

Table of Contents

Author Index	XV
--------------------	----

Part 1 Opening Lectures

Process Intensification Through Miniaturization of Chemical and Thermal Systems in the 21st Century	2
<i>R.S. Wegeng, M.K. Drost, D.L. Brenchley</i>	

Implementation of Microreaction Technology in Process Engineering	14
<i>W. Ehrfeld, V. Hessel, S. Kiesewalter, H. Löwe, Th. Richter, J. Schiewe</i>	

Part 2 Design and Production of Microreactor Systems

Lecture Session

Fabrication and Application of Silicon-based Microchannels	36
<i>J.G.E. Gardeniers, R.W. Tjerkstra, A. van den Berg</i>	

Macroporous and Mesoporous Silicon: New Materials for Microfluidic and Microreaction Devices	45
<i>V. Lehmann</i>	

The Effect of Shape Variation in Microlamination on the Performance of High-Aspect-Ratio, Metal Microchannel Arrays	53
<i>B.K. Paul, R.B. Peterson, W. Wattanutchariya</i>	

Fabrication of Microchannel Chemical Reactors Using a Metal Lamination Process	62
<i>D.W. Matson, P.M. Martin, D.C. Stewart, A.L.Y. Tonkovich, M. White, J.L. Zilka, G.L. Roberts</i>	

Poster Session

Microreactor Technology for Biological Applications	72
<i>G.M. Greenway, T. McCready</i>	

VIII

Laserprocessing for Manufacturing Microfluidic Devices	80
<i>E. Bremus, A. Gillner, D. Hellrung, H. Höcker, F. Legewie, R. Poprawe, M. Wehner, M. Wild</i>	
Functional Coatings for Microstructure Reactors and Heat Exchangers	90
<i>M. Fichtner, W. Benzinger, K. Haas-Santo, R. Wunsch, K. Schubert</i>	
Polymer Nanowell Plates with Variable Well Slope Angles	102
<i>H. Becker, T. Klotzbücher</i>	
Micro Molding of Fluidic Devices for Biochemical Applications	113
<i>M. Niggemann, W. Ehrfeld, L. Weber</i>	

Part 3

Microreactors in Combinatorial Chemistry

Lecture Session

Combinatorial Organic Compound Libraries on Continuous Surfaces:	
Towards Chemical Chips	124
<i>L. Germeroth, U. Reineke, K. Dietmeier, C. Piossek, N. Heine, D. Scharn, T. Ast, M. Schulz, H. Matuschewski, A. Kramer, J. Schneider-Mergener, H. Wenschuh</i>	

Part 4

Microreactors in Production Processes

Lecture Session

Electrochemical Microreactors: A New Approach for Microreaction Technology	136
<i>A. Ziogas, H. Löwe, M. Küpper, W. Ehrfeld</i>	

High Temperature HCN Generation in an Integrated Microreaction System	151
<i>V. Hessel, W. Ehrfeld, K. Golbig, C. Hofmann, St. Jungwirth, H. Löwe, Th. Richter, M. Storz, A. Wolf, O. Wörz, J. Breysse</i>	

Micro Mixing Effects in Continuous Radical Polymerization	165
<i>T. Bayer, D. Pysall, O. Wachsen</i>	

Novel Liquid Phase Microreactors for Safe Production of Hazardous Specialty Chemicals	171
<i>T.M. Floyd, M.W. Losey, S.L. Firebaugh, K.F. Jensen, M.A. Schmidt</i>	

Experiences with the Use of Microreactors in Organic Synthesis	181
<i>H. Krummradt, U. Koop, J. Stoldt</i>	
A Microstructured Reactor for the Catalytic Partial Oxidation of Methane to Syngas	187
<i>J. Mayer, M. Fichtner, D. Wolf, K. Schubert</i>	
Expansion of Microreactor Capabilities through Improved Thermal Management and Catalyst Deposition	197
<i>A.J. Franz, S.K. Ajmera, S.L. Firebaugh, K.F. Jensen, M.A. Schmidt</i>	
Synthesis of Ethylene Oxide in a Microreaction System	207
<i>H. Kestenbaum, A. Lange de Oliveira, W. Schmidt, F. Schüth, W. Ehrfeld, K. Gebauer, H. Löwe, Th. Richter</i>	
Selective Reactions in Microchannel Reactors	213
<i>A. Kursawe, E. Dietzsch, S. Kah, D. Hönicke, M. Fichtner, K. Schubert, G. Wießmeier</i>	
Periodic Operation in Microchannel Reactors	224
<i>M.A. Liauw, M. Baerns, R. Broucek, O.V. Buyevskaya, J.-M. Commengé, J.-P. Corriou, L. Falk, K. Gebauer, H.J. Hefter, O.-U. Langer, H. Löwe, M. Matlosz, A. Renken, A. Rouge, R. Schenk, N. Steinfeldt, St. Walter</i>	
Poster Session	
Micro-Reactor Synthesis: Synthesis of Cyanobiphenyls Using a Modified Suzuki Coupling of an Aryl Halide and Aryl Boronic Acid	235
<i>V. Skelton, G.M. Greenway, S.J. Haswell, P. Styring, D.O. Morgan</i>	
Optimization of Reaction-Separation Networks via Mass Integration on the μ -Scale	243
<i>F. Štěpánek, M. Marek</i>	
Modelling of Gas-Liquid Catalytic Reactions in Microchannels	253
<i>P. Angeli, D. Gobby, A. Gavriilidis</i>	
Simultaneous Screening of Catalysts in Microchannels: Methodology and Experimental Setup	260
<i>T. Zech, D. Hönicke, A. Lohf, K. Golbig, Th. Richter</i>	
Palladium Membrane Microreactors	267
<i>A.J. Franz, K.F. Jensen, M.A. Schmidt</i>	
A Micro Packed-Bed Reactor for Chemical Synthesis	277
<i>M.W. Losey, M.A. Schmidt, K.F. Jensen</i>	

Parallel Synthesis and Testing of Heterogeneous Catalysts	287
<i>U. Rodemerck, P. Ignaszewski, M. Lucas, P. Claus, M. Baerns</i>	

Single Flow Electrochemical Microreactor Application to Furan Methoxylation	294
<i>R. Ferrigno, V. Reid, H.H. Girault</i>	

Part 5

Microfluidics

Lecture Session

Microfluidic Devices for Sample Preparation (Liquid) in the Nanoliter Range	302
<i>H. Fiehn</i>	

Liquid Handling in the Pico- and Nanoliter Range	312
<i>W. Meyer, M. Döring</i>	

Flow-Through Microdispenser for Liquid Handling in a Levitated-Droplet Based Analyzing System	320
<i>J. Nilsson, T. Laurell, M. Petersson, S. Santesson, T. Johansson, E. Degerman, S. Nilsson</i>	

Simulation of Microscale Chemical Separation Processes Using the Lattice- Boltzmann Method	327
<i>D.R. Rector, B.J. Palmer</i>	

Modelling of Complex Reaction-Separation Processes in a D.C. Electric Field in Microchannels	336
<i>D. Snita, J. Kosek, H. Sevcikova, J. Lindner, J. Havlica, M. Paces, M. Marek</i>	

Poster Session

Microporous Silica Structures for the Immobilisation of Catalysts and Enhancement of Electroosmotic Flow (EOF) in Micro-Reactors	346
<i>N.G. Wilson, T. McCready</i>	

A New Hydraulic Stroke Amplifier for Microfluidic Components	353
<i>N. Schwesinger, S. Pobering</i>	

Part 6**Microreactors for Energy Generation and Storage****Lecture Session**

- Microchannel Chemical Reactors for Fuel Processing Applications. 364
II. Compact Fuel Vaporization 364
*A.L.Y. Tonkovich, S.P. Fitzgerald, J.L. Zilka, M.J. LaMont, Y. Wang,
D.P. VanderWiel, R.S. Wegeng*

- Microstructured Catalysts for Methanol-Steam Reforming 372
P. Pfeifer, M. Fichtner, K. Schubert, M.A. Liauw, G. Emig

- Fuel Cells for Low Power Applications 383
C. Hebling, A. Heinzel, D. Golombowski, T. Meyer, M. Müller, M. Zedda

Poster Session

- Recent Developments in Microtechnology-Based Chemical Heat Pumps 394
M.K. Drost, M. Friedrich, C. Martin, J. Martin, R.J. Cameron

- Miniaturised Direct Methanol Fuel Cell with a Plasma Polymerised
Electrolyte Membrane 402
L. Mex, J. Müller

Part 7**Application of Microreactors in Drug Development and
Biotechnology****Lecture Session**

- Rapid PCR in Flow-Through Si Chip Thermocyclers 410
S. Poser, R. Ehricht, T. Schulz, S. Uebel, U. Dillner, J. M. Köhler

- Disposable Electrophoresis Chip for High Throughput Analysis of
Biomolecules 420
*R. Konrad, W. Ehrfeld, H.-J. Hartmann, P. Jacob, M. Neumann,
R. Pommersheim, I. Sommer, J. Wolfrum*

- A Micromachined Analysis System for Rapid Protein Identification 430
*S. Ekström, P. Önnerfjord, M. Bengtsson, J. Nilsson, T. Laurell,
G. Marko-Varga*

Simulation of Biochemical Reaction Kinetics in Microfluidic Systems 441
V.B. Makhijani, J. Raghavan, A. Przekwas, A.J. Przekwas

Microfluidic Devices on Polymer Substrates for Bioanalytical Applications . . 451
*Y. Lin, D.W. Matson, D.E. Kurath, J. Wen, F. Xiang, W.D. Bennett,
P.M. Martin, R.D. Smith*

Poster Session

Transfer of Plasmid DNA into Cells with Microelectroporation Arrays on a
Chip 461
R. Poppe

On-line Monitoring of Enzyme Activities Using Microreactor Heat Power
Meters 469
J. Lerchner, A. Wolf, A. Weber, R. Hüttl, G. Wolf, J.M. Köhler, M. Zieren

Isothermal Biochemical Amplification in Miniaturized Reactors with
Integrated Microvalves 479
R. Bräutigam, D. Steen, R. Ehricht, J.S. McCaskill

Microfluidic Filtration Chip for DNA Extraction and Concentration 488
A. Przekwas, D. Wang, V.B. Makhijani, A.J. Przekwas

Part 8

Commercialization of Microreaction Technology

Lecture Session

The Commercial Use of Multilayer Microcapsules for Biotechnological
Applications 500
R. Pommersheim, A. Noack, S. Scholz

Part 9

Microreaction Devices

Lecture Session

A Capillary Force Filled Auto-Mixing Device 506
R.U. Seidel, D.Y. Sim, W. Menz, M. Esashi

Fast Heating and Cooling for High Temperature Chemical Microreactors . . . 514
Ch. Alépée, R. Maurer, L. Paratte, L. Vulpescu, Ph. Renaud, A. Renken

Gas / Liquid Microreactors for Direct Fluorination of Aromatic Compounds Using Elemental Fluorine	526
<i>V. Hessel, W. Ehrfeld, K. Golbig, V. Haverkamp, H. Löwe, M. Storz, Ch. Wille, A.E. Guber, K. Jähnisch, M. Baerns</i>	
Solvent Extraction and Gas Absorption Using Microchannel Contactors	541
<i>W.E. TeGrotenhuis, R.J. Cameron, V.V. Viswanathan, R.S. Wegeng</i>	
Poster Session	
Polymer Membranes for Product Enrichment in Microreaction Technology	550
<i>B. Schiewe, A. Vuin, N. Günther, K. Gebauer, Th. Richter, G. Wegner</i>	
Compact Heat Exchangers	556
<i>L.A. Luo, U. D'Ortona, D. Tondeur</i>	
Optimizing the Geometry of a Catalytic Enzyme Microreactor in Porous Silicon	566
<i>M. Bengtsson, J. Drott, T. Laurell</i>	
High Aspect Ratio Silicon Micromachined Heat Exchanger	573
<i>J. Bengtsson, L. Wallman, T. Laurell</i>	
Comparison of Two Microvalve Designs Fabricated in Mild Steel	578
<i>B.K. Paul, T. Terhaar</i>	
Integrated Microfluidics / Electrochemical Sensor System for Field-Monitoring of Toxic Metals	588
<i>Y. Lin, D.W. Matson, W.D. Bennett, K.D. Thrall, C. Timchalk</i>	
Thermoelectrical Measurement System for Chemical Instrumentation	597
<i>S. Beißner, T. Elbel, J.M. Köhler, M. Zieren</i>	
Electrically Heated Microstructure Heat Exchangers and Reactors	607
<i>J. Brandner, M. Fichtner, K. Schubert</i>	
Analytical Module for In-line IR Spectroscopy of Chemical Reactions in Microchannels	617
<i>A.E. Guber, W. Bacher</i>	
A Microstructure Reactor for Gas Purification	625
<i>R. Wunsch, M. Fichtner, K. Schubert</i>	
A Flexible Multi-Component Microreaction System for Liquid Phase Reactions	636
<i>Th. Richter, W. Ehrfeld, V. Hessel, H. Löwe, M. Storz, A. Wolf</i>	

Fast Response Heating Module for Temperature Programmed GC Analysis in Microreaction Systems	645
<i>J. Schiewe, W. Ehrfeld, T. Hang, H. Löwe, Th. Richter, X.L. Yan, A.A. Kurganov, K.K. Unger</i>	
A Silicon-based Microreaction System for Analytical Applications	654
<i>P. Woias, K. Hauser, E. Yacoub-George, B. Hillerich</i>	
Designing and Constructing Microplants	664
<i>H. Fink, M.J. Hampe</i>	
A Modular Microreactor Design for High-Temperature Catalytic Oxidation Reactions	674
<i>G. Veser, G. Friedrich, M. Freygang, R. Zengerle</i>	
Microstructured Reactor for Consecutive Heterogeneous / Homogeneous Gas Phase Reactions	687
<i>Th. Richter, W. Ehrfeld, D. Erntner, K. Gebauer, K. Golbig, H. Löwe, A. Lange de Oliveira, W. Schmidt, F. Schüth</i>	