

Sensor Systems

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In 2004 several new devices have been designed and realized within the ZMNS for the different projects. In the cooperation with the TU Delft (the Netherlands), on-chip particle detectors were made and characterized. These detectors are based on optical (strip photodiodes) and electrical (impedance) measurements. Further, a particle selector and a particle separator, both based on dielectrophoresis have been developed, the last one within the frame of a diploma thesis. The work was presented at the international microTAS conference in Lund, Sweden. In the EU project Microprotein, new layers have been tried out for wetting and electrowetting purposes for manipulation of liquids at the surface of (silicon) chips. Our cooperation with the competence center AC2T have led to novel devices for viscosity sensing which, amongst other things, allow new insight in dispersed fluids. In the frame of an FFF project with the firma Graf, thermal conductivity sensors in silicon have been designed to monitor the ageing of oil.

Cooperations have started with a newly established research center of the Austrian Academy of Sciences (Integrated sensor systems), with ARCS Research, and with Robert Bosch USA. In the frame of the Austrian Nanoinitiative, the MNA Network has been established with partners from the University of Leoben, University of Linz, ARCS Research, IMS (Vienna), IMA, and the University of Agriculture (BOKU) in Vienna.

The research has led to close to 40 publications in scientific journals and international conference proceedings and 1 patent was submitted.

Project Information

Project Manager

Univ.Prof. Michiel J. Vellekoop

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Project Group

Last Name	First Name	Status	Remarks
Agoston	Attila	dissertation	
Beigelbeck	Roman	student	
Hairer	Gabriel	dissertation	
Jachimowicz	Artur	senior researcher	
Jakoby	Bernhard	associate professor	
Keplinger	Franz	postdoc	
Kohl	Franz	postdoc	
Kostner	Stefan	student	
Kuntner	Jochen	dissertation	
Kvasnica	Samuel	postdoc	
Lindenbauer	Thomas	student	
Nieuwenhuis	Jeroen Hans	dissertation	
Pirker	Ewald	technician	
Rocha Wiese Meneses	Daniel Paolo	assistant professor	
Rogler	Gerhard	technician	
Schalko	Johannes	postdoc	
Stangl	Günther	technician	
Svasek	Edeltraud	technician	
Svasek	Peter	technician	
Vellekoop	Michiel J.	full professor	
Zoppel	Sandra	dissertation	

Books and Contributions to Books

1. A. Agoston, C. Ötsch, B. Jakoby:
"Evaluation of Sensors for On-line Oil Condition Monitoring";
in: "Current Trends in Tribology", K. Vercammen et al. (ed.); Institute for

Terotechnology - National Research Institute, Poland, 2004, ISBN: 83-70204-418-X, L.13 - L.16.

2. D. Rocha Wiese Meneses, P. M. Sarro, M. Vellekoop (ed.):
“*CD-Rom Proceedings of the Third IEEE International Conference on Sensors*”;
IEEE Sensors, 2004, ISBN: 0-7803-8693-0; 850 pages.

Publications in Reviewed Journals

1. M. Ando, H. Steffes, R. Chabicovsky, M. Haruta, G. Stangl:
“*Optical and Electrical H₂- and NO₂-Sensing Properties of Au/In_xO_yN_z Films*”;
IEEE Sensors Journal, **04** (2004), 2; 232 - 236.
2. R. Beigelbeck, B. Jakoby:
“*A two-dimensional analysis of spurious compressional wave excitation by thickness-shear-mode resonators*”;
Journal of Applied Physics, **95** (2004), 9; 4989 - 4995.
3. S. Eder-Kapl, H. Löschner, M. Zeininger, W. Fallmann, O. Kirch, G. Patsis, V. Constantoudis, E. Gogolides:
“*Line edge roughness investigation on chemically amplified resist materials with masked helium ion beam lithography*”;
Microelectronic Engineering, **73-74** (2004), 252 - 258.
4. R. Grössinger, F. Keplinger, H. Hauser:
“*The Design and Construction of a Thin Foil High Field Magnet*”;
Physica B, **346-347** (2004), 604 - 608.
5. V. Iordanov, J. Bastemeijer, R. Ishihara, P. M. Sarro, A. Bossche, M. Vellekoop:
“*Filter-protected Photodiodes for High-Throughput Enzymatic Analysis*”;
IEEE Sensors Journal, **4** (2004), 5; 584 - 588.
6. B. Jakoby, A. Ecker, M. Vellekoop:
“*Monitoring macro- and microemulsions using physical chemosensors*”;
Sensors and Actuators A, **115** (2004), 209 - 214.
7. B. Jakoby, M. Vellekoop:
“*Physical sensors for water-in-oil emulsions*”;
Sensors and Actuators A, **110** (2004), 28 - 32.
8. F. Keplinger, S. Kvasnica, A. Jachimowicz, F. Kohl, J. Steurer, H. Hauser:
“*Lorentz force based magnetic field sensor with optical readout*”;
Sensors and Actuators A, **110** (2004), 112 - 118.
9. F. Kohl, F. Keplinger, A. Jachimowicz, J. Schalko:
“*A Model of Metal Film resistance bolometers based on the electro-thermal feedback effect*”;
Sensors and Actuators A, **115** (2004), 308 - 317.
10. J. Nieuwenhuis, F. Kohl, J. Bastemeijer, P. M. Sarro, M. Vellekoop:
“*Integrated Coulter counter based on 2-dimensional liquid aperture control*”;
Sensors and Actuators B, **102** (2004), 44 - 50.
11. J. Nieuwenhuis, M. Vellekoop:
“*Simulation study of dielectrophoretic particle sorters*”;
Sensors and Actuators B, **103** (2004), 331 - 338.
12. P. Svasek, E. Svasek, B. Lendl, M. Vellekoop:
“*Fabrication of miniaturized fluidic devices using SU-8 based lithography and low temperature wafer bonding*”;
Sensors and Actuators A, **115** (2004), 591 - 599.

Presentations

1. A. Agoston, F. Keplinger, B. Jakoby:
"A Novel MEMS-Based Viscosity Sensor";
Presentation: 18th European Conference on Solid-State Transducers (EUROSENSORS XVIII), Rome, Italy; 09-12-2004 - 09-15-2004; in: "Technical Digest of Eurosensors XVIII", (2004), ISBN: 88-7621-282-5; 161 - 163.
2. A. Agoston, C. Ötsch, B. Jakoby:
"Application of microacoustic viscosity sensors for online oil condition monitoring";
Poster: VDI Fachtagung, Ludwigsburg, D; 03-15-2004 - 03-16-2004; in: "Sensoren und Messsysteme VDI-Berichte 1829", (2004), ISBN: 3-18-091829-2; 833 - 836.
3. A. Agoston, C. Ötsch, F. Novotny-Farkas, H. Eisenschmid, B. Jakoby:
"Sensors for a Lubrication-Monitoring-System";
Presentation: 14th International Colloquium Tribology, Esslingen, Germany; 01-13-2004 - 01-15-2004; in: "Tribology and Lubrication Engineering", W.J. Bartz (ed.); 3 (2004), ISBN: 3-924813-54-X; 1883 - 1889.
4. A. Agoston, C. Ötsch, J. Zhuravleva, B. Jakoby:
"An IR-Absorption Sensor System for the Determination of Engine Oil Deterioration";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 463 - 466.
5. R. Beigelbeck, B. Jakoby:
"Analytical 3D-Analysis of Compressional Wave Excitation by Thickness-Shear-Mode Resonators";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 91 - 94.
6. P. Bertrand, M. Scherer, T. Hilberath, B. Jakoby:
"Oil condition monitoring sensor for diesel engines";
Presentation: International Congress The Diesel Engine: Today and Tomorrow, Lyon, France; 05-12-2004 - 05-13-2004; in: "CD-Rom Proceedings", (2004), 11 pages.
7. B. Iliev, V. Iordanov, J. Bastemeijer, A. Bossche, P. Sarro, I. T. Young, G.W.K. Van Dedem, M. Vellekoop:
"Integrated nanoliter sensors reactor chamber for PCR analysis - from the idea to a complete system";
Presentation: International Conference Sense of Contact, 2004, Wageningen, Netherlands; 03-23-2004; in: "Proceedings Sense of Contact, 2004", (2004), ISBN: 954-438-386-7; 6 pages.
8. V. Iordanov, B. Iliev, J. Bastemeijer, A. Bossche, P. M. Sarro, I. T. Young, H. Dietrich, R. van den Doel, G.W.K. Van Dedem, A. Kroon, M. Vellekoop:
"Integrated sensors for nanoliter bioluminescence and fluorescence bio-chemical analysis";
Presentation: International Conference Sense of Contact, 2004, Wageningen, Netherlands; 03-23-2004; in: "Proceedings Sense of Contact, 2004", (2004), ISBN: 954-438-386-7; 6 pages.
9. V. Iordanov, B. Iliev, J. Bastemeijer, A. Bossche, P. M. Sarro, I. T. Young, G.W.K. Van Dedem, M. Vellekoop:

- "Integrated nanoliter sensors reactor chamber for DNA multiplication - thermal characterization"*;
Presentation: International Conference Sense of Contact, 2004, Wageningen, Netherlands; 03-23-2004; in: *"Proceedings Sense of Contact, 2004"*, (2004), ISBN: 954-438-386-7; 6 pages.
10. V. Iordanov, B. Iliev, A. Bossche, J. Bastemeijer, P. M. Sarro, I. T. Young, G.W.K. Van Dedem, M. Vellekoop:
"Integrated Sensor Arrays for Bioluminescence and Fluorescence Bio-Chemical Analysis";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: *"CD-ROM Proceedings Sensor 2004"*, D. Rocha Wiese Meneses, P. M. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 810 - 813.
11. V. Iordanov, B. Iliev, V. Joseph, A. Bossche, J. Bastemeijer, P. M. Sarro, I. T. Young, G.W.K. Van Dedem, M. Vellekoop:
"Sensorized nanoliter reactor chamber for DNA multiplication";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: *"CD-ROM Proceedings Sensor 2004"*, D. Rocha Wiese Meneses, P. M. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 229 - 232.
12. B. Jakoby, N. Dörr:
"Monitoring Phase Transitions in Microemulsions Using Impedance and Viscosity Sensors";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: *"CD-ROM Proceedings Sensor 2004"*, D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 627 - 630.
13. B. Jakoby, F.P. Klinger, P. Svasek:
"A Novel Viscosity Sensor with Integrated Heater and Temperature Sensor";
Presentation: 18th European Conference on Solid-State Transducers (EUROSENSORS XVIII), Rome, Italy; 09-12-2004 - 09-15-2004; in: *"Technical Digest of Eurosensors XVIII"*, (2004), ISBN: 88-7621-282-5; 600 - 603.
14. B. Jakoby, M. Vellekoop, A. Ecker:
"Monitoring W/O-Emulsions by Means of Sensors";
Presentation: 14th International Colloquium Tribology, Esslingen, Germany; 01-13-2004 - 01-15-2004; in: *"Tribology and Lubrication Engineering"*, W.J. Bartz (ed.); 3 (2004), ISBN: 3-924813-54-X; 1877 - 1880.
15. N. Kaun, S. Kulka, J. Baena, U. Schade, M. Vellekoop, E. De Lorenzi, B. Lendl:
"Synchrotron Radiation for On-Chip Mid-IR Detection at the Diffraction Limit";
Presentation: 8th International Conference on Miniaturized Systems in Chemistry and Life Sciences, Malmö, Sweden; 09-26-2004 - 09-30-2004; in: *"Proceedings 2004"*, (2004), 530 - 532.
16. F. Keplinger, R. Beigelbeck, F. Kohl:
"Simultaneous Measurement of Two Magnetic Field Components Using a U-Shaped Cantilever Device";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: *"CD-ROM Proceedings Sensor 2004"*, D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 1450 - 1453.
17. F. Kohl, R. Beigelbeck, F. Keplinger, A. Jachimowicz, J. Steurer:
"A Precise 1/f Noise Spectroscopy Setup for Sensor Characterization";

- Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 1143 - 1146.
18. S. Kostner, J. Nieuwenhuis, E. Svasek, P. Svasek, A. Jachimowicz, M. Vellekoop: "Continuous Particle Separator Based on Periodical DEP Elements"; Presentation: 8th International Conference on Miniaturized Systems in Chemistry and Life Sciences, Malmö, Sweden; 09-26-2004 - 09-30-2004; in: "Proceedings of μ TAS 2004", (2004), ISBN: 0-85404-643-7; 9 - 11.
 19. J. Kuntner, R. Chabicovsky, B. Jakoby: "Oil Condition Monitoring Using a Thermal Conductivity Sensor"; Presentation: 18th European Conference on Solid-State Transducers (EUROSENSORS XVIII), Rome, Italy; 09-12-2004 - 09-15-2004; in: "Technical Digest of Eurosensors XVIII", K. Riedling (ed.); (2004), ISBN: 88-7621-282-5; 983 - 986.
 20. J. Kuntner, B. Jakoby: "Two-Dimensional FEM Analysis of Pressure Wave Generation Mechanisms in TSM Liquid Sensors"; Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 83 - 86.
 21. J. Nieuwenhuis, A. Jachimowicz, P. Svasek, M. Vellekoop: "High-Speed Integrated Particle Sorters based on Dielectrophoresis"; Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 64 - 67.
 22. J. Nieuwenhuis, P. Svasek, P. M. Sarro, M. Vellekoop: "Particle Discrimination with an Improved Projection Cytometer"; Presentation: 8th International Conference on Miniaturized Systems in Chemistry and Life Sciences, Malmö, Sweden; 09-26-2004 - 09-30-2004; in: "Proceedings of μ TAS 2004", (2004), ISBN: 0-85404-643-7; 419 - 421.
 23. J. Nieuwenhuis, P. Svasek, P. M. Sarro, M. Vellekoop: "Particle Size Discrimination with a Liquid Aperture Coulter Counter"; Presentation: 18th European Conference on Solid-State Transducers (EUROSENSORS XVIII), Rome, Italy; 09-12-2004 - 09-15-2004; in: "Technical Digest of Eurosensors XVIII", (2004), ISBN: 88-7621-282-5; 317 - 320.
 24. D. Rocha Wiese Meneses, V. Ferrari, B. Jakoby: "Improved Electronic Readout Circuit for Resonant Acoustic Sensors"; Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 32 - 35.
 25. M. Roy, S. Kvasnica, C. Eisenmenger-Stittner, G. Vorlaufer, A. Pauschitz: "PVD-18: An Analysis of Nanotribological Study of Ti-Containing Hard Carbon Film"; Presentation: International Convention on Surface Engineering, INCOSURF 2004, Bangalore, India; 08-25-2004 - 08-27-2004; in: "Proceedings INCOSURF 2004", (2004), 441 - 450.

26. M. Scherer, M. Arndt, P. Bertrand, B. Jakoby:
"Fluid Condition Monitoring Sensors for Diesel Engine Control";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 459 - 462.
27. B. Valentin, M. Mündlein, R. Chabicovsky, J. Nicolics:
"Evaluation of a Novel Transepidermal Water Loss Sensor";
Presentation: 3rd IEEE Conference on Sensors (IEEE Sensors 2004), Vienna, Austria; 10-24-2004 - 10-27-2004; in: "CD-ROM Proceedings Sensor 2004", D. Rocha Wiese Meneses, P. Sarro, M. Vellekoop (ed.); (2004), ISBN: 0-7803-8692-2; 115 - 118.

Seminar Talks

1. B. Jakoby:
"Angewandte Forschung am Institut für Sensor- und Aktuatorssysteme";
Presentation: FH Vorarlberg Symposium Mikrosystemtechnik für die Industrie, Dornbirn, Austria (invited); 04-28-2004.
2. B. Jakoby:
"Lab on a Chip und Mikrosensorik";
Presentation: Mikro- und Nanostrukturen: Anwendungen und Perspektiven, Wirtschaftskammer, Wien (invited); 11-23-2004.
3. B. Jakoby:
"Zustandsüberwachung von Fluiden mit physikalischen Sensoren";
Presentation: Gastvortrag Johannes Kepler Universität Linz, Linz, Austria (invited); 06-28-2004.
4. M. Vellekoop:
"Physical chemosensors";
Presentation: Smart Sensor Systems Course 2004 (SSS) at TU Delft, Delft, Netherlands; 05-11-2004.
5. M. Vellekoop:
"Sensing in microfluidic devices";
Presentation: Gastvortrag TU Warschau, Warschau, Polen (invited); 04-26-2004.

Patents

1. H. Hauser, M. Vellekoop:
"Verfahren zur zweidimensionalen Manipulation kleiner Volumina von Flüssigkeiten und Festkörpern und Aktuator zur Ausführung des Verfahrens";
Patent: Austria, No. AT 412.039; submitted: 02-21-2002, granted: 01-15-2004.

Doctor's Theses

1. S. Kvasnica:
"Modeling, Diagnostics and Application of the Unbalanced Magnetron Discharge for the Deposition of Novel Ti-C:H Interface Layers";
Reviewer: W. Fallmann, H. Biederman; Institut für Sensor- und Aktuatorssysteme, 2004.

Cooperations

1. AC2T, Wiener Neustadt, F. Franek
2. AMS Unterpemstätten, M. Brandl, F. Schrank
3. ARC Seibersdorf, H. Kroath, C. Nöhammer
4. IMS, E. Fantner, H. Löschner
5. EVG, Schärding, Lind, J. Weixlberger
6. Jenbacher, Jenbach, S. Chvatal
7. OMV, Wien, F. Novotny-Farkas
8. R. Bosch, Reutlingen, Germany, O. Schatz
9. R. Bosch, Stuttgart, Germany, H. Eisenschmidt
10. Ford Motor Company, Dearborn, USA, J.H. Visser
11. Elmar Graf GmbH, Dornbirn, E. Graf
12. Unilever Research, Vlaardingen, The Netherlands, R. Kohlus
13. DSM Research, Geleen, The Netherlands, R. Janssen, P. Vonk
14. Applikon, the Netherlands, A. Oudshoorn
15. National Center for Scientific Research, Demokritos, Athens, Greece, D. Ithakissios
16. National Hellenic Research Foundation, Athens, Greece, I. Siotis
17. TU Wien, B. Lendl, E. Benes
18. Universität für Bodenkultur Wien, U.Sleytr, D. Pum, B. Schuster
19. Fachhochschule Wiener Neustadt, Noll
20. Universität Krems, D. Falkenhagen
21. LBI for Biomedical MicroTechnology, Vienna
22. ÖAW Forschungstelle Integrated Sensor Systems, T. Sauter, F. Kohl
23. TU Delft, The Netherlands, A. Bossche, C. Dekker, P.J. French, I.T. Young
24. ETH Zürich (CH), H. Baltes
25. University of Freiburg, IMTEK, Germany, G. Urban, J. Korvink, O. Paul.
26. University of Technology Berlin, Germany, E. Obermeier
27. University Leuven, Belgium, C. Kirschhock