

Index

a

- actuation 185, 193–197
 - carbon nanomaterials
 - carbon nanotubes 188–190
 - fullerenes 190–191
 - graphene 186–188
- actuators 185
 - carbon nanomaterials 186
 - carbon nanotubes 188–190
 - fullerenes 190–191
 - graphene 186–188
 - carbon nanotube-based 191–194
 - fullerene actuators 198
 - graphene oxide actuators 194–197
 - challenges 198–199
 - molecular scale 186
- allotropes 1, 2, 10, 11, 37–39, 55, 185
- allotropy 37
- armchair configuration 40

b

- B-doped graphene 50, 52, 54
- biomechanical sensor 173–175
- buckminsterfullerene 38
- buckyball 2, 38, 191

c

- capacitor 78, 155, 174
- carbon 1, 2, 10
- carbon black (CB) 2, 10, 110, 112, 167
- carbon nanodots (CDs)
 - applications
 - electroluminescent LEDs 216–218
 - photoluminescent LEDs 213–216
 - LEDs display applications 213–218
 - optical properties 211–213
 - synthesis of 211
- carbon nanomaterials market 2
- carbon nanostructures (CNS) 9, 10
 - characterization 22

- electron microscopy 23–30
 - Raman spectroscopy 22–23
 - chemical vapor deposition 14–17
 - ion irradiation method 20–21
 - plasma-enhanced chemical vapor deposition 18–20
 - properties 11, 12
 - synthesis 13–21
 - thermal chemical vapor deposition 17–18
- carbon nanotube-based actuators 191–194
 - fullerene actuators 198
 - graphene oxide actuators 194–197
- carbon nanotube field-effect transistors (CNTFETs)-based gas sensors 64
- carbon nanotubes (CNTs) 2
 - alignment and polarized material 220–222
 - emission materials 218–220
 - LCD and OLED 222–224
 - transparent electrode and touch panel 224–226
- carbonous materials, in photovoltaics 110
- carbonuous 4, 5
- charcoal 10
- chemical vapor deposition (CVD) 14–17, 20, 30, 40, 41, 50, 190, 218, 220, 222, 229
- coal 10
- color rendering index (CRI) 214, 216
- Compound Annual Growth Rate (CAGR) 2
- crystalline carbon 11

d

- diamonds 1, 2, 10, 11, 39, 185
- dip coating 80, 88, 97
- display technology 209
 - carbon nanodots (CDs) 210
 - applications 213–218
 - optical properties 211–213
 - synthesis of 211

- carbon nanotubes 218
 - alignment and polarized material 220–222
 - emission materials 218–220
 - LCD and OLED 222–224
 - transparent electrode and touch panel 224–226
 - graphene and graphene oxide 226
 - liquid crystal materials 226–228
 - transparent electrode 228–230
 - dye-sensitized solar cells (DSSC) 111–113
- e**
- electroluminescent LEDs 216–218
 - electron microscopy 23–30
 - electrospinning 163, 168–171, 176
 - emerging carbon-based memory technologies 77–78
 - energy dispersive x-ray (EDX) spectrometers 23
 - energy harvesters 5, 173
- f**
- fabrication methods, piezoelectric materials 171
 - fabrication technology
 - electrode materials effects 80
 - of metal/insulator/metal structure 80
 - dip coating 88–89
 - inkjet printing 89–93
 - PP deposition method 93–96
 - spin coating 81–84
 - spray coating 84–87
 - substrate options 79
 - field-effect transistors (FETs) 57, 102, 103
 - field emission display (FED) 209, 218–220
 - figure-of-merit 132, 137, 139, 156
 - Fourier transform infrared spectroscopy (FTIR) 163, 164, 168
 - fullerenes 1, 2, 37, 38, 42, 43, 185, 190, 191, 199
 - actuators 198
- g**
- gas sensing applications 61–64
 - glow discharge polymerization 93
 - graphene 3–5, 10, 41, 167, 186
 - graphene-based materials actuation 194
 - graphene field-effect transistors (GFETs) 102, 104, 105
 - graphene oxide
 - actuators 194
 - liquid crystal materials 226
 - transparent electrode 228
 - graphene quantum dots (GQDs) 11, 56, 78, 110, 210, 212
 - graphite 1, 2, 10, 23, 26, 37, 55, 112, 185, 187
 - graphitic-N 54
 - green synthesis methods 244
- h**
- heteroatom-doped graphene
 - gas sensing applications 61–64
 - optoelectronic applications 55–57
 - plasma-based synthesis 47–55
 - post-growth plasma treatment 50–54
 - properties 54–55
 - in situ* plasma-assisted growth and doping 47–50
 - strain-pressure sensing applications 57–61
 - high-temperature TE Materials 138
 - hybrid organic–inorganic thermoelectric materials 144–146
 - hydroxyl fullerene 43
- i**
- indium tin oxide (ITO) 224
 - inductor 78
 - inkjet printing 78, 88–93, 97
 - inorganic piezoelectric materials 157, 159–162
 - carbon nanotubes 164–167
 - inorganic thermoelectric materials 137–138
 - in-situ* transmission electron microscopy 26–30
 - ion irradiation method 20–21
- l**
- lead-free ceramics 161
 - liquid crystal display (LCD) 209
 - low-dimensional carbon-based nanomaterials (LDCBNM) 37–41
 - modification 41–47
 - low-temperature TE materials 138
- m**
- medium-temperature TE materials 138
 - memristor-based memory 78–79
 - metal–organic coordination polymers 145
 - molecular actuation systems 186
 - movers 185
 - multi-mission radioisotope thermoelectric generator (MMRTG) 129
- n**
- nanotechnology 2, 4, 9, 55
 - non-volatile memory (NVM) 77, 78, 80–84, 88, 92, 93, 96, 97, 243

O

- open-circuit voltage 156
- optoelectronic applications 55–57
- optoelectronics
 - graphene 103–109
- optoelectronics 101
- organic light-emitting diode (OLED) display 209, 210, 218, 222–226, 228–230
- organic piezoelectric materials 162–164
 - carbon nanotubes 164–167
 - graphene 167–168
 - quantum dots 168–169
- organic thermoelectric generators (OTEG)
 - applications 146–149
- organic thermoelectric materials 138–144
- OTEG. *see* organic thermoelectric generators (OTEG) applications
- oxidation 43, 44, 46, 142, 185, 187

P

- patterned chemical doping technology 107
- P-doped graphene 52
- Peltier effect 130–132
- perovskite solar cell (PSC) 114–117
- photodetectors 56, 103–109
- photoluminescent LEDs 213–216
- piezoelectric materials
 - applications
 - biomechanical sensor 173–175
 - energy harvesters 173
 - direct effect 155
 - fabrication methods 169–172
 - inorganic 157, 159–162
 - open-circuit voltage 156
 - organic 162–164
 - carbon nanotubes 164–167
 - graphene 167–168
 - quantum dots 168–169
 - properties 157
- plasma-enhanced chemical vapor deposition (PECVD) 18–20, 47
- plasma polymerization (PP) deposition 93–96
- poly(sodium 4-styrenesulfonate) (PSS) 4
- power factor 132
- printing technology 91
- pyridinic-N 48–52, 54, 61

Q

- quantum dots (QDs) 168–169

R

- Raman spectroscopy 22–23
- resistor 78

S

- scanning electron microscopy (SEM) 24–25
- scanning transmission electron microscopy (STEM) 25, 52
- Seebeck effect 130–131
- simplified one-dimensional decoupled model 134–137
- single-crystal graphene 3
- solution processing techniques 80
- spray coating technique 84–87
- strain–pressure sensing applications 57–61

T

- thermal CVD 17–18
- thermoelectric effect
 - figure-of-merit 132–134
 - Peltier effect 131–132
 - Seebeck effect 130–131
 - Thomson effect 132–134
- thermoelectric energy harvesters 128
- thermoelectric generators (TEG) 127
 - application 129
 - power and efficiency 134
 - simplified one-dimensional decoupled model 134–137
 - three-dimensional coupled multiphysics model 137
- thermoelectric materials
 - hybrid organic–inorganic 144–146
 - inorganic 137–138
 - organic 138–144
- thin film transistor (TFT) 222–224
- Thomson effect 132–134
- three-dimensional coupled multiphysics model 137
- transmission electron microscopy (TEM) 25–26

W

- water-soluble fullerene derivatives 42
- wootz steel 10

X

- X-ray diffraction (XRD) 22, 163, 164, 168