

Sensor Systems

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In the following, a short overview over those activities of the Sensor Systems group which received support from the GMe will be given. The Sensor System group uses the facilities of the Center for Micro- and Nanostructures of the Vienna University of Technology (formerly "Microstructure Center " – MISZ) but also operates its own technology laboratories due to inherent incompatibilities of some processes and materials. The support received from the GMe allowed the purchase of a piece of equipment (a spray coater), which has been installed on the premises of the Center for Micro- and Nanostructures and consequently is also available to the other groups working there.

Introduction

In 2003, a spray coater has been installed in the MISZ (EVG 101 Advanced Spray Coater System, total costs € 50.000 of which € 20.000 was contributed by the GMe). Together with wafer-to-wafer bonding equipment, a back side aligner, and micro-machining equipment, it forms a processing line for integrated sensors and actuators. Several different substrate materials can be applied in the coater, e.g. silicon, pyrex glass or calcium fluoride wafers. The spray coater allows us to perform lithographic processing of wafers which already contain mechanical structures such as channels, cantilevers, or suspended membranes. These structures are the basis of integrated sensors and actuators. Spin coating cannot be used in this case because the resist would not form a uniform film over the irregular wafer surface.

After the installation, mid 2003, the equipment was tested together with EVG. Since the summer of that year, several new devices have been designed and fabricated using spray coating photolithography.

General

Spray processes are more complicated than spin-on processes. Many parameters like wafer rotation, resist volume, spray arm speed distribution and nitrogen pressure have to be evaluated to achieve homogeneously distributed layers. The consumption of resist is much lower than for spin coating (300 µl vs. 2 ml for 4 inch wafers).

Different spray coating processes were developed using the EVG 101 spray coater:

Deposition of positive resist "AZ 1512 HS"

For the fabrication of the particle shape sensor and the particle sorter device positive resist has to be deposited on a topographic surface in order to pattern a metal layer on top of a thick (60 µm) SU-8 layer which is exposed and softbaked. Due to the swelling of the exposed areas the surface of the SU-8 shows height differences of 5 µm. Homogenous layers with a thickness of 1.5 µm could be deposited.

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Deposition of image reversal resist "TI Spray"

In general, the viscosity of resists to be sprayed has to be lower than 20 cSt. The standard image reversal resist TI 35 ES is not suitable for spray processes because of its high viscosity. Dilution of this resist is not possible due to chemical problems.

"TI Spray" is an image reversal resist which can be deposited by spray coating. Additionally, it is possible to dilute the resist if necessary. A spray process for the deposition of 4 μm thick layers was developed. This allows the patterning of metal layers up to a thickness of 5 μm by evaporation and lift-off.

The new processes have been applied in several projects:

- Micromixers containing stacked channels (in cooperation with the Institute of Chemical Technologies and Analytics);
- Particle shape sensors containing optical detectors integrated in the channel (in cooperation with the Dutch Technology Foundation and the Delft University of Technology, NL);
- Particle sorters based on dielectrophoresis (in cooperation with the Delft University of Technology, NL);
- Particle separators based on dielectrophoresis; and
- Electrowetting devices (EU project MicroPROTEIN).

Project Information

Project Manager

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Project Group

Last Name	First Name	Status	Remarks
Agoston	Attila	PhD student	
Art	Georg	Student	
Chabicoovsky	Rupert	Univ. Prof.	
Hairer	Gabriel	PhD student	
Jachimowicz	Artur	Postdoc	
Jakoby	Bernhard	Assoc. Prof.	
Keplinger	Franz	Ass. Prof.	
Klinger	Franz	Student	
Kohl	Franz	Postdoc	
Kostner	Stefan	Student	
Kuntner	Jochen	PhD student	
Kvasnica	Samuel	PhD student	
Nieuwenhuis	Jeroen Hans	Ass. Prof.	
Oliveira	Sara	Student	ERASMUS
Pirker	Ewald	Technician	
Rakohl	Manfred	Technician	
Rocha Wiese Meneses	Daniel Paolo	Ass. Prof.	
Rogler	Gerhard	Technician	
Schalko	Johannes	Postdoc	
Stangl	Günther	Technician	
Strobach	Michael	Student	
Svasek	Edeltraud	Technician	
Svasek	Peter	Technician	
Valentin	Bernhard	Student	
Vellekoop	Michiel J.	Univ. Prof.	
Wölfl	Christoph	Technician	
Zoppel	Sandra	PhD student	

Books and Contributions to Books

1. M. Ando, H. Steffes, R. Chabicovsky, M. Haruta, G. Stangl:
"*Optical and Electrical Gas Sensing Properties of $In_xO_yN_z$ Films*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 139 - 144.
2. D. Bajalan, I. Groiss, G. Stangl, H. Hauser, P. Fulmek, P. Haumer:
"*Co/Pt Multi-Layer Production for Magnetic Nanostructures*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 193 - 199.
3. R. Fasching, F. Keplinger, G. Hanreich, G. Jobst, G. Urban, F. Kohl, R. Chabicovsky:
"*A Novel Miniaturized Sensor for Carbon Dioxide Dissolved in Liquids*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 151 - 158.
4. A. Glaninger, A. Jachimowicz, F. Kohl, R. Chabicovsky, G. Urban:
"*Wide Range Semiconductor Flow Sensors*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 163 - 168.
5. G. Hanreich, M. Mündlein, H. Hauser, J. Nicolics, G. Stangl, R. Grössinger, J. Espina-Hernandez:
"*Ultra Thin Pick-up Coil for Surface Flux Detection*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 171 - 176.
6. G. Hanreich, J. Nicolics, M. Mündlein, H. Hauser, R. Chabicovsky:
"*Development of a New Bonding Technique for Human Skin Humidity Sensors*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 145 - 150.
7. G. Hanreich, J. Nicolics, G. Stangl:
"*Investigation of the Thermal Performance of Micro-Whisker Structured Silicon Heat Spreaders for Power Devices*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 267 - 274.
8. H. Hauser, G. Stangl, J. Hochreiter, R. Chabicovsky, P. Aigner, R. Kloibhofer, W. Krenn, M. Janiba, K. Riedling:
"*Magneto-Resistive Sensors*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 49 - 56.
9. H. Hauser, R. Steindl, C. Hausleitner, J. Nicolics, A. Pohl:
"*Miniaturized Magnetic Field Sensors Utilizing GMI Effect and SAW Technology*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 127 - 136.
10. P. Hudek, I. Rangelow, I. Kostic, G. Stangl, P. Grabiec, E. Rangelow, M. Belov, F. Shi:
"*Chemically Amplified Deep UV Resists for Micromachining Using Electron Beam Lithography and Dry Etching*";
in: "[sensor & packaging]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 249 - 254.
11. B. Jakoby, F. Herrmann:
"*Chemical Sensors for Liquid Media*";

- in: "*Sensors for Automotive Applications*", WILEY-VCH GmbH & Co. KGaA, 2003, (invited), 516 - 527.
12. F. Keplinger, S. Kvasnica, H. Hauser, R. Grössinger:
"*Magnetic Cantilever Sensors*";
in: "[*sensor & packaging*]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 75 - 80.
 13. M. Mündlein, J. Nicolics, A. Aghzout, G. Hanreich, R. Chabicovsky, J. Morris:
"*Investigation of Conductive Adhesives*";
in: "[*sensor & packaging*]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 199 - 220.
 14. M. Mündlein, J. Nicolics, R. Chabicovsky, N. Sekiguchi, T. Komeda, H. Funakubo, G. Stangl:
"*Innovative Packaging Concept of a Miniaturized Skin Moisture Sensor and First Measuring Results*";
in: "[*sensor & packaging*]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 159 - 162.
 15. G. Stangl, G. Ehrenfels, F. Rüdener, J. Romstedt:
"*Stardust Collection Surfaces*";
in: "[*sensor & packaging*]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 177 - 180.
 16. G. Stangl, P. Hudek, I. Kostic, F. Rüdener, I. Rangelow, K. Riedling, W. Fallmann:
"*Micro-Technology of Densely Spaced Non-Conventional Patterns for Space Applications*";
in: "[*sensor & packaging*]", ÖVE, Wien, Austria, 2003, ISBN: 3-85133-032-3, 187 - 190.
 17. M. Vellekoop (ed.):
"*IEEE Sensors 2003 - Tutorial Lecture Notes*";
IEEE Sensors, 2003, ISBN: 0-7803-8133-5.

Publications in Reviewed Journals

1. R. Fasching, F. Kohl, G. Urban:
"*A miniaturized amperometric CO₂ sensor based on dissociation of copper complexes*";
Sensors and Actuators B, **93** (2003), 197 - 204.
2. B. Jakoby, M. Scherer, M. Buskies, H. Eisenschmid:
"*An Automotive Engine Oil Viscosity Sensor*";
IEEE Sensors Journal, **3** (2003), 5; 562 - 568.
3. F. Keplinger, S. Kvasnica, H. Hauser, R. Grössinger:
"*Optical Readouts of Cantilever Bending Designed for High Magnetic Field Application*";
IEEE Transactions on Magnetics, **39** (2003), 5; 3304 - 3306.
4. F. Kohl, R. Fasching, F. Keplinger, R. Chabicovsky, A. Jachimowicz, G. Urban:
"*Development of miniaturized semiconductor flow sensors*";
Measurement, **33** (2003), 109 - 119.
5. F. Laugere, R. Guijt, J. Bastemeijer, G. Van der Steen, A. Berthold, E. Baltussen, P. Sarro, G.W.K. Van Dedem, M. Vellekoop, A. Bossche:
"*On-Chip Contactless Four-Electrode Conductivity Detection for Capillary*

- Electrophoresis Devices*;
Anal. Chem., **75** (2003), 2; 306 - 312.
6. J. Nieuwenhuis, J. Bastemeijer, A. Bossche, M. Vellekoop:
"Near-Field Optical Sensors for Particle shape Measurements";
IEEE Sensors Journal, **3** (2003), 5; 646 - 651.
 7. J. Nieuwenhuis, J. Bastemeijer, P. Sarro, M. Vellekoop:
"Integrated flow-cells for novel adjustable sheath flows";
Lab on a Chip, **3** (2003), 56 - 61.
 8. A. Pauschitz, J. Schalko, Th. Koch, C. Eisenmenger-Sittner, S. Kvasnica, M. Roy:
"Nanoindentation and AFM studies of PECVD DLC and reactively sputtered Ti containing carbon films";
Bull. Mater. Sci., **26** (2003), 6; 585 - 591.
 9. F. Seifert, G. Riha:
"Evolution der akustischen Oberflächenwellen-Bauelemente";
Elektrotechnik und Informationstechnik (e&i), **3** (2003), 79 - 90.
 10. M. Vellekoop, B. Jakoby, R. Chabicovsky:
"Development trends in the field of sensors";
Elektrotechnik und Informationstechnik (e&i), **11** (2003), 120; 388 - 394.

Conference Presentations with Proceedings

1. A. Agoston, C. Ötsch, A. Ecker, F. Novotny-Farkas, H. Eisenschmid, S. Chvatal, M. Scherer, W.J. Bartz, B. Jakoby:
"Online-Monitoring of Lubrication Oil For Gas Engines";
Presentation: Zuverlässige Tribosysteme - Symposium 2003, Schwechat, Austria; 11-20-2003; in: *"Zuverlässige Tribosysteme - Werkstoffwahl - Berechnung - Sensorik"*, F. Franek, A. Pauschitz (ed.); (2003), ISBN: 3-901657-13-4; 109 - 116.
2. J. Espina-Hernandez, R. Grössinger, S. Kato, F. Keplinger, H. Hauser, E. Estévez-Rams:
"New Sensors for Measuring M and H in High Magnetic Fields";
Poster: 7th International Symposium on Research in High Magnetic Fields, Toulouse, France; 07-20-2003 - 07-23-2003; in: *"Proceedings"*, (2003), 129.
3. R. Grössinger, F. Keplinger, H. Hauser, E. Wagner:
"The Design and Construction of a Thin Foil High Field Magnet";
Poster: 7th International Symposium on Research in High Magnetic Fields, Toulouse, France; 07-20-2003 - 07-23-2003; in: *"Proceedings"*, (2003), 130.
4. V. Jordanov, J. Bastemeijer, A. Bossche, P. Sarro, M. Malátek, I. T. Young, G.W.K. Van Dedem, M. Vellekoop:
"PCR Array on Chip - Thermal Characterization";
Presentation: IEEE International Conference on Sensors 2003, Toronto, Canada; 10-21-2003; in: *"Proceedings of IEEE International Conference on Sensors"*, (2003), ISBN: 0-7803-8133-5; 1045 - 1048.
5. B. Jakoby:
"Sensors and Interface Electronics for Oil Condition Monitoring";
Presentation: GMe Forum 2003, Wien, Ö (invited); 04-10-2003 - 04-11-2003; in: *"Proceedings of the Seminar GMe Forum 2003"*, K. Riedling (ed.); (2003), ISBN: 3-901578-10-2; 45 - 48.
6. B. Jakoby, G. Art, J. Bastemeijer:
"Novel Readout Electronics for TSM Viscosity Sensors";

- Presentation: IEEE International Conference on Sensors 2003, Toronto, Canada; 10-21-2003; in: "*Proceedings of the IEEE International Conference on Sensors 2003*", (2003), ISBN: 0-7803-8133-5; 839 - 842.
7. B. Jakoby, R. Beigelbeck:
"*Hydrodynamical Analysis of Compressional Wave Excitation by Microacoustic TSM Liquid Sensors*";
Presentation: 6. Dresdner Sensor-Symposium - Sensoren für zukünftige Hochtechnologien und Neuentwicklungen für die Verfahrenstechnik, Dresden, D; 12-08-2003 - 12-10-2003; in: "*Tagungsband des 6. Dresdner Sensor-Symposium*", J.P. Baselt, G. Gerlach (ed.); w.e.b. Universitätsverlag, (2003), ISBN: 3-935712-92-8; 47 - 50.
 8. B. Jakoby, A. Ecker, M. Vellekoop:
"*Physical Sensors for Macro- and Microemulsions*";
Presentation: 17th European Conference on Solid-State Transducers (Eurosensors XVII), Guimaraes, Portugal; 09-21-2003 - 09-24-2003; in: "*Proceedings of EUROSENSORS XVII*", (2003), ISBN: 972-98603-1-9; 805 - 808.
 9. B. Jakoby, M. Vellekoop:
"*The Influence of Water Contamination on the Performance of Oil Condition Sensors*";
Presentation: 11th International Conference Sensors 2003, Nuremberg, Germany; 05-13-2003 - 05-15-2003; in: "*Proceedings Sensor 2003*", (2003), 123 - 128.
 10. F. Keplinger, S. Kvasnica, H. Hauser:
"*Measuring High Magnetic Fields With A U-Shaped Micro Machined Cantilever Using an Optical Readout*";
Presentation: INTERMAG 2003 (International Magnetism Conference Boston, March 30 - April 3), Boston, Massachusetts; 03-28-2003 - 04-03-2003; in: "*INTERMAG 2003 Diges CD-ROM*", (2003), 2 pages.
 11. F. Keplinger, S. Kvasnica, F. Kohl, H. Hauser:
"*Simulated and Measured Characteristic of a Micromachined Cantilever Sensor*";
Poster: GMe Forum 2003, Wien, Ö (invited); 04-10-2003 - 04-11-2003; in: "*Proceedings of the Seminar GMe Forum 2003*", K. Riedling (ed.); (2003), ISBN: 3-901578-10-2; 173 - 176.
 12. J. Kuntner, B. Jakoby:
"*Finite Element Analysis of Spurious Compressional Wave Excitation by Transverse-Shear-Mode Liquid Sensors*";
Poster: 17th European Conference on Solid-State Transducers (Eurosensors XVII), Guimaraes, Portugal; 09-21-2003 - 09-24-2003; in: "*Proceedings of EUROSENSORS XVII*", (2003), ISBN: 972-98603-1-9; 552 - 555.
 13. J. Kuntner, B. Jakoby:
"*Recent Advances in the Design and Analysis of Microacoustic Sensors*";
Presentation: 1st Congress of Alps-Adria Acoustics Association, Portoroz, Slovenia; 09-01-2003 - 09-02-2003; in: "*Proceedings of Alps-Adria Acoustics Association*", M. Cudina (ed.); (2003), ISBN: 961-6238-73-6; 543 - 548.
 14. J. Kuntner, G. Stangl, B. Jakoby:
"*Analyzing the Non-Newtonian Behavior of Oil-Based Liquids Using Microacoustic Sensors*";
Presentation: IEEE International Conference on Sensors 2003, Toronto, Canada; 10-21-2003; in: "*Proceedings of IEEE International Conference on Sensors 2003*", (2003), ISBN: 0-7803-8133-5; 956 - 960.
 15. J. Kuntner, G. Stangl, B. Jakoby:
"*Sensing Physical Parameters for the Characterization of Oil Based Liquids*";

- Poster: Mikroelektronik 2003 (ME 2003), Wien, Ö; 10-01-2003 - 10-02-2003; in: "*Beiträge der Informationstagung ME03*", G. Fiedler, D. Donhoffer (ed.); 33 (2003), ISBN: 3-85133-030-7; 431 - 435.
16. S. Kvasnica, P. Adamek, P. Spatenka:
"*Investigation of unbalanced planar magnetron discharge - experimentally acquired and simulated plasma parameters*";
Poster: 16th International Symposium on Plasma Chemistry, Taormina, Italy; 06-22-2003 - 06-27-2003; in: "*Book of Abstract: 16th Intern. Symposium on Plasma Chemistry*", (2003).
17. S. Kvasnica, P. Adamek, P. Spatenka:
"*Mapping of the internal plasma parameters of an unbalanced magnetron DC discharge*";
Poster: 16th International Symposium on Plasma Chemistry, Taormina, Italy; 06-22-2003 - 06-27-2003; in: "*Book of Abstract: 16th International Symposium on Plasma Chemistry*", ID 523 (2003), 6 pages.
18. M. Mündlein, R. Chabicovsky, J. Nicolics, B. Valentin, P. Svasek, E. Svasek, T. Komeda, H. Funakubo, T. Nagashima, T. Itoh:
"*Mikrosensor zur Bestimmung des Transepidermalen Wasserverlustes der Menschlichen Haut*";
Poster: Mikroelektronik 2003 (ME 2003), Wien, Ö; 10-01-2003 - 10-02-2003; in: "*Tagungsband Mikroelektronik 2003*", (2003), ISBN: 3-85133-030-7; 349 - 354.
19. M. Mündlein, H. Hauser, J. Nicolics, R. Chabicovsky:
"*Partial Discharge Current Measurement in High Permittivity Dielectrics and their Meaning for Quality Control*";
Poster: 26th International Spring Seminar on Electronics Technology, Stará Lesná, Slovak Republic; 05-08-2003 - 05-11-2003; in: "*Proceedings ISSE 2003*", (2003), ISBN: 0-7803-8002-9; 438 - 443.
20. M. Mündlein, J. Nicolics, R. Chabicovsky, P. Svasek, E. Svasek, T. Komeda, H. Funakubo, T. Nagashima, M. Ito:
"*Packaging of a thin film sensor for transepidermal water loss measurements*";
Presentation: 26th International Spring Seminar on Electronics Technology, Stará Lesná, Slovak Republic; 05-08-2003 - 05-11-2003; in: "*Proceedings ISSE 2003*", (2003), ISBN: 0-7803-8002-9; 328 - 333.
21. J. Nieuwenhuis:
"*Particle Behaviour in a Non-Coaxial Sheath Flow for Application in an Integrated Coulter-Counter*";
Presentation: 11th International Conference Sensors 2003, Nuremberg, Germany; 05-13-2003 - 05-15-2003; in: "*Proceedings of the 11th Intern. Conf. SENSOR 2003*", (2003), 81 - 83.
22. J. Nieuwenhuis, J. Bastemeijer, P. Sarro, M. Vellekoop:
"*First Measurement Results with an Integrated Projection Cytometer*";
Poster: Seventh International Conference on Micro Total Analysis Systems (μ TAS2003), Squaw Valley, California, USA; 10-03-2003 - 10-09-2003; in: "*Proceedings of μ TAS 2003*", M. Northrup, K.F. Jensen, D.J. Harrison (ed.); (2003), ISBN: 0-9743611-0-0; 1219 - 1222.
23. J. Nieuwenhuis, J. Bastemeijer, P. Sarro, M. Vellekoop:
"*Novel Flow-Cell to Create a Sheath Flow with Adaptable Sample Flow Dimensions*";
Poster: GMe Forum 2003, Wien, Ö (invited); 04-10-2003 - 04-11-2003; in: "*Proceedings of the Seminar GMe Forum 2003*", K. Riedling (ed.); (2003), ISBN: 3-901578-10-2; 177 - 181.

24. J. Nieuwenhuis, J. Bastemeijer, P. Sarro, M. Vellekoop:
"Novel Flow-Cell to Create a Sheath Flow with Adaptable Sample Flow Dimensions";
Poster: Mikroelektronik 2003 (ME 2003), Wien, Ö; 10-01-2003 - 10-02-2003; in:
"Beiträge der Informationstagung ME03", 33 (2003), ISBN: 3-85133-030-7; 1 - 5.
25. J. Nieuwenhuis, F. Kohl, J. Bastemeijer, M. Vellekoop:
"First Particle Measurements with an Integrated Coulter Counter based on 2-Dimensional Aperture Control";
Presentation: 12th International Conference on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS 03), Boston, Massachusetts, USA; 06-08-2003 - 06-12-2003; in: "Digest of Technical Papers - Transducers 03", 1 (2003), ISBN: 0-7803-7731-1; 296 - 299.
26. J. Nieuwenhuis, M. Vellekoop:
"Improved Dielectrophoretic Particle Actuators for Microfluidics";
Presentation: IEEE International Conference on Sensors 2003, Toronto, Canada; 10-21-2003; in: "Proceedings of IEEE International Conference on Sensors ", (2003), ISBN: 0-7803-8133-5; 573 - 577.
27. J. Nieuwenhuis, M. Vellekoop:
"Performance Comparison of Dielectrophoretic Particle Sorters based on a Novel Analysis Method";
Poster: 17th European Conference on Solid-State Transducers (Eurosensors XVII), Guimaraes, Portugal; 09-21-2003 - 09-24-2003; in: "Proceedings of EUROSENSORS XVII", (2003), ISBN: 972-98603-1-9; 276 - 279.
28. G. Stangl, A. Gabriel, A. Eder, E. Wintner, W. Fallmann:
"Study on excimer laser applications in dentistry with special consideration of the ArF line ($\lambda = 193$ nm wavelength) ";
Presentation: 2nd Congress of the European Society for Oral Laser Applications ESOLA, Florence, Italy; 05-15-2003 - 05-18-2003; in: "Digest", (2003), 41.
29. A. Steinschaden, G. Urban, R. Chabicovsky:
"Thin film conductometric urea sensor";
Poster: 17th European Conference on Solid-State Transducers (Eurosensors XVII), Guimaraes, Portugal; 09-21-2003 - 09-24-2003; in: "CD-ROM Proceedings EUROSENSOR XVII", (2003), ISBN: 972-98603-1-9; 240 - 243.
30. P. Svasek, E. Svasek, P. Hinsmann, B. Lendl, M. Harasek, M. Vellekoop:
"Micromachined Mixing Device for FTIR-Spectroscopy";
Poster: GMe Forum 2003, Wien, Ö (invited); 04-10-2003 - 04-11-2003; in:
"Proceedings of the Seminar GMe Forum 2003", K. Riedling (ed.); (2003), ISBN: 3-901578-10-2; 183 - 187.
31. P. Svasek, E. Svasek, B. Lendl, M. Vellekoop:
"SU-8-Based Fluidic Devices";
Poster: 17th European Conference on Solid-State Transducers (Eurosensors XVII), Guimaraes, Portugal; 09-21-2003 - 09-24-2003; in: "Eurosensors XVII - Book of Abstracts", (2003), ISBN: 972-98603-1-9; 283 - 286.

Other Presentations

1. M. Vellekoop:
"Integrated Sensor Systems";
Presentation: Österreichische Akademie der Wissenschaft, Vienna, Austria (invited); 06-26-2003.

2. M. Vellekoop:
"*Physical Chemosensors*";
Presentation: Smart Sensor Systems Course 2003, Delft, The Netherlands (invited); 05-13-2003.
3. M. Vellekoop:
"*Sensing in Microfluidic Systems*";
Presentation: 6. Dresdner Sensor-Symposium - Sensoren für zukünftige Hochtechnologien und Neuentwicklungen für die Verfahrenstechnik, Dresden, Germany (invited); 12-09-2003.
4. M. Vellekoop:
"*Sensors for Medical Applications*";
Presentation: Chirurgen Kongress 2003, Bregenz, Austria (invited); 06-21-2003.

Patents

1. J. Nieuwenhuis, M. Vellekoop:
"Teilchen- und Zellendetektor basierend auf der Coulter-Methode unter Verwendung einer nicht-koaxialen partiellen Schichtströmung und einer zweidimensionalen Dynamischen Apertursteuerung";
Patent: Austria, No. A672-2002; submitted: 05-02-2002, granted: 02-24-2003.

Diploma Theses

1. G. Art:
"*Entwurf und Aufbau einer neuen Auswertelektronik für den Prototyp eines Viskositätssensors*";
Supervisor: B. Jakoby; Institut für Industrielle Elektronik und Materialwissenschaften, 2003.
2. W. Fürst:
"*Transducers for physical chemosensing*";
Supervisor: M. Vellekoop; Institut für Industrielle Elektronik und Materialwissenschaften, 2003.
3. D. Janneau:
"*Viscosity measurement techniques using Thickness-Shear Mode*";
Supervisor: B. Jakoby; Institut für Sensor- und Aktuatorssysteme, 2003.