

Index

A

Active mixing, 198
Adhesives, 56, 74–76, 79, 86, 119
Advection, 23–25, 200, 201, 206, 208
Alignment, 60, 64, 68, 71, 74, 76, 77, 79, 80, 89
Amperometry, 114, 148, 156, 188
Anisotropic etch, 95
Array, 3, 102, 112, 121, 156, 205, 213
Assembly methods, 55, 56, 58, 74–77

B

Biosensors, 9, 11, 12, 116, 141–158, 171
Body-on-chip, 4
Boundary conditions, 21, 22, 25, 26, 29, 45

C

Capillarity, 2, 3, 86, 87, 90–92
Centrifugal microfluidics, 93–95, 105, 155
COC. *See* Cyclic olefin copolymer (COC)
Colorimetric detection, 186
Commercialization, 77, 78
Computational fluid dynamics software, 5, 7, 9, 13, 200
Conductive polymers, 156
Conductometry, 148, 188
Convection, 23, 29, 43–46, 198, 202
Cyclic olefin copolymer (COC), 7, 65, 69, 95, 98, 168

D

Damping coefficient, 39
Density, 18–21, 32, 113, 178, 180, 183, 199, 201, 212
Diagnostics, 3, 6–8, 10, 14, 89–91, 95, 102, 104, 120–121, 141, 155, 161–190
Dicing, 63, 64, 79, 80
Diffusion, 23–25, 28, 29, 33, 34, 42–49, 85, 89, 108–110, 166, 167, 175, 182, 198–200, 202, 203, 205, 209, 213
Diffusion coefficient, 24, 25, 46, 47, 198, 199, 205
Diffusive mixing time (T_m), 198, 199, 201, 210
Digital microfluidics, 5, 6, 93, 205, 210
Dimensionality, 28
DNA sensing, 152, 157
Dose on demand, 211, 222, 223
Drug screening, 155

E

Electrochemical sensing, 188, 189
Electrochemical sensors, 147, 152, 154, 189
Electrochemistry, 113, 142, 148, 189
Electrodes, 3, 27, 90, 92, 102, 109, 113, 114, 141–150, 152, 154, 156, 157, 188, 189, 225
Electrokinetics, 92–93, 102
Electroosmotic flow, 23, 93, 109, 113
Energy dissipation, 209
Environmental monitoring, 113, 141, 170, 186

Enzymatic catalysis, 185, 218
Etching, 56–60, 62, 64, 73, 95, 144, 145
Explosives, 217

F

Fabrication methods, 2, 3, 53, 60, 64, 66–69,
72, 73, 77, 78, 157
Field effect transistor (FET), 149
Flow profile, 22, 28, 29, 41–43, 46, 92, 113
Flow rate, 6, 18, 22, 35, 37, 39, 40, 46, 47, 60,
116, 175, 178, 180, 183, 200–203, 205,
206, 208, 210, 213, 230
Fluids definition, 17
Food safety, 141, 155, 170, 186
Fourier number, 198

G

Gas chromatography, 84
Geometric restriction, 205
Glass, 2, 3, 8–10, 56–64, 66, 72–80, 84, 91, 92,
95, 97, 109, 116, 142, 144, 166, 168,
182, 183, 200, 207, 214–216, 229
Gravimetric sensors, 116
Grignard reagent, 228, 229

H

Hagen, G.H.L., 2
Hagen–Poiseuille equation, 2, 35, 40
History, 1–14, 56, 60, 171, 178
Hot embossing 3D printing, 56
Hydraulic diameter, 198
Hydraulic resistance, 22, 35–40, 44
Hydrodynamic restriction, 205

I

Immunosensors, 154, 155
Impedance spectroscopy, 156, 157
Impedimetric, 148, 149, 188
Injection moulding, 56, 66–70, 72, 73, 76, 78,
80
Ink-jet, 2, 145, 147, 179
Inkjet printing, 144–146, 157, 169, 171, 179
Integration, 3, 4, 55, 60, 65, 67, 72, 78, 79, 103,
141, 142, 148, 157, 189, 226
Isotropic etch, 59, 60, 95

J

Jurin, J., 2

L

Laminar flow, 20, 32, 34, 85, 89, 91, 105, 182,
201, 206
Lateral flow, 170, 176, 183, 186
Lumped element, 28, 29, 34–38, 43

M

Mask, 58, 59, 63, 64, 144, 146, 169
Materials, 2–4, 17, 21, 28, 53–61, 63–80, 84,
87, 91, 95–98, 102–104, 113, 142, 144,
149, 156, 157, 165–171, 173–180, 182,
186, 189, 190, 200, 209, 213, 214, 225,
232
Medical diagnostics, 155, 186
MEMS. *See* Micro-electromechanical systems
(MEMS)
Mesh convergence, 47
Meshing, 50
Meso reactors, 226–232
Metals, 54, 60, 62, 67, 68, 70, 73, 74, 76, 78,
80, 102, 107, 156, 157, 183, 200, 214,
225, 229
Micro-electromechanical systems (MEMS), 6,
12, 50, 84, 95, 121
Microfluidic companies, 5–11
Microfluidic conferences, 4, 13, 14
Microfluidic forums, 4, 13
Microfluidic journals, 4, 12
Microfluidic platforms, 7, 10, 85, 88, 90, 96,
141, 142, 155, 157
Microfluidics theory, 2, 12, 14, 17–26, 28, 32, 36
Micromilling, 60–63, 66–67, 72, 77, 79, 80
Micro mixing, 200–231
Micropumps, 5, 6, 72, 102, 105–108
Microreactors, 8, 9, 198–202, 205, 206, 208,
209, 211, 212, 214–218, 220, 226–233
Microsystems, 14, 18–20, 23, 141
Microvalves, 72, 83, 88, 98–105, 107, 201
Micro vessel systems (MVS), 211, 220, 226,
232–233
Migration, 23, 230
Multilamination, 198, 201, 202, 205–207, 210

N

Nanotechnology, 3
Navier–Stokes equation, 20–22, 26, 32, 36
Nernst equation, 148
Newtonian liquids, 19, 21, 35
Non-Newtonian liquids, 176
No slip condition, 21, 22, 26
Numerical simulations, 28, 33, 38, 39, 50

O

Optical sensors, 12, 116, 184
Organs-on-chip, 4

P

Packed beds, 201, 209–213
Paper, 2, 3, 27, 28, 30, 50, 51, 56, 83, 84, 90,
91, 94, 118, 119, 144, 146, 164–189
Paper sensors, 175, 183–189
Passive mixing, 198–200
PC. *See* Polycarbonate (PC)
PDMS. *See* Polydimethylsiloxane (PDMS)
PE. *See* Polyethylene (PE)
Péclet number, 24–25, 28, 32–35, 198,
212, 213
PET. *See* Polyethylene terephthalate glycol
(PET)
Photolithography, 3, 56–60, 144, 169
Photoresist, 58, 59, 96, 184
PI. *See* Polyimide (PI)
PMMA. *See* Poly methyl methacrylate
(PMMA)
Point-of-care (POC), 5, 6, 9, 10, 14, 84, 86, 88–
90, 92, 95–97, 102, 104, 114, 118–121,
141, 142, 157, 161, 163, 164, 170, 171,
177, 180
Poiseuille, Jean Léonard, 2
Polycarbonate (PC), 7, 65, 98, 168, 181, 232
Polydimethylsiloxane (PDMS), 3, 7, 72, 73, 76,
86, 87, 91, 96, 101, 103, 104, 107, 113,
116, 120, 121, 150, 154, 168, 178, 211,
232
Polyethylene (PE), 65, 207
Polyethylene terephthalate glycol (PET),
65, 146
Polyimide (PI), 65
Polymers, 5, 9, 10, 54, 56, 57, 59, 65–78, 80, 84,
90, 91, 95, 96, 102–104, 107, 113, 116,
120, 144, 145, 150, 152, 154, 156, 166,
168, 175, 178–180, 186, 200, 214, 230
Poly methyl methacrylate (PMMA), 65, 77, 95,
97, 98, 168, 175
Potentiometry, 114, 148–149
Powder blasting, 56, 63
Pressure, 2, 18, 21–23, 26, 32, 35–40, 58, 62–
64, 68, 70, 72–75, 87, 89, 98, 100, 101,
104, 105, 109, 111, 113, 116, 121, 163,
166, 171, 174, 178, 198–209, 212, 213,
220, 229, 233
Pressure drop, 2, 22, 35, 36, 38, 39, 174,
199–204, 207–209, 213
Prototyping, 3, 56, 67, 71, 72, 74, 77–78, 86,
96, 169, 232

Q

Quasi-3D, 39–42

R

Radiochemistry, 211, 214, 218–219, 222,
224–226, 232–233
Reactive-ion etching (RIE), 60, 95, 110
Reference electrode, 146–150, 188
Reynolds number, 19, 28, 32–34, 36, 40, 42,
108, 182, 198
RIE. *See* Reactive-ion etching (RIE)
Rigid polymers, 65–73

S

Screen printing, 145–147, 157, 169
Serial and parallel coupling, 36–38
Shear rate, 18, 176
Shear strain, 18
Shear stress, 18
Silicon, 60, 70, 83, 84, 91, 95, 97, 142, 144,
168, 200, 207, 214
Simulations, 2, 6, 7, 22, 27–51, 58, 202
Soft polymers, 56, 72–73, 76
Sputtering, 142–144, 147, 157, 166, 169
Styrene copolymer, 65
Synthesis on-chip, 197–234

T

Thermal bonding, 75, 76
3D imprinting, 3, 4
T-mixer, 111, 202–203
Transport modes, 23–25
Turbulent flow, 20, 28, 32, 108, 198
Type of transports, 23

U

Ultrasonic welding, 56, 74–76

V

Viscosity, 18, 19, 21, 22, 26, 32, 36, 39, 42, 74,
92, 103, 113, 174–176, 179, 198

W

Water jet cutting, 56, 63–64

Y

Y-mixer, 111, 201–203, 210, 214