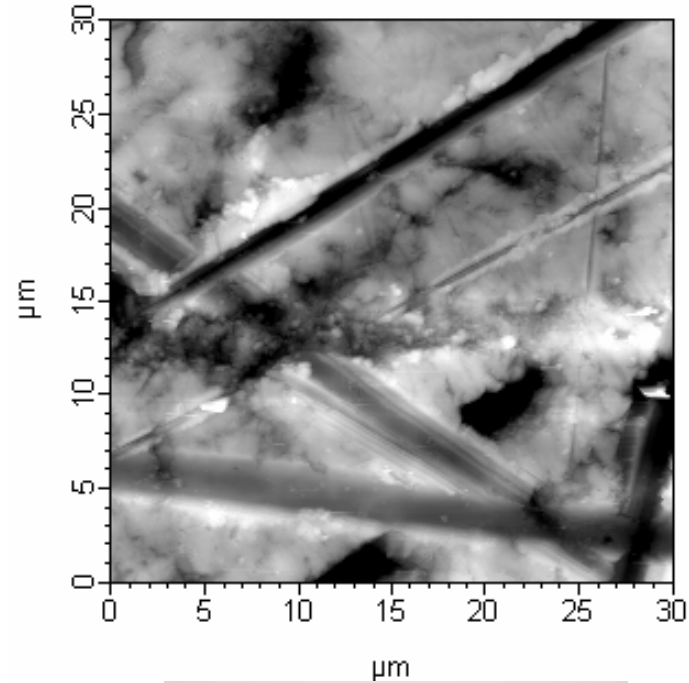
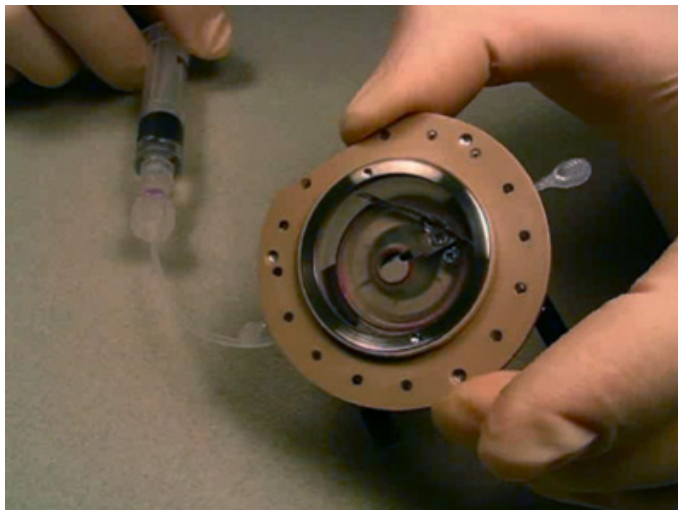
Wissenschaftliche Ergebnisse 6/15

Austrian Center of Competence for Tribology
Österreichisches Kompetenzzentrum für Tribologie

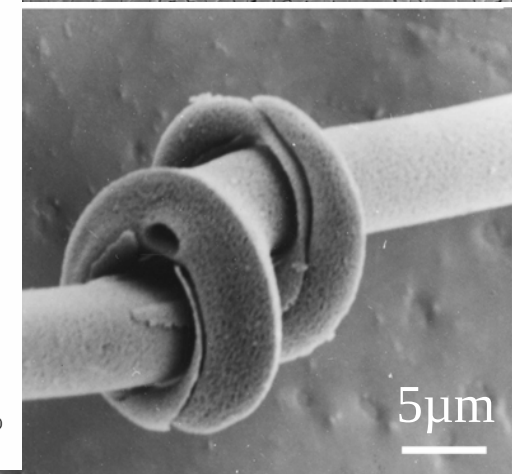
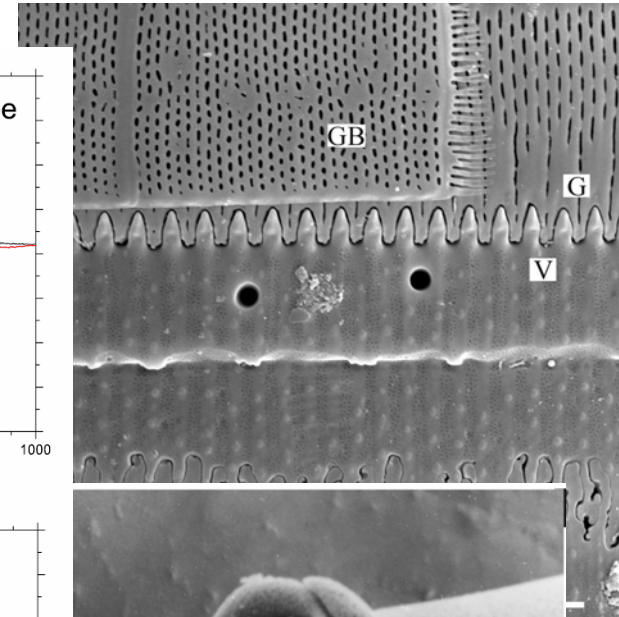
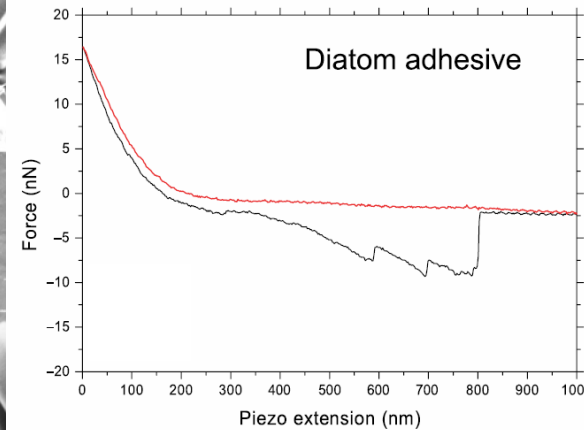
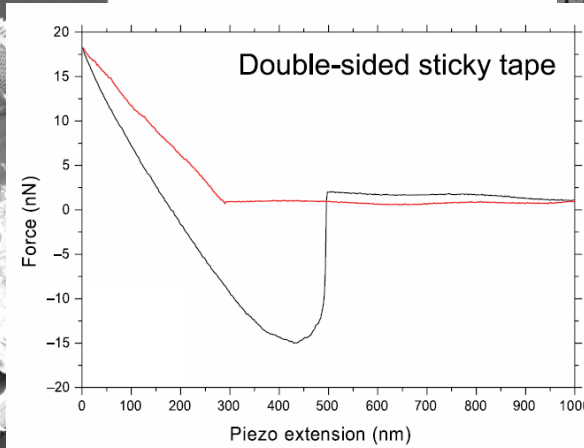
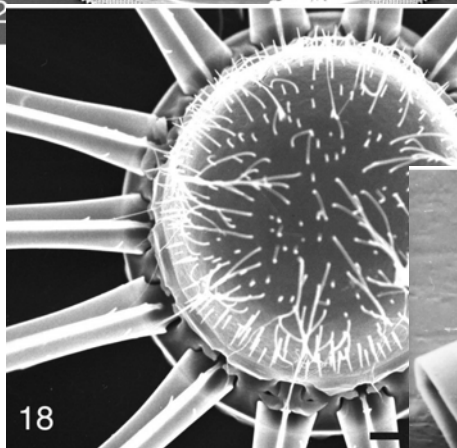
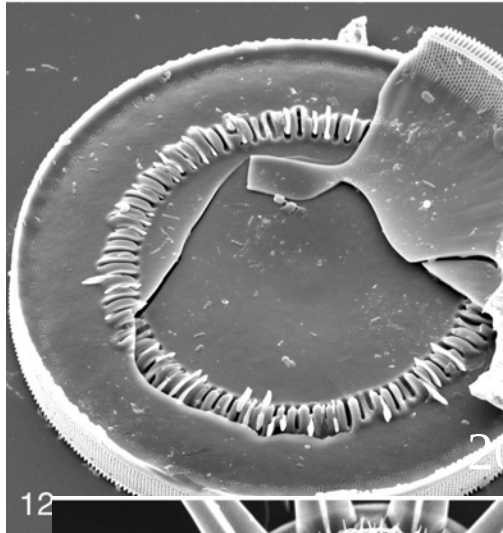
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Wissenschaftliche Ergebnisse 6/15



Wissenschaftliche Ergebnisse 7/15

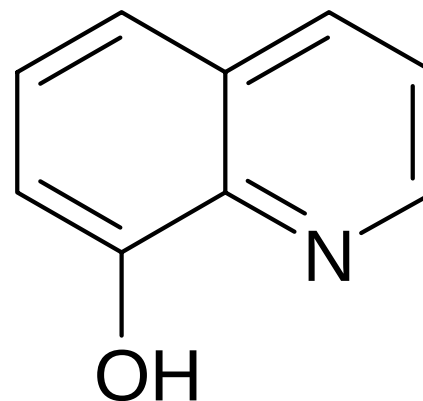
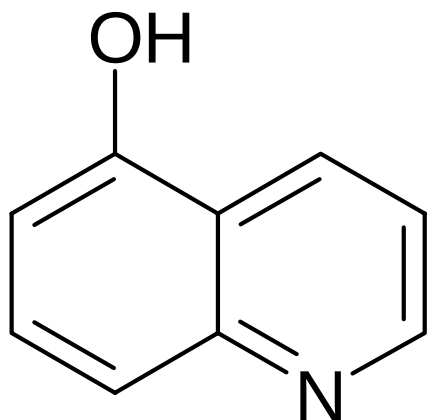


Wissenschaftliche Ergebnisse 8/15

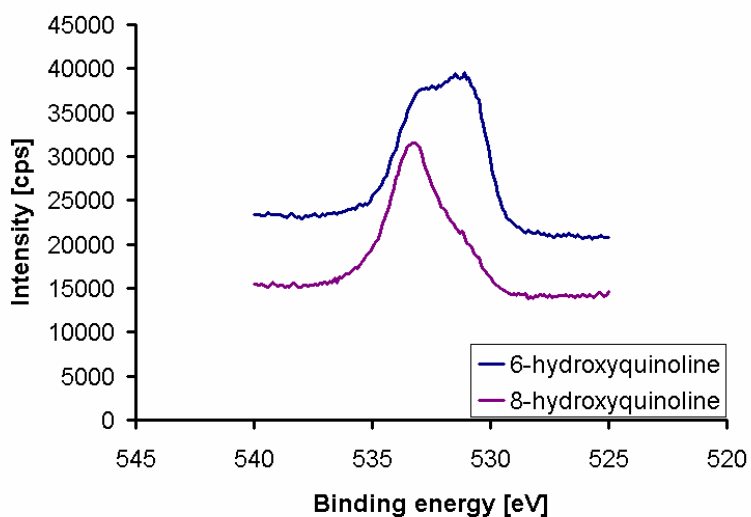
6-hydroxyquinoline

XPS

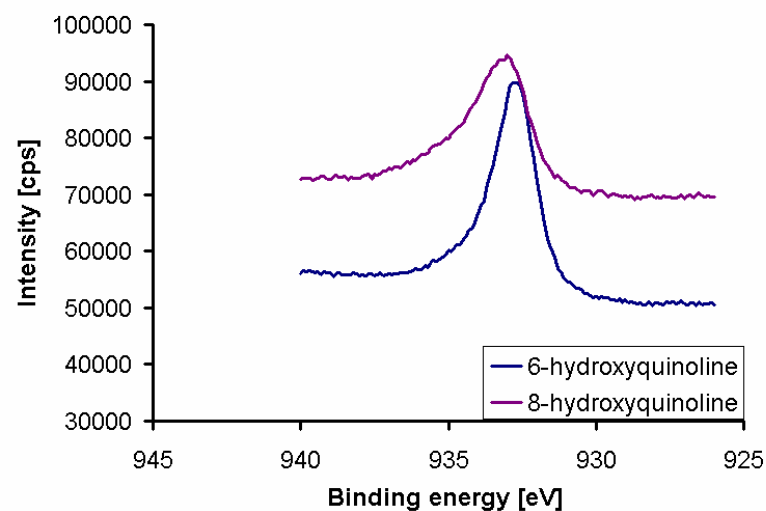
8-hydroxyquinoline



Comparison of the oxygen 1s photoelectron region



Comparison of the copper 1s photoelectron region



Wissenschaftliche Ergebnisse 9/15

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Wissenschaftliche Ergebnisse 10/15

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Publikationen FS1

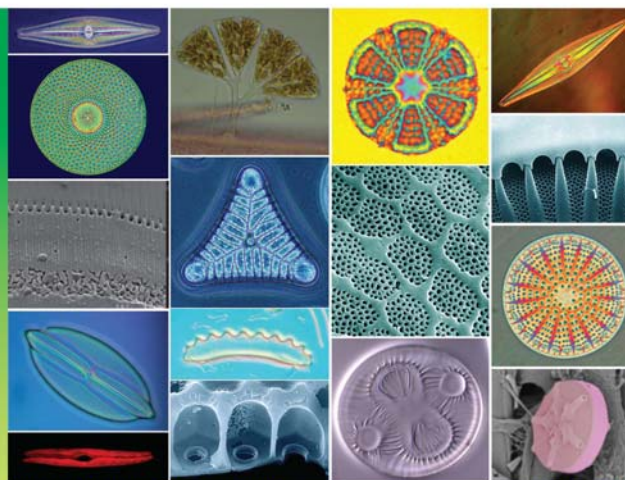
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- **Gebeshuber I.C.**, Cernusca S., Aumayr F. and Winter HP. (2003) "*Nanoscopic surface modification by slow ion bombardment*", Int. J. Mass Spectrometry 229, 27-34
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- **Gebeshuber I.C.**, Stachelberger H. and Drack M. (2005) "*Diatom bionanotribology - Biological surfaces in relative motion: their design, friction, adhesion, lubrication and wear*", J. Nanosci. Nanotechnol. 5(1), 79-87.

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A Special Issue on

Diatom Nanotechnology

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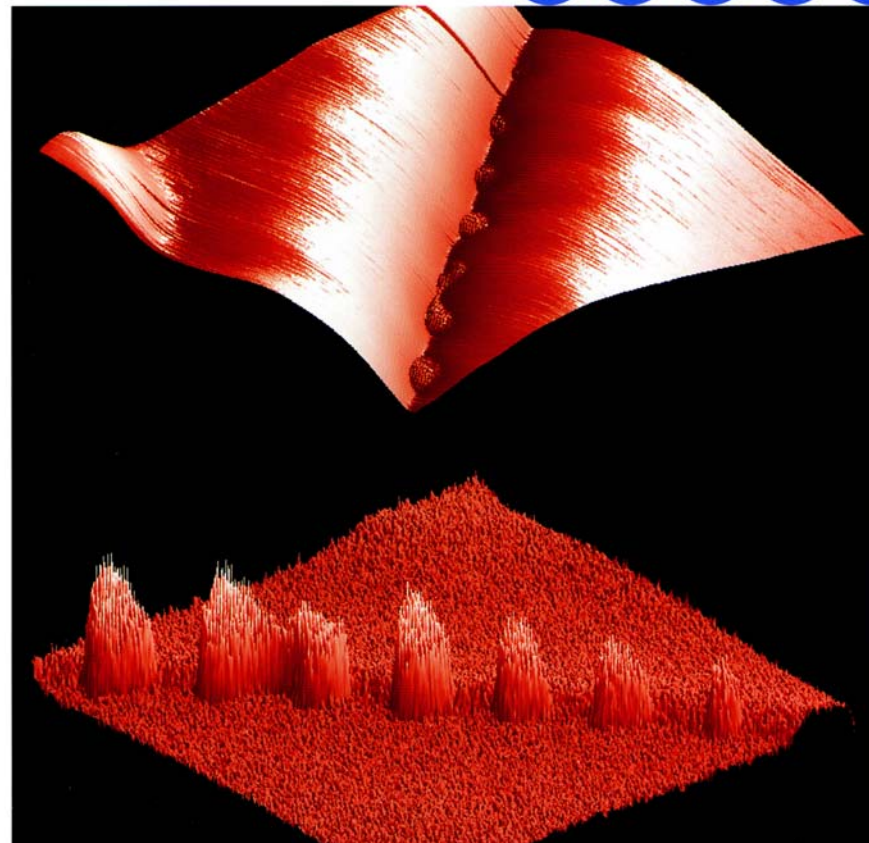


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Peer review Journale

- **Kolm R., Gebeshuber I.C., Kenesey E., Ecker A., Pauschitz A., Werner W.S.M., and Störi H.** (2005) *"Tribiochemistry of mono molecular additive films on metal surfaces, investigated by XPS and HFRR"*, in: Life Cycle Tribology, Eds.: D. Dowson, M. Priest, G. Dalmaz and A.A. Lubrecht, Tribology and Interface Engineering Series, No. 48, Series Editor B.J. Briscoe, Elsevier, 269-282.
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- **Doerr N., Gebeshuber I.C., Holzer D., Wanzenboeck H.D., Ecker A., Pauschitz A. and Franek F.** *"Evaluation of ionic liquids for the application as lubricants - part 2."*, submitted
- **Gebeshuber I.C., Holzer D., Kolm R., Goschke R., Aumayr F. and Störi H.** *"Development of an atomic force microscope closed fluid cell for tribological investigations of large samples in chemically aggressive environments."*, submitted to Journal of Engineering Tribology

Peer review Journale

- **Gebeshuber I.C.**, Drack M. and Scherge M. "*Tribology in biology*", submitted to Wear
- **Gebeshuber I.C.** and Crawford R.M. "*Microtribology in glass - hinges and interlocking devices in diatoms*", submitted to IMechE Journal of Engineering Tribology
- **Gebeshuber I.C.**, Smith R.A.P., Fuersatz M., Kaska K., Pleschko S., Winter HP. and Aumayr F. "*Nanostructuring surfaces with slow multiply charged ions.*", submitted to IEEE Transactions in Nanotechnology
- El-Said A.S., Meissl W., Simon M., Crespo López-Urrutia J.R., **Gebeshuber I.C.**, Winter HP., Lang M. and Aumayr F., Slow highly charged ion-induced surface nanostructures on CaF₂ single crystals studied by scanning force microscopy, in preparation
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Poster

- Smith R.A.P., **Gebeshuber I.C.**, Gruenberger C., Kaska K., Pleschko S., Winter HP. and Aumayr F. (2005) "Surface modifications on Si(111): H surfaces caused by the impact of multiply-charged ions.", Poster ECASIA-2005 (presented September 27), Vienna
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- Deachapunya S., Major A., Goldfarb F., **Gebeshuber I.C.**, Aumayr F. and Arndt M. (2005) "Towards surface detection of interference fringes and molecular nanopatterns.", Poster 55. Jahrestagung Österr. Physikal. Ges. (presented September 28), Vienna

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- Meissl W., El-Said A.S., Simon M., **Gebeshuber I.C.**, Winter HP., Aumayr F., Crespo López-Urrutia J.R., Tawara H., Ullrich J. (2006) "Surface modifications on and electron emission from insulator surfaces induced by impact of slow highly charged ions", Poster presented at Symp. on Surface Science 2006, March 5-11, St. Christoph am Arlberg, Austria
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- **Gebeshuber I.C.**, Drack M. and Scherge M. (2005) "Tribology in Biology", Abstract for the 4th International Colloquium Micro-Tribology'05, September 5-7, 2005, Karwica, Poland, p. 17
- **Doerr N., Gebeshuber I.C., Ecker A., Pauschitz A. and Franek F.** (2005) "Evaluation of ionic liquids for the application as lubricants - part 2.", Abstract 32nd Leeds-Lyon Symposium on Tribology, September 2005, Lyon, France, p. XI/3
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- Fürsatz M., Pleschko S., **Gebeshuber I.C.**, Winter HP., Lemell C., Stolterfoht N. and Aumayr F. (2005) "2-D scattering distribution of multiply charged ions guided through nano-capillaries.", Abstract ICPEAC-2005, July 2005, Rosario, Argentina

Abstracts 2005 (3/3)

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Abstracts 2006 (1/3)

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- Gebeshuber I.C., Smith R.A.P., Fuersatz M., Kaska K., Pleschko S., Winter HP. and Aumayr F. (2006)"Nanostructuring surfaces with slow multiply charged ions.", Abstract NanoSingapore 2006, IEEE Conference on Emerging Technologies - Nanoelectronics, January 10-13, 2006, Singapore, p. 274-275
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Abstracts 2006 (2/3)

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- El-Said A.S., Meissl W., Simon M., Crespo López-Urrutia J.R., Gebeshuber I.C., Winter HP., Lang M., Aumayr F. (2006) "Slow highly charged ion-induced surface nanostructures on CaF₂ single crystals studied by scanning force microscopy.", Abstract ICACS-2006, July 2006, Berlin, Germany

Abstracts 2006 (3/3)

- Meissl W., El-Said A.S., Simon M., Gebeshuber I.C., Winter HP., Aumayr F., Crespo López-Urrutia J.R., Tawara H., Ullrich J. (2006) "Surface modifications on and electron emission from insulator surfaces induced by impact of slow highly charged ions", Abstract Symp. on Surface Science 2006, March 5-11, St. Christoph am Arlberg, Austria
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Öffentlichkeitsarbeit 2/2

- **Gebeshuber I.C.** and Bauer J. (2005) Chemische Elemente - Ausstellung, 5.12.2005, Sem 134A (TU-Wien, Wiedner Hauptstrasse 8-10/134, Institut für Allgemeine Physik, Freihaus, 5. Stock gelb. 14-20 Uhr. Ausstellung und Verkauf, www.smart-elements.com
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- **Gebeshuber I.C.** (2006) Öffentliche Vorlesung „Nanotechnologie“, Ringlinienstrassenbahn, Wien, 10.05.2006

Akquirierte Projekte

- **Grain scale investigation into fretting contacts.** Project with T. Dick and Prof. G. Cailletaud from the Ecole National Supérieure des Mines de Paris, sponsored by ÖAD, Amadee Program (exchange with France), 2005, 2006.
- **Magnetic carbon?** Innovative project 2005, Vienna University of Technology.
- 01/2006-12/2009: **Production and Characterisation of Gas Phase Biomolecular Targets**, Joint Research Activity 4 of the European Union Sixth Framework programme "Structuring the European Research Area Specific Programme", Research Infrastructure Action: Integrated Infrastructure Initiative (I3) ITS LEIF, Full Title: Ion Technology and Spectroscopy at Low Energy Ion Beam Facilities

Scientific Community Services (1/2)

- January 1, 2006 -: **Editorial Board Member** of the Proceedings of the Institution of Mechanical Engineers: J. Mechanical Engineering Science - Part C (**I.C. Gebeshuber**)
- **Reviewing Tätigkeiten** für die folgenden wissenschaftlichen Journale:
 - Biophysical Journal (**I.C. Gebeshuber**)
 - Journal of Phycology (**I.C. Gebeshuber**)
 - IEEE Transactions on Nanotechnology (**I.C. Gebeshuber**)
 - Proceedings of the Institution of Mechanical Engineers Part J: Journal of Engineering Tribology (**I.C. Gebeshuber**)
 - Micron (**I.C. Gebeshuber**)

Scientific Community Services (2/2)

- February 13-14, 2003: **NetMeeting2003 Proteomics: A functional approach** (Network of Excellence Coordination Meeting) Vienna, University of Technology. Conference organizer: **I.C. Gebeshuber**
- September 25-30, 2005: **ECASIA'05** 11th European Conference on Applications of Surface and Interface Analysis, University of Technology, Vienna, Austria. Conference organizer: **W.S.M. Werner**, members of the scientific committee: **H. Störi, I.C. Gebeshuber**, chairperson session on Biomaterials: **I.C. Gebeshuber**
- March 14-16, 2007: 2nd Vienna International Conference Micro- and Nanotechnology - **Viennano07**, Vienna and Wiener Neustadt. Member of the Scientific Committee: **I.C. Gebeshuber**, chairperson session on Bionanotechnology & Ethics: **I.C. Gebeshuber**

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2003

- June 1-3, 2002: **TRIMIS2003** meeting (Tribology in Microsystems), Neuchâtel, Switzerland
- June 8 - July 5, 2003: **CSSS03** (Complex Systems Summer School 2003), Santa Fe Institute, New Mexico, USA.
- June 27-29, 2003: Visit to **Paul Hansma's lab, Physics Department , University of California Santa Barbara**
- November 26-28, 2003: Visit to **Alfred Wegener Institute Bermerhaven**, Prof. Dick Crawford. Seminary lecture: AFM of living diatoms in ambient conditions.

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2004

- April 22-24, 2004: **Bionik 2004** International Industrial Conference, Hannover, Germany
- June 1-2, 2004: Visit to **Alfred Wegener Institute Bermerhaven**, Profs. Dick Crawford and Dick Gordon
- September 7-10, 2004: **31st Leeds-Lyon Symposium on Tribology**: Life Cycle Tribology, Leeds, United Kingdom
- September 11-23, 2004: **NATO ASI** "From cells to proteins: Imaging nature across dimensions" Pisa, Italy

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2005 1/2

- March 9-11, 2005: 1st Vienna International Conference on Micro- and Nano-Technology, **VIENNANO´05**, Vienna, Austria
- July 3-6, 2005: **IIWE2005** International Institute for Women in Engineering, Paris, invited lecture
- August 24-27, 2005: **Alpbach** Technology Forum 2005, Alpbach/Tirol (**Technologieggespräche** Forum Alpbach)
- September 5-7, 2005: 4th International Colloquium **Micro-Tribology´05**, Karwica, Poland, invited keynote lecture "Tribology in biology"
- September 6-9, 2005: **32nd Leeds-Lyon Symposium**, Lyon, France

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2005 2/2

- September 10-13, 2005: Visit to Prof. Georges Cailletaud, Ecole Nationale Supérieure des Mines de Paris, France (financed by **ÖAD Amadee Project** 5/2005 "Grain scale investigations into fretting contacts")
- September 25-30, 2005: **ECASIA-05** 11th European Conference on Applications of Surface and Interface Analysis, Vienna, Austria. Member of the scientific committee, chairperson of the session "Biomaterials"
- December 14-16, 2005: Visit to Prof. Priest, Mechanical Engineering department, University of Leeds. Seminar lecture "Biotribological model systems for emerging micro- and nano-scale technologies - switchable adhesives and glassy rubber bands,,," **British Council**

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2006 1/2

- January 10-13, 2006: **NanoSingapore 2006**: IEEE Conference on Emerging Technologies - Nanoelectronics, Singapore
- February 3-6, 2006: **VIII. Annual Linz Winter Workshop** "Advances in single-molecule research for biology & nanoscience", Linz, Austria
- February 7, 2006: **Editorial board meeting**, IMechE J. Mech. Eng. Sci., London, UK

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2006 2/2

- March 17, 2006: "Rastersondenmikroskopie: von lebenden Zellen zu einzelnen elektronenspins", **Seminar** lecture at E164 - **Institut für Chemische Technologien und Analytik**, Seminar series "Analytical Chemistry", Prof. Gernot Friedbacher, Vienna University of Technology, Vienna, Austria
- March 23-26, 2006: **20. DDT** Treffen der deutschsprachigen Diatomologen mit internationaler Beteiligung, Trebon, Southern Bohemia
- May 2-4, 2006: Visit to Prof. Georges Cailletaud, Ecole Nationale Supérieure des Mines de Paris, France (financed by **ÖAD Amadee** Project 5/2005 "Grain scale investigations into fretting contacts")
- May 7-9, 2006: Visit to **Warsaw Technical University**, Prof. Zygmunt Rymuza. Seminar and lecture "Nanotribology in Biology"

Konferenzbesuche und wissenschaftliche Auslandsaufenthalte 2006 3/2

- May 11-12, 2006: **1. Österreichisches Nanoanalytik-Symposium: Nanoanalytik in Wissenschaft und Wirtschaft** - Angebot, Bedarf und Problemlösungskompetenz, Grundlsee, Austria
- May 28 - June 2, 2006: **ICC2006** International Conference on Clusters at Surfaces, Rostock - Warnemünde, Germany
- July 2-9, 2006: **IIWE2006** International Institute for Women in Engineering, Paris, invited lecture
- July 7-12, 2006: 1st Annual Meeting **ITSLEIF**, Sandbjerg, Denmark
- September 4-8, 2006: **YUCOMAT 2006**, 8th annual conference of the Yugoslav Materials Society , Herceg Novi, Serbia and Montenegro

Projektplan FS1

- War sehr detailliert bis Ende 2003.
- Ab 01/2004 war der Gedanke, dass grundlegende Probleme von Firmenprojekten an uns herangetragen werden → dieses Angebot wurde nicht genutzt.
- Stattdessen konzentrierte sich das FS1 Team auf die Problemstellungen, die sich 2003 als vielversprechend herausstellten.

Charakterisierung von tribologisch beanspruchten Oberflächen

▲ Ziele

- ▲ Verschleiß von Polymeren: Chemie vs. Physik
- ▲ Tribochemie von Additiven und Schmierstoffen auf Oberflächen
- ▲ Wechselwirkungen von Polymeren, Schmierstoffen, Wasser und Verunreinigungen
- ▲ Zusammenhang Tribochemie – Rauigkeit mit Additiven, mit dem AFM Reibkoeffizienten ansehen

▲ Potenzielle wissenschaftliche Projektpartner

- ▲ ARC Seibersdorf
- ▲ TU-Wien, IAP

▲ Kontakt: I.C. Kinnen-Gebeshuber (gebeshuber@ac2t.at)

Projektbudget und Personalplan				
Kosten in €	Jahr 1	Jahr 2	Jahr 3	Gesamt
Projektkosten AC²T	160.660	160.660	160.660	481.980
Mitarbeiterjahre AC²T	2	2	2	6,0

S01 Aufgaben

- Investigation of significant effects of tribosystems
- know-how transfer from model tribometers to real systems
- Concepts for new and improvement of already applied wear measurement methods
- Studies of mono-molecular additive layers
- Highly parallel nanoscale friction characterization (millipede)
- Development of ambient in situ online surface sensitive techniques for characterisation of sliding friction, especially for organic materials
- Evaluation and implementation of monolayer analysis methods (e.g. for combinations of high molecular organic materials on steel or on polymeric solids).
- Wear of polymers - chemistry vs. physics
- Microtribochemistry of additives and lubricants on surfaces, connection to macroscopic effects
- Interactions of polymers, lubricants, water, impurities. Investigations of Chromium-free and metalorganic-free new materials as a basis for new, optimised tribosystems.
- (Micro- and nano-)Biotribology
- development of a novel highly parallel nanoscale tribometrological device