

Index

a

air bubble transport 146
 allylamine (AA) 223–224
 allylamine plasma polymer (AAPP)
 223–224
 anisotropic texture gradient 137
 anisotropic wetting 25–26, 53
 anti-fogging properties 5
 anti-freeze proteins (AFPs) 34–36,
 77–78, 251
 anti-icing 248
 properties 141
 robust photothermal icephobic surface
 249–251
 onto wind turbine blades 248–249
 anti-wetting features 16–23, 293
 Araucaria Leaf Effect 30–31
 artificial skin and sensor 268–272
 artificial skin vision (ASV) 269–270
 artificial spider silk (ASS) 150–151, 176,
 178, 181
 artificial wet adhesives for medical
 applications 273
 atmosphere water harvesting (AWH)
 244
 MOF-based polymer composite
 245–247
 MOF-composite nanofibers textures
 244–245
 solar-driven absorption/desorption
 244
 superhydrophilic photothermic
 nanocapsule 247–248

atmospheric water capture effects
 78–82
 AWF-6 240

b

barbules 17–18
 beetle back 4, 8, 23, 78, 180, 198–200,
 207, 239
 Beetle Back Effect 31–32
 bioaerosol 150–151
 bio-based coatings for multi-liquid
 repellency 254, 255
 bioelectrical signals 158
 bioinspired active injection drug delivery
 and mechanism 275
 bioinspired fog harvesting 239–240
 bioinspired heterostructured fibers
 191–193
 bioinspired hydrogel-functionalized
 bandage 272, 273
 bioinspired ionic skins 271–272
 bioinspired lotus-like structures
 190–193
 bioinspired nanofibril-humped fiber
 (BNF) 195, 197
 bioinspired needle array, for fog
 harvesting 243
 bioinspired structured passive radiative
 cooling ceramic 267
 bioinspired thermal energy regulation and
 utilization 261–264
 bioinspired wearable artificial skin vision
 270

- bioinspired wetting control mechanism
 - atmospheric water capture effects 78–82
 - controlling ice effects 76–78
 - liquid-repellent effects 73–75
 - liquid unidirection-transport effects 75–76
 - biological ion channels 259
 - biological thermal energy regulation and utilization 261–265
 - biological wet adhesion 273
 - biomimetic fog harvesting devices 239–240
 - bipolar electrochemistry 201–203
 - butterfly wing 1, 4–5, 16, 32, 45, 75, 83, 89, 91, 127, 130, 248, 293
 - with multi-level oriented structures 21–23
- C**
- cacti 7, 13–14, 75, 133
- Cactus Effect 29–30
- cactus fog-harvesting device 240
- CAM photosynthesis 13
- capillarity-induced selective oxidation
 - method 200–201
- capillary
 - bioinspired structured-surfaces with
 - controlled capillary rise 94–95
 - definition 92
 - force formation and capillary rise 93
 - induced driving strategy for separations 97–100
 - microfluidic system 100–103
 - rough capillary rise 95–97
 - solar-driven steam generation (SSG) 103–105
- Cassie–Baxter (CB) state droplets 237
- Cassidy and Box equation 1
- chemical gradients
 - in density 131
 - dual-gradient 133–134
 - membrane thickness 135–136
 - molecule gradient 131–133
 - polymer brushes 136–137
- chemical vapor deposition 66, 141
- Cicada Wing 6, 16, 32, 235
- coalesced-droplet vertical transport 235–236
- coalescence-induced self-propelled
 - jumping, on hierarchical SHS 238
- coaxial capillary microfluidics 182–183
- co-axial microfluidic 184
- complete wetting 44, 54, 63, 161
- composite nanofibers 188–189
- composite nanofibrils 195–197
- composite wettability gradient 154–155
- condensate droplet transport 235
 - coalesced-droplet vertical transport 235–236
 - hierarchical droplet size-effect 236–237
 - self-propelling coalesced-droplet 237–238
- cone-shaped microporous passageways (CSMP) 165–166
- conical-induced gradient 144–147
- controlling ice effects 76–78
- copper oxide microhill-nanoscale
 - structures, hierarchical
 - condensation on 236, 237
- counterpropagating gradients (CPGs) 136
- cribellate spider silk 9–10, 28
- cryopreservation 251–252
- cryoprotectants 251
- CSMP-DSF membrane 165
- d**
- dexamethasone sodium phosphate (DEX) 181, 275, 276
- 2,5-diamino-1,4-phenyl-dicarboxylic acid (DAPAC) 135
- directional-controllable drug delivery 272–273
- directional ratchet transport 12–13
- double-layered silk fibroin (DSF) 165
- drug delivery
 - directional-controllable 272–273

inspired active injection 274–276
 nature-inspired wet drug delivery
 273–274
 dual-gradient 133, 134, 157–159
 dual-gradient wettability 157–159
 dually-mobile superrepellent surfaces
 252–254
 duck feathers 1–3, 16–18, 293
 dynamic gradients 129, 130

e
 elastocapillary mechanism 162
 electro/photothermal super-hydrophobic
 layer (E-EPS) 257
 electrochemistry
 bidirectional microchannel-connected
 pattern 199–200
 bipolar electrochemistry 201–202
 capillarity-induced selective oxidation
 method 200–201
 multi-inspired 3D wettable gradient
 198–199
 wetable gradient pattern 197–198
 electrodeposition process 235
 electronic skin 157–158
 electrospinning 147
 basics of 189–190
 bioinspired lotus-like structures
 190–191
 bioinspired heterostructured fibers
 191–193
 composite nanofibrils 195–197
 omni-adhesive fibers 194–195
 wet adhesive with supercold tolerance
 193–194
 emulsion polymerization 137
 energy dissipation 136
 energy harvesting 256
 photothermal energy storage 256–257
 salinity gradient 257–259
 energy storage 256–258
 photothermal 256–257
 environmental scanning electronic
 microscopy (ESEM) 9, 15, 16, 18,
 19, 21, 22, 26, 28, 62, 192

ethanol-infused nanofibrils wire for
 cutting droplet 205
 eye of mosquito 24

f

FIL-CNC nanostructured films 271, 272
 Fish Scales 5–6, 14–16, 109
 fluid-coating
 for composite nanofibers 188–189
 origin of 185–186
 velocity-regulated 187–188
 fluid diffusion for gradient
 ethanol-infused nanofibrils wire for
 cutting droplet 205
 liquid confined modification for Janus
 wire 204–205
 5-fluorouracil (5-FU) 275, 276
 fogdrop harvesting 14
 fog droplet harvesting 239
 bioinspired 239–240
 Janus-integrated fog harvesting
 241–243
 thermodynamical 240–241
 fog droplet transport 27
 fog harvesting rate 240, 241
 free radical polymerization 137

g

gas bubble generations 134
 GCOMx 135, 136
 Gecko Skin 7, 32, 33
 geometry gradients 133, 142–150
 Gerridae 4
 glomerular membrane 135
 gradient covalent organic framework
 membranes (GCOMx) 135, 136
 gradient quasi-liquid surface (GQLS)
 131–133

h

helical-induced gradient 147–148
 heterostructure patterning on printed
 matrix 215
 hexamethoxymethylmelamine (HMMM)
 254

hierarchical droplet size-effect 236–237
 hierarchical microchannel (HMC) needle
 arrayed fog harvesting system
 241, 242
 hydrogel-functionalized bandage 272,
 273
 hydrophilic hump 26, 27, 31
 hydrophilic-hydrophobic patterns
 26–27, 198
 hygroscopic gels 247

i

ice-binding proteins (IBPs) 76, 77
 ice inhibition, for cryopreservation
 251–252
 icephobic surface aluminum alloy (ISAl)
 248, 249
 insect wings 3, 45
 inspired active injection drug delivery
 274–276

j

Janus effect 34–36
 Janus-integrated fog harvesting 241–244
 Janus spectral responsiveness fabrics
 (JSRFs) 266
 Janus thermal management 263
 Janus wettability 133–135, 272

l

Laplace pressure gradient 82, 83, 142,
 152
 laser ablation for wettability pattern
 211
 laser direct structuring technique 142
 laser-fabricated geometric gradient
 surfaces 207
 laser-layered microfabrication strategy
 207, 250
 laser microfabrication strategy 207, 210
 laser techniques
 laser ablation for wettability pattern
 211
 laser-fabricated geometric gradient
 surfaces 207, 208–209

laser microfabrication strategy 207,
 210
 liquid confined modification for Janus
 wire 204–205
 liquid-controlling effect 30
 liquid-infused spindle-knot 151–154
 liquid infused surfaces
 bioinspired lubricated slippery
 magnetic responsive array
 107–110
 liquid-infused regulation 105–107
 slippery liquid-infused surface for
 integrative functions 111–115
 SLIPS 110
 liquid repellency 252
 dually-mobile super-repellency
 252–254
 multi-liquid repellency 254
 switchable repellency, in air and liquid
 254–256
 in Wenzel's state 252
 liquid-repellent effects 73–75
 liquid-solid interaction 41, 145
 liquid unidirection-transport effects
 75–76, 77
 Lotus Effect 3, 19, 26, 42, 45, 73, 82
 lotus leaf 3, 18–20, 25–26, 32, 41, 44–45,
 58, 62, 73–74, 82, 87, 133, 190–191,
 237, 248, 254, 272
 lubricated slippery magnetic-responsive
 microplate array (LS-MMA) 109,
 110

m

Marangoni flows 130
 Marangoni force 132
 metal-organic frameworks (MOF) based
 nanostructure 220, 221, 244
 micro-and nano-scale structures
 anisotropic 25–26
 hydrophilic-hydrophobic patterns
 26–27
 isotropic 24–25
 micro-nanostructured superhydrophobic
 surface 235

microbubbles 146
 microfluidics
 coaxial capillary 182–183
 co-axial microfluidic 184, 185
 introduction of 179–181
 multiphase 181–182
 parallel-nozzles 183–184
 micropapillae structures 235
 MOF-based polymer composite 245–247
 MOF-composite nanofibers 221–222,
 244–245
 MOF-composite nanofibers textures
 244–245
 MOF-303/thiolated polymer composite
 (MTC) 246, 247
 moisture-driven electricity generators
 (MEGs) 260
 molecule gradient 131–133
 mono-hydroxyl-terminated
 poly(dimethylsiloxane) 254
 Morse code 271, 272
 mosquito eye 5
 multiinspired 3D wettable gradient
 198–199
 multi-liquid repellency 254
 multiphase microfluidics 181–182

n

nanograss structures 207, 235
 nanotechnology
 MOF based nanostructure 220–221
 MOF-composite nanofibers 221–222
 photothermal dual-nanoscale effect
 219–220
 superhydrophilic photothermic
 nanocapsule 218–219
 natural self-propelling system 82–83
 nature-inspired wet drug delivery
 273–274
 nepenthes 7, 8, 10–12, 45, 78, 83, 89, 92,
 94, 105, 109, 127, 148, 161, 239, 240
 peristome surface of 10–12
 Nepenthes alata fog-harvesting device
 78, 239, 240
 non-wetting 44

o

ommatidia 24
 omni-adhesive fibers 194–195
 optical microscopy 9, 144, 188
 organic solvent nanofiltration (OSN)
 135

p

parallel-nozzles microfluidics 183
 partial wetting 18, 42, 44, 63
 passive cooling effect (PCE) 156
 pattern fabrication in wetting-enabled-
 transfer strategy 224–225
 peristome's wetting 10
 petal effect 5
 phosphate buffer saline (PBS) 136
 photocatalyst 150–151
 rough spindle-knot for 150–151
 photosynthesis method 13
 photothermal dual-nanoscale effect
 219–220
 photothermal energy storage 256–257
 photothermal-triggered MOF-composite
 nanofiber texture (PMNT) 222,
 244, 245
 PIL membrane (PIL-M) 135, 158, 159
 pitcher plant 7, 8, 10, 11, 75, 105, 111,
 161, 179
 plasma techniques
 functionalities of titania nanotube
 arrays 223–224
 pattern fabrication in wetting-enabled-
 transfer strategy 224–225
 Plateau-Rayleigh instability (PRI)
 175–178
 polydimethylsiloxane 70, 131, 132,
 181
 polymer brushes 106, 136, 137
 poly (4-styrenesulfonic acid) and
 poly-(vinyl alcohol) (PSSA-PVA)
 aerogel 260
 pond skaters 4
 printed divisional optical biochip
 215–218

printing techniques
 heterostructure patterning on printed matrix 215
 introduction of 213–214
 principle of fabrication from printings 214–215
 printed divisional optical biochip 215–218

q

quartz crystal microbalance with dissipation (QCM-D) 136

r

radiative cooling regulation 267–268
 Rayleigh instability
 bioinspired effects of 178–179
 controlling of 177–178
 formation of 175–177
 resonance frequency 136
 reversed electrodialysis (RED) approach 259
 rice leaf 4, 25, 26, 45, 85, 207
 robust photothermal icephobic surface 249–251
 rose petal 5
 rough spindle-knot 150–151, 182, 195

s

salinity gradient energy harvesting 257–259
 Salvinia 6–7
 self-propelling coalesced-droplet 237–238
 self-propelling effect 32–34, 82, 84–87, 180, 292
 self-propelling effects of surfaces
 controlled on conical-structured surfaces 85–88
 droplet jumping 88–89
 natural 82–92, 293
 self-propelling theory from gradient Surfaces 84–85
 topological liquid diode 89–92
 self-propelling theory from gradient Surfaces 84–85

shape memory effect (SME) 139, 161
 shape memory polymer (SMP) 161
 Sharks 15
 silk fibroin-pluronic F127 (Silk-Fp)–poly(*N*-isopropylacrylamide) (PNIPAm) 274–276
 skin-inspired wearable devices and systems 268, 269
 slippery liquid-infused porous surfaces (SLIPS) 110, 111, 113, 115
 slippery liquid-infused surface for integrative functions 111–115
 solar-driven steam generation (SSG) 103
 sorption-based atmospheric water harvesting (SAWH) 247
 spider silk 6
 fog-harvesting device 240–241
 nano-fibrils on 8–10
 Spider Silk Effect 28–29
 spine-shaped gradient 148–150
 spine with microbarbs and channels 142–143
 static gradients 127–129
 superhydrophobic floating 20–21
 superhydrophilic photothermic hollow nanocapsule (SPHN) 218, 219, 247, 248
 superhydrophilic photothermic nanocapsule 218–219, 247
 superhydrophobic coatings 4, 137, 219
 superhydrophobic property 1
 superhydrophobic surfaces (SHSs) 1, 4, 137, 197, 205, 235, 237, 250
 superhydrophobicity 5–7, 16, 23, 24, 41, 48, 49, 52, 73, 91, 139, 148, 191, 198, 235, 254
 superwetable microspine (SMS) 148–150
 surface-initiated atom transfer radical polymerization (SI-ATRP) 136
 surface tension
 control 160–162
 gradient 84, 132, 159–166, 205, 293
 shape shifting of 162–164
 switchable repellency, in air and liquid 254–256

switchable thermoregulation 263–267
synergism 150–159, 293

t

texture gradient
 anisotropic 137
 with polymers 140–142
 of wetting heterogeneity 137–138, 139
 of wetting-controlling 138–140
thermal conduction 261
thermal convection 261
thermal energy regulation and utilization 261–264
thermal radiation 261
thermodynamical fog harvesting 240–241
thermodynamically-induced interfacial condensation-enhanced fog-harvesting fabric (AWF-6) 240
thermodynamic work of adhesion (W_{adh}) 57
thermoregulatory textiles 156
three-dimensional (3D) gel interface system, for energy harvesting 259, 260
titania nanotube arrays 223–224
trilayered fibrous dressing (TFD) 154, 155
twisting method 147

u

uropygial gland 17

v

value of biomimicry 6
vapor diffusion-controlled process 131
velocity-regulated fluid-coating 187–188
vertical aerogel-on-water-collecting gel (VAWG) MEG 261

w

water droplets, lotus leaf 18
water-splitting device 133–134

water strider 4, 20–21, 33–34, 235
wedged-induced gradient 143–144
Wenzel equation 1, 48
wet adhesive with supercold tolerance 193–194
wettability gradient
 composite 154–155
 in cross-thickness 164–166
wettability gradient-induced diode (WGID) 155–157
wetting
 bioinspired wetting control mechanism 73–82
 in biological systems 44–46
 capillary regime 92–105
 control technology 47
 definition of 42, 44
 dynamics and kinetics 51–52
 extension and theoretical models 49–51
 fundamental wetting theories 48–49
 liquid infused surfaces 105–115
 physics of
 biological structures and adhesion models 58–59
 external influences 63–64
 molecular interactions 55–56
 properties and adhesion 56–58
 quantitative analysis 59–63
 self-propelling 82–92
 and significance 41–42, 43
 surface chemistry and structures
 chemical composition 64–65
 chemical gradient 70–73
 chemical heterogeneity and Janus 68–70
 chemical modifications for wetting control 66–68
 surface topography on wetting behavior 65–66
 surface roughness 52–53
 transitions and behavior 53–55
wetting-controlled effect 30, 31
wetting-controlling 138, 140
wetting heterogeneity 137, 139





