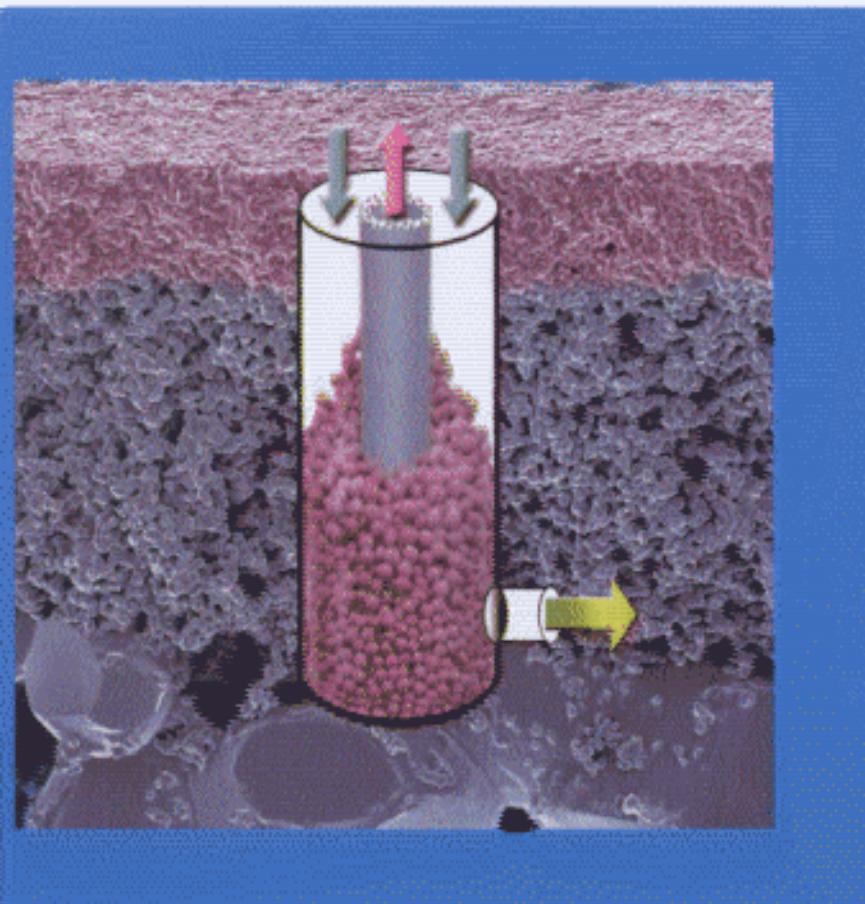




WILEY-VCH

José G. Sanchez Marcano and
Theodore T. Tsotsis

Catalytic Membranes and Membrane Reactors



Contents

1 Introduction	1
1.1 Principles of Membrane Separation Processes	1
1.2 The Coupling of the Membrane Separation Process with a Catalytic Reaction	5
1.3 References	11
2 Catalytic Membrane Separation Processes	15
2.1 Dehydrogenation Reactions	15
2.2 Hydrogenation Reactions	25
2.3 Oxidation Reactions	31
2.4 Other Catalytic Reactions	62
2.5 References	81
3 Pervaporation Membrane Reactors	97
4 Membrane Bioreactors	133
4.1 Membrane Reactors for the Production of Biochemicals	133
4.1.1 Whole-cell Membrane Bioreactors	136
4.1.2 Enzymatic Membrane Bioreactors	142
4.1.3 Technical Challenges for Membrane Bioreactors	147
4.2 Environmental Applications of Membrane Bioreactors	150
4.3 References	164
5 Modelling of Membrane Reactors	169
5.1 Catalytic Membrane Reactors	170
5.1.1 Fundamentals	170
5.1.2 Thermal Effects	181
5.1.3 The Catalytic Membrane Reactor vs. Conventional Reactors	188
5.1.4 Non-permselective Catalytically Active Membranes	191
5.1.5 Three-Phase Catalytic Membrane Reactors	198
5.1.6 Other Modelling Aspects of Catalytic Membrane Reactors	200

- 5.2 Modelling of Pervaporation Membrane Reactors 209**
- 5.3 Modelling of Membrane Bioreactors 213**
- 5.4 References 218**

6 Economic and Technical Feasibility Issues of Membrane Reactor Processes 223

- 6.1 Catalytic Membrane Reactors 223**
- 6.2 Membrane Bioreactors 231**
- 6.3 References 238**

7 Conclusions 241

8 Index 243