

Contents

Preface V

Foreword VII

List of Contributors XI

Nomenclature XV

- 1 **Process Engineering Methods and Microsystem Technology** 1
Norbert Kockmann
- 2 **Momentum and Heat Transfer in Microsized Devices** 47
Heinz Herwig
- 3 **Transport Processes and Exchange Equipment** 71
Norbert Kockmann
- 4 **Multiphase Flow, Evaporation, and Condensation at the Microscale** 115
Michael K. Jensen, Yoav Peles, Theodorian Borca-Tasciuc, and Satish G. Kandlikar
- 5 **Generation and Multiphase Flow of Emulsions in Microchannels** 149
Isao Kobayashi and Mitsutoshi Nakajima
- 6 **Chemical Reactions in Continuous-flow Microstructured Reactors** 173
Albert Renken and Lioubov Kiwi-Minsker
- 7 **Design Process and Project Management** 203
Steffen Schirrmeyer, Jürgen J. Brandner, and Norbert Kockmann
- 8 **Simulation and Analytical Modeling for Microreactor Design** 235
Osamu Tonomura

- 9 Integration of Sensors and Process-analytical Techniques** 249
Stefan Löbbecke
- 10 Microfabrication in Metals and Polymers** 267
Jürgen J. Brandner, Thomas Gietzelt, Torsten Henning, Manfred Kraut, Holger Mortiz, and Wilhelm Pfleging
- 11 Silicon Microfabrication for Microfluidics** 321
Frank Goldschmidtböing, Michael Engler, and Alexander Doll
- 12 Microfabrication in Ceramics and Glass** 353
Regina Knitter and Thomas R. Dietrich
- 13 Industrial Applications of Microchannel Process Technology in the United States** 387
Daniel R. Palo, Victoria S. Stenkamp, Robert A. Dagle, and Goran N. Jovanovic
- 14 Industrial Applications in Europe** 415
Thomas Bayer and Markus Kinzl
- 15 Industrial Production Plants in Japan and Future Developments** 439
Jun-ichi Yoshida and Hideho Okamoto
- 16 Laboratory Applications of Microstructured Devices in Student Education** 463
Walther Klemm, Bernd Ondruschka, Michael Köhler, and Mike Günther
- Subject Index** 497