

Index

a

- ACDP nanohybrids 344
 - active and passive μ -ECoG systems 211, 212
 - actively induced sweat 163
 - active matrix addressing approach, multiplexer and amplifier units in 220, 222
 - active-matrix sensory implantable electrodes 222
 - active vs. passive terahertz imaging systems 313
 - advanced drug delivery systems, clinical objectives of 387
 - all-textile piezoionic pressure sensor 445
 - anti-programmed death-1 antibody (aPD-1) 372
 - Archimedean-spiral interconnects 27, 30
 - deformation and mechanical responses 31
 - artificial intelligence 173, 275, 282, 283, 406, 431, 457
 - Au nanomesh electrodes 111
- ### **b**
- barrier lifetime, of thermal SiO₂ with and without capping layer 221
 - bioadhesive ultrasound (BAUS) device 292
 - biocompliance 204, 205
 - bioelectronic systems, structure of 203, 205, 228
 - biofluid barriers 211, 214
 - biofluid-enabled wearable sensors, for remote health care monitoring 149
 - biofluids 148, 150–161
 - dermal 150, 153
 - oral 150, 157
 - biofuel cells (BFCs) 81
 - biomacromolecules 387, 391
 - bioresorbable electronic patch (BEP) 397
 - biosignal monitoring systems 417
 - Bluetooth Low Energy (BLE) 168, 425, 430
 - BOOST topology 421, 422
 - brain-computer interfaces (BCIs) 181–194
 - categories 181
 - brain-machine interfaces (BMIs) 181, 183
 - brain signals 184, 186, 192, 222
 - buckling
 - of corrugated structure 9–11
 - mechanism, of serpentine conductors 23
 - modes 13–15, 21
 - principle 3
 - buckling-guided 3D assembly 45, 51

C

- cancer, flexible sensors for 127–128
- capacitive MUT 291
- capacitive sensor 245
- capacitive-type strain sensors 236–237, 241
- capsule-based tear sensors 87
- carbon-based materials, for neural interfaces 210
- carbon-based nanomaterials 69, 241, 242
- carbon black 280
- carbon nanotubes (CNTs) 49, 72, 82, 103, 239, 314, 339
 - for neural interfaces 210
- cardiovascular disease (CVD) vital sign monitoring, flexible sensors for 115, 116, 211, 217
 - blood oxygen saturation 115–117, 302
 - blood pressure 102, 117
 - heart rate 115, 116, 207, 275, 277, 302, 326, 348, 408, 431
- cellular graphene 3D hierarchical architectures of, 57
- cellular networks 426
- cellular substrate designs 40–43
- cerium oxide nanoparticles (CNPs) 82
- chemical sensor 102, 126, 150, 162, 169
- chronic inflammatory diseases 123, 125–126
- chronic neural interfaces 119, 203–229
- chronic respiratory diseases, flexible sensors for 114, 126–127
- chronoamperometry (CA) 89, 172
- closed-loop controlled healthcare monitoring systems 431
- closed-loop theranostic systems 372–375
- CNT yarns electrodes 204
- coiled structure, flexible sensors 109, 112–113
- colorimetric sensing techniques 89, 169, 171
- communication methods 330, 424–427
 - Bluetooth 425
 - RFID 425
 - Wi-Fi 426
 - wired connections 424
 - wireless connections 425–426
- communication modes 428
- conductive polymer-based resistive heaters 341, 343
- conductive polymers 243, 341–343
 - for flexible sensors 106–107
 - for neural interfaces 209–211
- conformable ultrasound bladder patch (cUSB-Patch) 294
- conformable ultrasound breast patch (cUSBr-Patch) 292
- contact electrification 442
- contact lens sensor 81–87
 - colorimetry 82–83
 - electrochemical analysis 85–87
 - fluorescence 82–85
 - photonic crystals 82
 - signaling mechanisms and signal transduction 82
- continuous glucose monitoring (CGM) devices 87, 123, 148
- coronavirus disease 2019 (COVID-19) 103, 127, 160
- corrugated structure preparation
 - closed colloidal solution expansion method 4, 5
 - substrate pre-strain release method 4, 5
 - ultraviolet radiation 4, 6
- corrugated structures
 - buckling delamination of 7, 8
 - finite thickness substrate assumption 8
 - geometric deformation process of 7
 - post-buckling mechanical behavior of 10
- cortisol 86, 159
- crack propagation 247
- C-reactive protein (CRP) 89–91, 159
- critical buckling load 10
- cryotherapy 335, 354–355
- curvilinear electronic systems 43
- curvilinear substrate designs 43–45
- cystatin C 151, 157

d

DC-to-DC Buck converter (BUCK)
 topology 420, 421

deformation mode 51, 112
 of a filamentary ribbon 14
 of thick rod serpentine conductor 25,
 26

dermal biofluids
 interstitial fluid 155–156
 biomarkers 156
 composition 155
 creatinine (metabolite) 154–155,
 157
 cytokines 157
 drugs 157
 electrolytes 156
 glucose (metabolite) 156
 urea (metabolite) 156

sweat 153
 biomarkers in 73, 150, 153
 creatinine (metabolites) 154, 155
 cytokines 155
 drugs 155
 electrolytes 153, 154
 glucose (metabolites) 154
 urea (metabolites) 154
 uric acid (metabolites) 154

dermal fluid-enabled wearable sensors
 148

dermal fluids 148, 150, 151, 172

dexamethasone (Dex) 370, 391,
 395

diabetes, flexible sensors for 123–125

differential pulse voltammetry (DPV)
 70

dip-coating strategy 342, 343

directly implantable DDSs 394

double-layer capacitance-based ion
 sensors 455

double-layered MNs device, for cancer
 stem cell synergistic
 immunity/hydrogen therapy 369,
 372

double substrate soft layer film-substrate
 system 10

dry electrodes 183–185 *see also* flexible
 dry electrodes; semi-dry electrodes

dual peptide-decorated melanin-like
 nanoparticle 344

e

echocardiography 322–324

elastomers, for flexible sensors 103, 106

electrical impedance tomography (EIT)
 305–312
 advantages 312
 cancer detection 309–310
 description 305
 gesture detection 310–312
 principles 305–306
 pulmonary imaging 307–309
 structures and materials 306–307

electrical probes of doped silicon 204

electrochemical impedance spectroscopy
 (EIS) 70

electroencephalogram (EEG) 102, 122,
 181

electromagnetic sensors 236, 238, 438,
 446, 448, 449

electromagnetic-type strain sensors 238

electromyography (EMG) signals 102,
 340

electron-cloud-potential-well model
 442, 443

electronic conductive elastomers 106

electronic skin 104, 105, 403, 424, 426,
 427, 448

electrophysiological sensors 42, 101, 123

electrophysiological (ECG) signal 101,
 102, 181, 187, 341

encapsulation, for stable device operation
 211–220

encapsulation method 422–424

environmental sensing, soft robotic
 406–409

enzymatic biofuel cells (EBFCs) 77

enzyme-based sensing platform 168

enzyme-linked immunosorbent assay
 (ELISA) 70

- epidermal electronic tattoo (E-tattoo)
 - system 340, 341
- epidermal wearable biosensors
 - flexible and stretchable 74–76
 - self-powered sweat sensors 76–79
 - sensing methods 74
 - in sweat and ISF 73, 74
- f**
- finite element analysis (FEA) 8, 16–18, 21, 23, 30–38, 40–42, 48
 - of serpentine interconnects 16
- finite element simulation structure, of
 - buckling delamination 8
- 5G 426, 427
- flexible and stretchable epidermal sensors 74–76
- flexible device structure design 2D spiral interconnects, 27
- flexible drug delivery microdevice (f-DDM) 395, 397
- flexible dry electrodes 186–189
 - coating technology 186–187
 - textile-based electrode 188–189
 - 3D-printed flexible electrodes 187–188
- flexible hybrid electronics (FHE) 191, 193
- flexible liquid metal-coated
 - magnetolectric sensor 448
- flexible Mg-hydrogel battery 391
- flexible piezoelectric pulse sensor (F-PPS) 440, 441
- flexible printed circuit board (FPCB) 56, 57, 77, 126, 308, 324, 373
- flexible sensors
 - advantages 127
 - categories 101, 123
 - coiled structure 112–113
 - composite materials 103, 105
 - conductive polymer 104, 106–107
 - conductive textiles and textile composites 108–109
 - conversion element 102, 103
 - in diseases diagnosis 101, 114–128
 - brain diseases 118–122
 - cardiovascular diseases 102, 115–118
 - chronic diseases 101, 114, 123, 125–126, 128
 - elastomers 103, 106
 - fractal structure 110, 112
 - hydrogels 107–108
 - infectious disease diagnosis 103
 - Kirigami structure 110, 111
 - liquid conductors 102–105
 - mesh structure 110, 111
 - nanomaterials 102–105
 - sensitive element 102, 103
 - serpentine structure 103, 109–110
 - structure composition 102
 - structure diagram
 - 2D 110
 - 3D 113
 - 3D porous structure 113, 114
 - wave structure 113–114
- flexible smart bandage 376, 377
- flexible/stretchable matrix materials 239–240
- folding-based origami, strategy of 45–51
- 4 x 4 stretchable honeycomb structure
 - organic electrochemical transistors (OECTs) array 207
- four-layer stretchable system design and characterization 58
- fractal-inspired hierarchical computing model (HCM), for stretchable interconnects 37
- fractal structure, flexible sensors 112
- freestanding triboelectric nanogenerator (FTENG) 77
- fully integrated autonomous wearable ultrasonic-system-on-patch (USoP) 324–326
- g**
- GaIn@Pt-PEG NPs 346
- gallium-based liquid metals 105
- geometric deformation process, of
 - corrugated structure 7

- gingival crevicular fluid (GCF) 148, 157, 158, 160
- glucocorticoid therapy 367
- glucose oxidase (GOx) 68, 70, 82, 85, 86, 125
- GlucoWatch 162
- gold nanostar@ZIF-8 (Au@MOF) nanoparticles 346
- gout, flexible sensors for 126, 155, 158, 168
- graphene 72, 75, 82, 103, 210, 239, 241
for neural interfaces 210
- graphene based biotransferrable oral sensor 169
- graphene-based electrochemical patch 374
- graphene-based hydroelectric generators (GHEGs) 46, 47
- h**
- hemispherical imaging systems,
advantage of 44
- hemispherical substrates 43
- high-resolution stereolithography (SLA)
3D printing techniques 446
- hollow microneedle (MN) 166, 167
- hollow-porous fiber-based all-in-one
integrated wearable systems 353
- human energy, types of 437
- hydrogel microneedle (MN) 166, 167
- hydrogels 103, 106, 191, 270
for flexible sensors 107–108
- hypotonic sweat solution 153
- i**
- implantable bioabsorbable electronic
patch (BEP) 394, 395, 397
- implantable bioelectronic systems 203, 204
- implantable electronics, stable operation
and development of 211
- implantable soft electronic drug delivery
systems
based on flexible bioresorbable MN
system 397
- development of refillable reservoirs
398
pharmacokinetic benefits 398
- implanted soft sensors 121
- inflammatory skin diseases, flexible
sensors for 126
- inorganic semiconductor materials 3
- internal electric potential 439
- interstitial fluid (ISF) 123, 147, 155–157
biomarkers 147, 155, 453
composition 155, 235
creatinine (metabolite) 157
cytokines 157
drugs 157
electrolytes 156
extraction methods 165–166
glucose (metabolite) 156
sampling methods 165–168
urea (metabolite) 156, 157
- invasive BCI 181
- ion effect, on SiO₂ dissolution 221
- ionic conductive elastomers 106
- ionic-hydrogel electrode 191, 192
- iontophoresis 368, 371, 378
- iontophoresis-driven MNs patch 368, 369
- iontophoresis-microneedle array patch
(IMAP) 390
drug delivery mechanism of 393
- iron-chelated semiconducting
polycomplex nanoparticles
(SPFeN), for photothermal
ferrotherapy of cancer 344, 346, 347
- ISF-enabled chemical sensors 148
- island bridge structure 14, 15, 21, 30, 301
analytical mechanical model 12
on non-deployable surface 17, 21
- island bridge structure-curved line
12–15
- island bridge structure-serpentine line
15–26
- ITO serpentine tape 16
structure diagram 19

j

Janus magneto-plasmonic nanoparticles 347

k

Kirigami structure, flexible sensors 110, 111

l

label-free immunosensors 70, 71

large motion monitoring 250–252

laser lift-off (LLO) technique 441

Levodopa (L-dopa)

in ISF 157, 172

in sweat 155, 172

lifetime

defined 215

of Parylene C/HfO₂/t-SiO₂ barrier 215, 216, 218, 219

liquid conductors, for flexible sensors 102–106

lithium polymer (LiPo) battery 326, 418

long-term stable implants, multimodal functions of 225–228

low-cycle fatigue test 23

low dropout regulator (LDO) 419, 421 design 420

equivalent circuit 420

modern circuit 420

thermal resistance and power dissipation 420

Low Power Wide Area Networks (LPWAN) 426

m

magnetic field-driven soft robots 409

MCU-embedded ADC function 428

meander line-based hemispherical electrically small antennas (MHESAs) 54

mechanical sensors

material architectures 238–244

electrically conductive materials 241–244

flexible/stretchable matrices

239–240

representative applications

large motion monitoring 250–252

small strain detection 248–250

sensing mechanisms

crack propagation 247

disconnection mechanism 246

geometrical effect 244–245

piezoresistive effect 245–246

tunneling effect 247–248

stretchable 236

membrane spacing effect, on buckling amplitude 12

mesh structure, flexible sensors 110, 111

metal-like 2D MXene thin film heaters 339

metals, for neural interfaces 209

microcontroller unit (MCU) 76, 268, 270, 428, 430, 455

microfluidics 4, 76, 77, 81, 163

micromachined ultrasound transducer (MUT) 290, 291

microneedle-based interstitial fluid (ISF) sampling and biomarker detection technology 168

microneedle-based self-powered transcutaneous electrical stimulation system (mn-STESS) 391, 393

microneedle (MN)-mediated passive drug delivery 364–367

microneedle (MN) types 166

miniature robotic *in vivo* medicine 403, 409–410

miniaturization of filamentary probes 205

minimally invasive procedures 226, 289, 398

Miura folding procedures 49, 51

Miura unit cell 49, 50

morphable 3D mesostructures 53, 55

MoS₂ hollow nanospheres 349, 351

mouthguard-based salivary uric acid sensors 168

- MP-PC film 348
- MRI-guided synergetic
chemodynamic/photothermal
therapy 344
- multifunctional CP/PU/PC composite
aerogel 341, 342
- multifunctional wearable electronics
(MWEs) 337
- multimodal neuromodulation device
225, 228
- MXene-based materials 339, 340
- MXene/CFs composite material 350
- MXene heterostructure 351
- n**
- nanomaterials, for flexible sensors
103–105, 108
- nanoparticle-embedded contact lenses
(NECLs) 82, 83
- near-field communication (NFC) 86,
124, 330, 377, 378, 408, 425, 429
- Neo-Hookean constitutive law 7
- Nernst equation 71, 453
- neural circuits 203, 226
- Neuralink array 204
- neural interfaces 222, 224
advanced chronically stable materials
for 209–211
carbon-based materials 210
conductive polymers 211
doping semiconductors 210–211
metals 209–210
capacitively-coupled sensing mode
222–224
challenges and future research
directions 228–229
conductively-coupled sensing mode
224–225
- NeuroGrid 205
- neuron-like electronics (NeuE) 205, 206
- Neurotassel probe 208
- NixCo_{1-x}Se/PDMS/rGO composite 350
- non-coplanar arc line structure 12, 13
- non-invasive BCIs 181–183
challenges 191–193
development 182–183
- flexible electrodes
advantage 186
flexible dry electrodes 186–189
semi-dry electrodes 189–192
- rigid electrodes 183–185
dry electrodes 184–185
vs. invasive BCIs 181
wet electrodes 184
- non-invasive soft sensors 122
- non-invasive wearable chemical sensors
detection mechanisms for 169–172
need for 161–162
- nonlinear corrugated-substrate system,
structure diagram of 11
- o**
- ocular wearable sensors 79–81
capsule-based tear sensors 87
category of 80
contact lens sensor 81–82
eyeglass sensor 88
ocular biomarkers 79–80
wearable eye patch 87
- 1D transducer array wearable ultrasound
bioimaging sensor 292–294
- optoacoustic imaging sensor 299–301
- optoelectronics 257–272
- optogenetics 225, 226, 267, 273, 379
- oral biofluids
gingival crevicular fluid (GCF) 148,
157, 158, 160
saliva 157–160
creatinine 158–159
DNA biomarkers 160
glucose 158, 159
proteins 159, 160
salivary hormones 159
urea 158
uric acid 158
- origami-enabled silicon solar cells 47, 49
- orthogonal transducer array, for wearable
ultrasound bioimaging sensor
296–298

p

paper-based photodetector array 49
 passive addressing 220
 passively induced sweat 163
 Peltier effect 450, 451
 perturbation method 11
 pharmaceutical-based therapies 398
 phase change materials (PCMs) 348, 371
 photoacoustic (PA) imaging 327–329
 photoacoustic imaging sensor
 applications 302–305
 description 299
 principles 299–301
 structures and materials 301–302
 photocrosslinking method 6
 photo-patternable, transparent cellulose
 nanofiber (CNF) hybrid films 47
 photothermal nanomaterials 343–348
 physical sensors 102, 126
 piezocapacitance 245–246
 piezoelectric effect 439
 piezoelectric materials, classification of
 439
 piezoelectric MUTs 291
 piezoelectric nanogenerators (PENG)
 77, 391, 419
 piezoelectric polymers 439
 piezoelectric sensors 439–441
 piezoelectric-type strain sensors 237
 piezoelectric ultrasound transducer (PUT)
 290
 piezoionic phenomenon 445
 piezoionic sensors 445–447
 piezoresistive effect 245–246
 piezoresistive module 404
 piezoresistivity 245–246
 platinum disc electrodes on silicone
 sheets 204
 PNIPAM hydrogel 163
 Poisson's ratio 43, 49, 244, 245, 371
 poke with patch drug administration
 strategy 365
 poly(vinylidene fluoride) (PVDF) 291,
 440

poly(3,4-ethylenedioxythiophene)
 @cotton/spandex fabric
 (PEDOT@CSF) 353
 polymer-based ion-conducting
 modification 391
 porous MNs (PMNs) 368–370, 391
 post-buckling mechanical behavior, of
 corrugated structures 10
 potentiometric electrochemical sensors
 438
 potentiometric ion sensors 453–455
 power source, for soft electronics
 batteries 417
 self-charging power unit 419
 wireless powering system 419
 PZT film-based self-powered sensor 441

r

reactive diffusion model
 hydrolysis of thermal SiO₂ and
 Polymer/HfO₂/SiO₂ barriers 216,
 218
 hydrolysis of t-SiO₂ with capping layers
 216
 resistance-strain test results 19
 resistive heaters
 advantages 336
 conductive polymers 341–343
 limitations 343
 metal nanowires 336–339
 2D materials 339, 341
 resistive-type strain sensors 236
 reverse iontophoresis (RI) 166
 rigid electrodes, non-invasive BCIs
 dry electrodes 183–185
 wet electrodes 184
 RNA membrane coated MNs 365

s

saliva 148, 157–159
 creatinine 158
 DNA biomarkers 160
 glucose 158, 159
 proteins 159, 160
 salivary hormones 159

- sampling methods 168–170
- urea 158
- uric acid 158
- salivary alpha-amylase 159
- salivary hormones 159
- salivary pH 171
- Seebeck coefficient 450
- Seebeck effect 438, 450
- self-piezoelectric sensors 439–441
- self-powered MNs 370
- self-powered personal thermal management device 352
- self-powered sensors 437–457
 - electromagnetic sensors 446–448
 - piezoelectric sensors 439–441
 - piezoionic sensors 445–446
 - potentiometric ion sensors 453–455
 - sweat sensors 76–79
 - thermoelectric sensors 448–452
 - triboelectric sensors 441–445
- self-powered triboelectric auditory sensor (TAS) 443, 444
- semi-dry electrodes
 - hydrogels 191
 - in vivo* tests 190
 - vs. wet electrode 189
- semi-invasive BCIs 181
- sensors
 - defined 101
 - limitations 101
- serpentine interconnection inverter
 - analytical model diagram and tensile strengths 16, 20
 - optical microscopic images 18
- serpentine structure, flexible sensors 109, 110
- severe acute respiratory syndrome
 - coronavirus 2 (SARS-CoV-2) 127
- shear interconnection demonstration, of thick rod serpentine wire 26
- silicone hydrogel-based contact lens 378
- silicon nanoribbons and nanomembranes 210
- silicon shanks 204
- silver nanowire (AgNW) 336–339
- single-neuron action potential detection 205
- skin-interfaced colometric wearable sensor integrated with microfluidic platform 169
- skin-mountable (wearable) systems 389, 390, 394
- skin structure 362–364
- small-molecule-based photothermal nanomaterials 347
- small strain detection 248–250
- smart flexible electronics-integrated wound dressing 375
- smart wound theranostic system 377
- soak tests 214, 215
 - with bilayers of Parylene C/t-SiO₂ and HfO₂/t-SiO₂ 215
 - with trilayer of Parylene C/HfO₂/t-SiO₂ 215
- soft biotissue interfaces 204
- soft electronic drug delivery system (SEDDS) 388
 - application and composition 388
 - challenges and prospects 399–400
 - drug reservoir 388
 - implantable systems 390, 394–398
 - long-term operation requirement 399
 - medical applications 398
 - power supply system 388
 - release/delivery system 388, 389
 - skin-mountable (wearable) systems 389
- soft electronics-assisted TTDS, for drug delivery 364–378
 - microneedles 364–367
- soft-electronics based TDDS 362
- soft electronics-MNs systems
 - for active drug delivery 367–372
 - for closed-loop drug delivery 372–378
- soft network materials, infinitesimal deformation 43
- soft robotic
 - environmental sensing 406–409
 - miniature robotic *in vivo* medicine 409–410

- soft robotic (*contd.*)
 - tactile sensing 403–406
 - soft sensor materials, for brain interfaces 119
 - soft transdermal microneedle patch 171
 - solid contact (SC) ion-selective electrode (ISE) design 453
 - solid microneedle (MN) 166
 - sonography 316
 - spatial integration of device systems
 - buckling-guided 3D assembly, strategy of 51–57
 - folding-based origami, strategy of 45–51
 - stacked multilayer designs 57–59
 - squarewave voltammetry (SWV) 172
 - stacked multilayer designs 57–59
 - Stentrod 207, 208
 - stimuli-responsive manner, of drug delivery 395
 - strain sensors 103, 106, 109, 113, 115, 236–252
 - stratum corneum (SC) 362, 363, 390, 391
 - stress echocardiography 323, 324
 - stretchable electronic patch 354
 - stretchable film heater (SFH) 341
 - stretchable flexible device structure design
 - island bridge structure-curved line 12–15
 - island bridge structure-serpentine line 15–32
 - ripple method 3–12
 - 3D spiral interconnects 32–35
 - 2D fractal interconnect structure 35–38
 - 2D spiral interconnects 26–32
 - stretchable mechanical sensors
 - capacitive sensor 236–237
 - electromagnetic sensors 238
 - piezoelectric-type strain sensors 237
 - resistive sensor 236
 - triboelectric sensors 237–238
 - structural designs, for spatial integration of device systems 45–59
 - surface structure designs 39–40
 - sweat 148, 153
 - biomarkers in 153
 - creatinine (metabolites) 154
 - cytokines 155
 - drugs 155
 - electrolytes 153–154
 - glucose (metabolites) 154
 - sampling and induction methods 163–165
 - urea (metabolites) 154
 - uric acid (metabolites) 154
 - sweat-activated batteries (SABs) 79
- t**
- tactile sensing in soft robot 404
 - TENG-based self-powered acoustic skin sensor 443
 - tensile fracture, of fully bonded serpentine wire 24
 - tensile properties 27, 30, 33, 36, 38
 - ITO ribbons 16
 - of serpentine interconnects 23, 28
 - of 2D spiral structures 30
 - terahertz imaging sensor
 - applications 314, 315
 - description 312
 - principles 313
 - structures and materials 313–314
 - testosterone 159
 - textile-based electrode 188–189
 - textile-based wearable heaters 348–354
 - thermoelectric effect 438, 449
 - thermoelectric nanogenerators (TEGs) 47, 50
 - thermoelectric sensors 438, 448–452
 - thermotherapy
 - advantages 335
 - photothermal nanomaterials 343–348
 - resistive heaters 336–339, 341, 343
 - textile devices 348–354
 - thick rod serpentine conductor, deformation mode 25
 - 3D elastic membrane 17
 - 3D electronic/optoelectronic systems assembly 56, 57

- 3D macroporous nanoelectronic networks 208
- 3D porous structure, flexible sensors 114
- 3D printed dry electrode, for ECG/EEG recording 185
- 3D-printed flexible electrodes 187–188
- 3D spiral interconnects 32–35
- three-dimensional integrated stretchable electronics 58
- transdermal drug delivery system (TDDS) 361–362
- advantages 361
 - soft electronics 361–362
- triboelectric all-textile sensor array (TATSA) 444
- triboelectric nanogenerator (TENG) 77, 371, 375, 441, 442
- operational modes 442
- triboelectric nanogenerator-based electrical bandage 371, 375
- triboelectric nanogenerator-powered DDS 391
- triboelectric sensors 237–238, 441–445
- tripod designs 40
- tunneling effect 247–248
- 2D fractal interconnect structure 36
- 2D helical-node interconnect designs 32
- 2D spiral interconnects 26–32
- 2D transducer array wearable ultrasound bioimaging sensor 294–296
- two-dimensional (2D) materials 339–341
- two-stage soft encapsulation strategy 35
- U**
- ultradurable embedded Ag-Au core-shell nanowire network 337
- ultrasound bioimaging sensor
- 1D transducer array 292–294
 - orthogonal transducer array 296–298
 - 2D transducer array 294–296
- ultrasound imaging 316–327
- ultrathin nanomesh pressure sensors 104
- UV-responsive antibacterial hydrogel 376, 377
- V**
- vancomycin 155
- viologen-incorporated polyelectrolyte hydrogel 391–393
- voltage regulation unit 419
- W**
- water barriers assessment 215
- water permeation rate 211
- water vapor transmission rate (WVTR) 211, 214
- wave structure, flexible sensors 113–114
- wearable and robust optical resolution photoacoustic microscopy (W-ORPAM) 304
- wearable bioimaging sensors 288, 329–330
- electrical impedance tomography
- applications 307–312
 - description 305
 - principles 305–306
 - structures and materials 306–307
- photoacoustic imaging 327–328
- photoacoustic imaging sensor
- applications 302–305
 - description 299
 - principles 299–301
 - structures and materials 301–302
- terahertz imaging
- applications 314–315
 - description 312–313
 - principles 313
 - structures and materials 313–314
- ultrasound bioimaging technology
- description 288–289
 - 1D transducer array 292–294
 - orthogonal transducer array 296–298
 - principles 289–290

- wearable bioimaging sensors (*contd.*)
 - structures and materials 290–291
 - 2D transducer array 294–296
 - ultrasound imaging 316–326
 - wearable biosensing technology
 - enzymatic biosensors 68–69
 - history of 67–68
 - wearable immunosensors 69–70
 - wearable ion biosensors 70–72
 - wearable chemical sensors
 - challenges 162–163
 - non-invasive wearable chemical sensing, need for 161–162
 - wearable closed-loop MNs-mediated theranostic system based on MNs-iontophoresis platform 373
 - wearable dental patch, for caries restoration 377
 - wearable electrical impedance tomography 307–312
 - advantages 312
 - cancer detection 309–310
 - description 305
 - gesture detection 310–312
 - principles 305–306
 - pulmonary imaging 307–309
 - structures and materials 306–307
 - wearable electronic device requirement 15
 - wearable heaters 335, 336, 348, 349
 - wearable non-implantable microneedles
 - integrated theranostic system for intelligent and precise diabetic management 374
 - wearable photoacoustic imaging sensor
 - applications 302–305
 - description 299
 - principles 299–301
 - structures and materials 301–302
 - wearable salivary sensors 148
 - wearable soft electronic systems, for drug delivery 393
 - wearable terahertz imaging sensor
 - applications 314–315
 - description 312–313
 - principles 313
 - structures and materials 313–314
 - wet electrodes 183, 184, 307
 - Wi-Fi 426
 - wireless energy transmission methods 418
 - wireless flexible drug delivery microdevice (f-DDM) 395
 - wireless haptic feedback system 422
 - wireless powering system 418, 419
 - wireless theranostic contact lens 378
 - wireless wearable electrochemical sensors 171
 - wound sensor 88–91
- y**
- Young's modulus 10, 108, 119, 120, 205, 239, 240, 244, 319, 322, 389



















