

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 Schirrmeister, 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