

Index

a

ab initio steered molecular dynamics (AISMD) 10
 acylhydrazine-terminated PEO 282
 adamantane (Ad) 39, 41, 288
 adamantane carboxylic acid 39
 adenosine triphosphate (ATP) 286
 aggregation-induced emission (AIE) 89, 282
 aldehyde-poly(oligoethylene glycol methacrylate) (POEGMA) 166
 α -particles 136–137
 aminophenyl fluorescein (APF) 143
 aminopyridine 69
 aminothiophene 69
 amphiphilic chitosan 362
 amphiphilic sodium lauryl sulfate 351
 anils 69, 70
 anisotropic hydrogel actuators 301, 302, 308, 310, 322
 anisotropic structures
 innovative technology 322–325
 macromolecular assembly 322
 stepwise polymerization 318–320
 3D printing 320–321
 anthracene derived Diels–Alder adducts 20
 9-anthracene ester-terminated polydimethylsiloxane 101, 102
 anthracene-maleimide adduct-embedded polymer chain 20
 anticounterfeiting/authentication technologies 56, 61

anti-head-to-head dimer 75, 78
 artificial muscles 301, 302, 325, 327–328, 332
 asymmetric CNTs-elastomer/hydrogel composite 327
 Au/AgNWs-based neural interface coated with PVA hydrogels 357
 autocorrelation experiments 214, 217, 245
 averaged single-scattered intensity 216
 average ionization energy (W_e) 136
 azobenzene 54, 63, 68, 95, 96, 98, 101, 103–109, 112, 114, 115, 139
 azobenzene-containing polymers 101
 4,4-azodibenzoic acid 109

b

Batchelor–Einstein equation 231
 Bell's model 911
 benzoin acid (BA) 141
 benzopyran 16, 17, 63, 64
 benzoxazole aliphatic ester 29
 benzyl-based PPGs 71, 72
 β -cyclodextrin (β -CD) 105, 288
 Bethe–Bloch formula 136, 137
 bilayer hydrogel actuator 297, 309–311, 320, 322, 329
 bioadhesives 362
 bio-inspired mechanosensing systems and soft actuators/robotics 294
 biological hydrogels 342
 biomimetic devices 301, 325, 329, 332
 bis(naphthopyran) 18, 19

- bis(adamantyl)-1,2-dioxetane mechanoluminophore functionalized polymers 28
- bond rupture probability densities 13
- borate derivatives 61
- 4-bromobenzaldehyde 62
- 2-bromo-5-hydroxybenzaldehyde 62, 85
- α -bromonaphthalene 86
- 4-bromo-1,8-naphthalic anhydride 62, 86
- bulk polymers 12, 22, 30, 35, 38
- butyl methacrylate (BA) 88, 205
- C**
- capacitive strain sensors 343, 345
- carbazole 61, 111
- carbon-based nanomaterials 181
- carbon fiber 343
- carbon nanosheets 181
- carbon nanotube (CNT) 169, 316, 341, 343
- carbonyl-based PPGs 71, 72
- 5(6)-carboxytetramethylrhodamine (TAMRA) 143
- cell culture 111, 162–167, 176
- cellulose nanocrystals (CNCs) 161, 289
- chemically cross-linked poly(acrylamide) hydrogel 284
- chemical potential of solvent molecule 209
- chemical sensors 339
- chemical vapor deposition (CVD) 158
- chromene 63
- cinnamate derivatives 54, 71
- cis-trans* isomerization 54, 63, 101
- CNTs/Ecoflex 327
- coefficient of thermal expansion (CTE) 158
- coherent scattering 138, 219, 224, 225, 248
- colloidal core-shell particles 222
- colloidal suspensions 205, 220, 231, 235
- color change and emission 117
- color-changing mechanoresponsive fibers 14
- composite organohydrogel 329
- compressibility of microgels 204, 228
- swelling thermodynamics 207–210
- Compton effect 138–139
- Compton scattering 138, 139
- conductive hydrogel 342, 343, 354, 356, 357, 358, 360, 362
- conjugated polymer sensors 89
- constant thermal fluctuations 11
- constrained geometry simulating external force (CoGEF) 15
- contrast variation 205, 211, 222–227, 235, 236
- controlled/living radical polymerization (CRP) 70
- conventional emulsion polymerization and SEP 184–186
- core-shell microgels 182, 184, 189, 190, 195, 253, 255, 257, 259, 261, 262
- coumarin 20, 21, 54, 57–59, 71, 72, 73, 75, 77, 78, 84, 93, 95, 96
- coumarin-3-carboxylic acid (CCA) 141, 143
- coumarin-containing polymers 84, 117
- coumarin-derived isomeric hydrogelators 286, 287
- coumarin-functionalized telechelic associative model polymer 101
- coumarin-4-ylmethyl derivatives 54, 71
- COVID-19 pandemic 175
- cross correlation and 3D-DLS experiments 214–216
- cryo-electron tomography (Cryo-ET) techniques 191
- CT dyes 57
- cyanines 58, 89
- cyanostilbene 89
- cyclobutane mechanophore-fused lactone polymer (poly(CBL)) 22
- cyclobutenes 23
- cyclopropane 23
- cyclosporine A (CsA) 360

d

- dendrimer based sensors 89
 deswollen state 203, 204, 209
 diacetone acrylamide (DAA) 284
 diarylbibenzofuranone (DABBF) 25
 diarylethenes 54, 63, 68, 71, 106
 dibenzothiophene 61
 di(1-hydroxylundecyl) diselenide 147
 difluorenylsuccinonitrile (DFSN) 26
 difluoroboron dibenzoylmethane 62
N,N-dimethylacrylamide (DMA) 284
N,N'-dimethylaminoethyl methacrylate 95
 dinitrobenzylpyridine (DNBP) 63, 68, 70
 diphenyl(2,4,6-trimethylbenzoyl) phosphine oxide (TPO) 320
 direct-ink-write (DIW) 316, 320
 diselenide-containing carbon dots (dsCD) 363
 diselenide-containing polymer 147, 148
 dissipative particle dynamics simulations 206
 9,10-distyrylanthracene (DSA) 89
 1,2-disubstituted benzocyclobutenes (BCB) 8
 diverse gradient hydrogel actuators 312
 Donnan equilibrium 325
 Donnan potential 231
 dopamine/alginate/poly(acrylic acid-co-acrylamide) hydrogel 351
 dopamine-talc-polyacrylamide (DTPAM) hydrogels 341
 dosimeters 136, 139–141, 143, 149, 150
 DOX-loaded nanocarriers 147
 d3-pNIPAM-based microgels 227
 drug-delivery 33, 34, 57, 71, 111
 dual mechanophore-5,5-dichlorotricyclo (7.2.0.0)undecane (DCTCU) 22
 dual-networks glycol organogel 349
 dye dosimeters 139–141
 dynamic light scattering (DLS) 195, 204, 205, 211–216, 213, 241, 242–245

e

- E-4031 164
 electrical bio-adhesive interface 362
 electric field auto-correlation function 213
 electroactive hydrogel (EAH) 325, 326
 electroactive surface area (ESA) 173
 electrochemical sensors 173, 175, 341, 358
 electronic communication technology 342
 electronic conductive hydrogel 343
 electronic energy transfer (EET) 89
 electron-ion pairs 136
 electrons 17, 24, 25, 56–58, 70, 89, 110, 137, 138, 139, 147
 emulsions stabilized by nanocomposite microgels 194
 energy of the electrons 9
 epoxy-functionalized fluorescent polymer nanoparticles 84
 ethyl acrylate (EA) 205
 ethylene diamine tetraacetic acid (EDTA) 324
 3,4-ethylenedioxythiophene 343, 358, 362
 europium-doped barium fluorochloride 140
 excitation 20, 29, 57, 58, 60, 86, 91, 103, 136, 137
 excited-state intramolecular proton transfer (ESIPT) 70, 89
 exponential attenuation law 138

f

- femtosecond laser 320, 321
 Fermi pseudo-potential 217
 ferrocene mechanopolymers 30
 film dosimeters 139
 films 83, 86, 107, 110, 112, 157, 158, 160, 161–167, 169
 flexible hydrogels-based sensors expanded usage scenarios 353
 mechanical properties 347–351

- flexible hydrogels-based sensors (*contd.*)
 multi-functionalization and expanding application 354–355
 principles of conductive hydrogel sensors 343–347
 prolonged longevity of 351–353
 flexible wearable sensors 339
 flexible wrinkled carbon nanotube (CNT)-based sensor 169
 Flory–Rehner equation of state 210
 Flory–Rehner theory 203
 Flory solvency parameter 208
 Flory's theory 325
 flow properties of colloidal suspensions 231
 fluorene derivatives 61
 fluorescein 57, 58, 60, 88, 89, 93, 143, 282, 292
 fluorescence resonance energy transfer (FRET) 89
 fluorescent chemosensors 89, 290
 fluorescent compounds 57, 58, 59, 141
 fluorescent ink pattern 84
 fluorescently labelled sensitive hydrogel (FLASH) 292
 fluorescent merocyanine (MC) 63
 fluorescent polymer dosimeters 141–143
 fluorescent polymeric hydrogels 281–298
 fluorescent polymers 56–58
 fluorogen-containing vinyl monomers 284
 fluorogen-grafted FPHs 285
 force dependency of reaction rate 11
 form factor 169, 220–223, 227, 243, 244, 251, 256, 257, 261
 four-armed poly(ethylene glycol) 107
 free radical polymerization 25, 70
 fulgide 54, 63
 fumaric acid (FAc) 188
 furylfugides 63
- g**
 γ-ray-responsive diselenated amphiphilic block copolymer 147
 gelatine methacryloyl (GelMA) 292
 gelochromism phenomenon 117
 gene-embedded optoelectrode array 362
 glucose sensors 174, 176, 291, 292
 glutathione (GSH) 363
 glycerol hydrogel 358
 glycidyl methacrylate (GMA) 84, 88, 186
 gold nanoparticles (AuNPs) 39, 143, 146, 175, 327
 graft copolymers 95, 106
 graphene oxide (GO) 343
- h**
 hemithioindigo 63, 66
 Hertzian potential 228
 hexaarylbiimidazole (HABI) 27, 68, 79
 hexamethylene diisocyanate (HDI) 109
 hollow microgels 207, 224, 232, 257, 269
 homogeneous PAAm hydrogel 312
 homogeneous poly(*N*-isopropylacrylamide-*co*-acrylamide) (poly(NIPAM-*co*-AAm)) hydrogels 322
 hybrid conductive hydrogels 343
 hydrazide-POEGMA hydrogels 166
 hydrogel 339
 actuators
 addition of active ingredient 302–305
 anisotropic structures 310–318
 artificial muscles 327–328
 biomimetic devices 329
 information storage materials 329–332
 methods to fabricate anisotropic structures 318–325
 overview of 303
 pneumatic/hydraulic actuators 305–306
 soft robots 325–327
 stimuli-responsive 306–310

- stimuli-responsive
swelling/shrinking property 301
- 3D anisotropic structures 315–318
- bioelectronic devices 363
- hydrogel-based dosimeters 140
- hydrogen bond 29, 30, 39, 61, 84, 98, 147, 283, 286, 289, 329, 341, 347
- hydrogen transfer 54, 63, 69
- hydrophilic/hydrophobic block copolymers 95
- hydrophilic poly(ethylene glycol) moieties 285
- hydrophobic aggregation-induced emissive fluorogens (AIEgens) 282
- hydrophobically associated PAAm hydrogels 349
- hydrophobic monomers 182, 184, 186, 192, 195
- hydrophobic TPE 285
- i**
- imidazole containing brush copolymers (ICPs) 34
- implanted bioscaffolds 292
- imprinted polymer-based sensors 89
- indolinofulgides 63
- information storage materials 329–332
- inherent smart polymers 53
- inorganic nanofillers 347, 349
- in-situ* radical solution polymerization 181
- intensity auto-correlation function 213
- intermolecular cyclization 74
- interpenetrating cross-linked networks (IPN) 349
- intramolecular charge transfer (ICT) 57, 89, 331
- intrinsic conductive hydrogels 343
- ionic conductive hydrogels 343
- ionic dissociation 54, 63
- ionic effects 209–210
- ionic microgels 205, 209, 231, 256, 267
- ionic strength-responsive hydrogel actuator 308
- ionizing radiation 135
- dosimetry
fluorescent polymer dosimeters 141–143
- polymer-based dosimeters 139
- polymer/dye dosimeters 139–141
- polymer/metal nanomaterials dosimeters 143–146
- ionizing-radiation-responsive hydrogels 147
- ionizing radiation-responsive polymer systems for therapy 146–149
- ion pairs 136
- irreversible photolabile protecting groups 73
- isophorone diisocyanate (IPDI) 147
- isoprenaline 164
- isotropic deswelling 206, 207, 229, 235
- j**
- Jablonski diagram 57, 58
- k**
- keto–enol phototautomerism 70
- l**
- ladderenes 15, 23–24
- lamina 2–4, 160, 161
- lanthanide coordinated fluorescent particles 283
- Laponite nanoparticles 312
- leucomalachite green (LMG) 139
- light-actuating shape-changing polymer systems 106
- light-induced healable polymers 103
- light-responsive cross-linkable compounds 74
- light-responsive hydrogel actuators 308
- light-responsive polymers 53, 55, 116, 308
- light-sensitive molecules 71, 72
- living electrode 362
- luminescent carbon dots (CDs) 56

m

MAc comonomers 184
 macrogels 203
 macromolecular assembly 322
 magnetic and thermal dual-responsive hydrogel actuator 305
 magnetic nanoparticles 181
 manually stretched DABBF-linked polymer 27
 mechanochemistry 1
 in biological systems 2–7
 mechanistic view of 7–15
 polymer covalent 15–29
 polymer noncovalent
 mechanochemistry 29–41
 mechanochromic bis(naphthopyran) (BNP) 18
 mechanochromism 17, 19, 25, 30, 32
 mechanofluorescent hydrogels 295
 mechanophore oxanorbornadiene 20
 mechanophores 2, 13, 15, 17, 18, 20,
 22–30, 41
 mechano-responses of metal-ligand bonds 30
 mechanotransduction 1–4, 6, 7, 41
 membranes 2, 4, 7, 54, 112, 114–116, 167
 mercaptoethylamine 205
 merocyanine (MC) 16, 63, 101, 140
 metal-ligand charge transfer (MLCT) 89
 metal-ligand mechanopolymers 32, 33
 metal particles 343
 7-methoxycoumarinyl-4-methyl derivatives 72
 methylene blue (MB) 95, 139
 methyl methacrylate (MMA) 38, 86, 205
 methyl orange (MO) 139
 microgel elasticity 209
 microgel hydrodynamic radii 229
 microgels 181–196, 203–236
 microgel-stabilized emulsions (MS-Es)
 193
 microrganogel 329
 micro tissue engineered neural networks (μ TENNs) 362
 molecular dynamics 206

multi-layered nanocomposite microgels 189–190
 multi stimuli-responsive hydrogel actuators 306, 308–310
 mussel-inspired
 proanthocyanidins-coated cellulose nanofibrils
 nanocomposites 358

n

nanoclay 141
 nanocomposite/composite hydrogels 181
 nanocomposite microgels
 applications of 193–195
 background on 182–184
 characterization of 190–192
 conventional emulsion polymerization and SEP 184–186
 internal structure design 188–189
 multi-layered 189–190
 prepared by SEP in the presence of microgels 186–187
 seeded emulsion polymerization (SEP) 181
 nanofibrillar fluorescent hydrogels 289
 nanofibrillated cellulose (NFC) 320
 nanoparticles 20, 39, 56, 84, 86, 96, 136,
 139, 143, 145, 146, 149, 175, 181
 naphthalene imide 62
 naphthopyran (NP) 17–19, 18, 63
 2-naphthoquinone-3-methides groups 54
 negatively charged exfoliated Laponite nanosheets 287
 negatively charged poly(sodium *p*-styrenesulfonate) (PSS) 286
 neutral microgels 235
 2-nitrobenzyl (NB) series 71
 nitro blue tetrazolium (NBT) 139
 nitro blue tetrazolium (NBT)-gelation system 140
 nitrogen-containing heteroaromatic derivatives 61
 non-fluorescent spiropyran (SP) 63

- non-responsive hydrogel (NGR) 322
 non-spherical nanocomposite microgels 186
 nonviral gene vectors 362
 non-zero wavevectors 213
- O**
- oligourethane gelator (OUG) 289
 ONB derivatives 71, 72
 1D/2D anisotropic structures
 bilayer hydrogel actuator 310
 gradient 312–315
 oriented hydrogel 311
 patterned hydrogels 315
 o-nitrobenzyl acrylate 95
 optogenetics 361–363
 organic dyes 57, 139
 organic fluorescent compounds 58, 59
 organic fluorescent dyes 56, 57
 organic phosphorescent compounds 55, 62
 organo-boron complexes 89
 organohydrogel 329, 330
 oriented hydrogel 311–313
 Ornstein–Zernicke equation 222
 over-crowded alkene 63
 oxazine 18, 54, 63
 oxazine (OX)-derived mechanophores 17
 oxazolidine 63, 84, 85
- P**
- PAA-alginate hydrogel 37
 PAAm-*co*-PAAc 329
 PAAm-PAAc anisotropic hydrogel
 actuator 308
 pair production 138, 139
para-hydroxyphenylacetic acid 72
 patterned hydrogels 315, 316
 P(BCH-Naph) 24
 PEG capped iron oxide-based
 nanoparticles (IOPs) 302
 PEG-PUSeSe-PEG 147
- peptide target sequence
 Cys-Lys-Lys(Ac)-d-Ala-d-Ala
 (DADA) 39
 persulfurated derivatives 61
 perylene-tetracarboxylic-acid-modified
 gelatin (PTG) 332
 P(PyMA-*co*-AAc) fluorescent hydrogel 329
 phenacyl esters 54, 71, 72
 phosphorescence phenomena 60
 phosphorescent polymers 55, 58–62
 photoadaptable polymers 78–83
 photochromic polymer inks 86
 photochromic polymers 62–71
 photochromic sensors 91
 photochromism 62, 63, 68–70, 83, 84
 photocleavable polymers 71–74
 photoconductive polymers 54, 71,
 109–111
 photocromic polymeric chemosensors 89
 photocross-linking reaction 54, 74, 75,
 103, 106
 photocycloaddition reactions 75
 photodegradable polymers 71, 72
 photodimerizable polymers 74–78
 photodynamic covalent polymers 79, 83
 photoelectric effect 138
 photoinduced cyclization 74
 photoinduced electron transfer (PET)
 70, 89, 284
 photoisomerizable arylazopyrazole
 (*trans*-AAP) 105
 photolabile *ortho*-nitrobenzyl ester (ONB) 54
 photolabile protecting groups (PPGs) 71,
 73
 photolithography 72, 93–95
 photoluminescent cellulosic papers 84
 photoluminescent polymers 55–62
 photomelting azobenzene monomer 107
 photons 55–57, 137–139, 143
 photoresponsive O/W emulsions 95
 photoresponsive polymer composites 53

- photoresponsive polymers
 color change and emission 117
 drug-delivery 111–112
 films 112–115
 membranes 112–115
 photoadaptable polymers 78–83
 photochromic polymers 62–71
 photocleavable polymers 71–74
 photoconductive polymers 109–111
 photodimerizable polymers 74–78
 photolithography 93–95
 photoluminescent polymers 55–62
 photorheological polymers 98–103
 polymer sensors 89–93
 self-healing polymers 103–106
 shape-changing polymers 106–109
 smart polymeric inks 83–88
 sol-gel transition 117
 surface active agents 95–98
 textiles 112–115
 viscosity variation 116–117
 water contact angle variation 116
 photoreversible cross-linked epoxy polymers 106
 photorheological polymers 98–103
 photoswitchable polyacrylic nanofibers 86
 pH-responsive fluorescence molecule 332
 pH-responsive hydrogel actuators 307
 pH-responsive PAAm-PAAc bilayer hydrogel actuator 329
 pH-responsive polymers 53
 physical sensors 339
 physical vapor deposition (PVD) 157
 Piezo proteins 7
 π -extended anthracene-maleimide adducts 20
 $[2\pi+2\pi]$ or $[4\pi+4\pi]$ cycloaddition mechanism 74
 $[4\pi+4\pi]$ or $[2\pi+2\pi]$ cycloaddition mechanisms 54
 Planck's constant 217
 plant-based aloe vera hydrogel 360
 pneumatic/hydraulic actuators 305
 pNIPAM-based microgels 234
 POEGMA-CNC fibers 166
 polyacid derivatives 61
 poly(acrylamide-*co*-2-acrylamido-2-methylpropanesulfonic acid)
 $[\text{P(AAm-}co\text{-AMPS)}]$ hydrogels 315
 poly(acrylamide-*co*-methacrylic acid (MAc)) microgels 182
 poly(acrylamide-*co*-*N*-(3-amino-propyl methyl acrylamide)
 $(\text{PAAm-}co\text{-APMA})$ nanogels 143
 polyacrylamide (PAAm)/chitosan (CS)/multi-wall carbon nanotubes (MWCNTs) 341
 poly(benzoLDE) 24
 polycyclic aromatics 71
 poly(2-(dimethylamino)ethyl methacrylate) (PDMAEMA) 282
 polydimethylsiloxane (PDMS) 30, 101, 340
 polydopamine (PDA) adhesive layer 175
 polyelectrolytes-based hydrogels 343
 poly(3,4-ethylenedioxythiophene)/ poly(styrenesulfonate)
 (PEDOT/PSS) -coated MWCNTs 358
 poly(ethylene glycol) (PEG) 101, 147 hydrogel 101, 302, 357
 poly(ethylene oxide)-*b*-PSPA (PEO-*b*-PSPA) 112
 poly(3-hexylthiophene) (P3HT) 111
 poly(lactic acid) 61
 poly(lactic-*co*-glycol acid) (PLGA) microspheres (MS) 360
 polyladderene (PLDE) 23, 24
 polymer-based dosimeters 136, 139
 polymer-based phosphorescent materials 61
 polymer covalent mechanochemistry ladderenes 23–24
 mechanophores 27–29
 pyran-based mechanochromophores 16–19

- retro-cycloadditions 20–22
- stable radical systems 24–27
- polymer dots (PDs) 53, 56
- polymer/dye dosimeters 139–141
- polymer gel-based dosimeters 140
- polymeric fluorescence chemosensors 89
- polymeric hydrogels 105, 140, 281–298
- polymer mechanochemistry 2, 15, 27, 30, 37
- polymer/metal nanomaterials dosimeters 143–146
- polymer nanofillers 351
- polymer noncovalent mechanochemistry
 - functional polymers 37–41
 - mechano-responses of metal-ligand bonds 30–37
- polymers containing pendant ligand groups 89
- polymer sensors 71, 89–93
- polymer/solvent mixing 208
- poly(methacryloxyethyltrimethyl ammonium chloride) (PMETAC) 308
- polymethyl acrylate (PMA) matrix 20
- poly(methyl methacrylate) (PMMA) 26, 61, 143, 340
 - microspheres 186
- poly(methyl methacrylate-*co-n*-butyl acrylate) 38
- poly(NIPAm-*co*-FAC) microgels 188, 191
- poly(NIPAm-*co*-MAc) microgels 188, 189
- poly(*N*-isopropyl acrylamide) (pNIPAm) 20, 41, 91, 204, 307
 - hydrogels 20, 41, 305
 - microgels 182, 186
 - microgel suspensions 217
- poly(*N*-isopropylacrylamide) (PNIPAAm) 20, 41, 91
- poly(*N*-isopropylacrylamide-*co*-acrylic acid) (PNIPAm-*co*-AAc) 230
- poly(*N*-vinyl carbazole) 109
- poly(*N*-vinylpyrrolidone)/gallic acid (PVP/GA) composite hydrogel 347
- poly(oligo(ethylene glycol) methyl ether methacrylate) (POEGMEMA) polymer chains 39
- poly(propylene glycol) (PPG) 101, 285
- polypyrrole (PPy) 329, 343
- poly(sodium acrylate) (PNaAAc) hydrogel 315
- polystearyl methacrylate (PSMA) 329
- polystyrene (PS) 27, 87, 186
 - films 160
- polystyrene (PS)-based composite
 - microfibers 140, 141
- polystyrene-poly(NIPAm-*co*-FAC)
 - nanocomposite microgels 188, 193
- polythiophene/poly(3,4-ethylenedioxythiophene) (PEDOT) 343
- polyurethane (PU) 25, 27, 28, 101, 102, 139, 340
- poly(vinyl acetate) 109
- poly(vinyl alcohol) (PVA) 283, 322
 - hydrogels 61, 109, 345
- poly(vinyl carbazole) 110
- polyvinyl chloride (PVC) films 143
- poly(vinyl fluoride) 109
- poly(vinyl pyrene) 110
- polyzwitterionic hydrogel actuator 308
- precipitation polymerization 182–184, 188, 189, 190, 204
- PRESAGE® dosimeters 139
- protein unfolding by force 4–6
- pure organic room-temperature phosphorescence luminophores 61
- PVP/GA composite hydrogels 347
- pyran-based mechanochromophores 16–19
- pyrenylmethyl 54, 71, 72, 329
- 1-pyrenylmethyl acrylate (PyMA) 329

- pyrenylmethyl esters 72
 pyromellitic acid (PMA) 141
 pyrrolidine-appended naphthopyrans 18
- q**
 quantum dots (QDs) 56, 284
 quinoline-malononitrile (QM) 89
- r**
 radiation dose 135, 139, 140, 143, 149
 radiation-matter interaction
 α -particles 136
 electrons 137
 photons 137–139
 radical-based mechanochromophores 25, 26
 raspberry-shaped composite microgels 186, 187
 ratiometric fluorescence dosimeter 143
 reaction pathway 7, 8
 reduced graphene oxide (rGO) 309, 360
 resistive strain sensors 343
 resonant dyes 57
 responsive hydrogel (RH) 39, 147, 305, 322
 retro-cycloadditions 15, 19–22
 reversible chromophore-containing polymeric surfactants 95
 reversible photodimerization reactions 75
 reversible photoresponsive chromophores 112
 rhodamine 28, 57, 58, 84, 89
 ring formation/cleavage 54
 ring-opening metathesis polymerization (ROMP) 23, 91, 107
- s**
 salicylideneaniline 63, 67, 69
 SANS setup 218
 SARS-CoV-2 spike protein 175
 scattering angle 211, 212, 214, 215, 217
 scattering length density (SLD) 219, 223, 224, 227, 248, 249, 253
 scattering theory 218–220
 security ink 55, 71, 84
 seeded emulsion polymerization (SEP) 181–196
 seeded precipitation polymerization 182, 184, 189
 self-healing mechanism 38, 229, 352, 353, 361
 self-healing polymers 37, 54, 71, 103–106
 semiconductor dosimeters 139
 sensing by ion channel opening 6–7
 Se-polymer 147, 149
 shape-changing polymers 106–109
 silole 89
 silver nanowires (AgNWs) 351
 single-molecule spectroscopy 12
 single scattered intensity 216
 single stimulus-responsive hydrogel actuators 307–308
 small-angle neutron scattering (SANS) 205, 216–228, 235
 small-molecule fluorogen-containing monomer units 286
 smart photoluminescent nano- or microgel hybrids 284
 smart photoresist polymers 93
 smart polymeric inks 54, 83–88
 smart polymers 53, 54, 58, 83, 89
 soft actuators/robotics 281, 294–297
 soft alginic acid gel 358
 soft robots 285, 297, 325–327
 sol-gel transition 117
 solid-like nanocomposite microspheres 186
 solvent-based polymeric inks 83
 spherical polystyrene-core/poly(NIPAm-co-FAc)-hydrogel-shell core-shell microgels 195
 spirooxazine 54, 63, 88
 spiropyran (SP) 16, 54, 63, 68, 71, 86, 91, 139, 140
 spiropyran-containing polymer 91, 92, 101, 117
 spirothiopyran (STP) 17, 63

- stable radical systems 15, 24–27
 static light scattering (SLS) 213, 242–245
 stereocilia 6, 7
 stereolithography (SLA) 320, 321
 stilbene 54, 63, 66, 68
 stimuli-responsive block copolymer-grafted CNC 97
 stimuli-responsive fluorescent polymeric hydrogels (FPHs)
 advantages 281
 bio-inspired mechanosensing systems and soft actuators/robotics 294–297
 covalently bonding fluorogens 284–285
 information encoding and encryption 293–294
 optical sensing and bio-imaging 290–293
 physically incorporating fluorogens 282–284
 supramolecular
 polymerizing/crosslinking
 monomeric fluorogens 286–290
 synthetic strategies 290
 tunable luminescent properties 281
 stimuli-responsive hydrogel actuators 306–310
 stimuli-responsive photoresist polymers 93
 stimuli-responsive polymers 53, 55, 117, 135, 136
 strain-dependent mechanosensing hydrogels 295
 strain-induced elastic buckling instability for mechanical measurements (SIEBIMM) 160
 stressful environment during heart development 3–4
 stress-mitigation by tissue 6
 structured thin films 157–158
 structure factor 220–222, 224, 228, 229, 244
 styrene 85, 86, 88, 93, 98, 184, 186–189
 styrene nanoparticles 86, 186–188, 190, 191, 195
 sulfur-containing heteroaromatic derivatives 61
 sulfur-nitrogen-containing heteroaromatic derivatives 61
 super-resolved fluorescence microscopy (SRFM) 205
 supramolecular β -peptide-based hydrogel 341
 supramolecular conductive PANI/PSS-UPy hydrogels 352
 supramolecular
 polymerizing/crosslinking
 monomeric fluorogens 286–290
 supramolecular structures 56, 286, 287
 surface active agents 54, 71, 95–98
 suspension phase behavior 207, 228–231
 swelling ratio 204, 224
 syn head-to-head dimer 75, 78
 synthetic hydrogel 339, 342
 synthetic polymer mechanochemistry 30
- t**
- temperature-responsive polymers 53, 72
 terephthalic acid (TPA) 141
 tetraaldehyde-terminated PEO polymers 283
 tetraarylsuccinonitrile (TASN) 25
 tetraphenylethene (TPE) 89, 286
 tetraphenylhydrazine 70
 tetraphenylpyr-azine (TPP) 89
 textiles 112–115
 thermally expanded
 poly(dimethylsiloxane) (PDMS)
 substrate 158
 thermal wrinkling 159–176
 thermoluminescence dosimeters 139
 thermo-responsive hydrogel actuators 307
 thermoresponsive microgels 204
 thermo-responsive poly(diethylene glycol methyl ether methacrylate) 284

thermoresponsive polymer 41
 thiazine derivatives 70
 thin films
 cell culture 162–167
 current challenges and future perspectives 175–176
 structured 157–159
 thermal wrinkling 159–176
 for wearable electronics 167–173
 wrinkled electrochemical sensors 173–175
 thiomerocyanine 17
 3D anisotropic structures 315–318
 3D cross-linked polymer network 284
 3D dynamic light scattering (3D-DLS) 235
 3D nanocomposite structures 190
 3D printing 163, 301, 302, 310, 320–321
 3D shape hydrogel 320
 three-layered nanocomposite microgels 189
 tissue-machine interfaces
 design and mechanism of the neural interfaces 356–360
 multi-functional applications 360–363
 titanate(IV) nanosheets (TiNSs) 312
 traditional wearable sensors 339
 transient body-centered cubic (bcc) crystals 230
 trimesic acid (TMA) 141
 3-(trimethoxysilyl)propyl methacrylate (TMSPMA) 316
 1,3,3-trimethylindolino-6'-nitrobenzopyrylospiran
 6-nitro BIPS 140
 triphenylimidazole 63
 triphenylimidazolyl dimer (TPID) 70
 triphenylimidazolyl (TPI) radicals 27
 triphenylimidazolyl radicals (TPIR) 70
 tubular hydrogel 327
 “turn-on” thiol-responsive fluorescence probe 89

twisted intramolecular charge transfer (TICT) 89
 two-dimensional (2D) cell culture 162
 two-layered core-shell microgels 189

U

ultra-low crosslinked microgels 230, 235
 ultrasonication-induced benzoxazole (Bz)- appended aliphatic esters 28
 upconverting nanoparticles (UCNPs) 56
 ureidopyriminone-conjugated gelatin (Gel-UPy) 363

V

vancomycin (Van) 39
 vinyl-functionalized CdSe quantum dots (QDs) 284
 viologen 63, 68, 70
 viscosity variation 98, 101, 116–117
 Vogel–Fulcher–Tammann (VFT) model 233
 von Willebrand Factor (vWF) 4 protein 5

W

water-based colloidal polymers 83
 water contact angle variation 116
 water-soluble biopolymers 161
 wearable bioelectronics 342
 wearable device 168, 170, 341–344, 347, 354
 wearable electronics, wrinkled conductive thin films for 167–173
 wearable hydrogels-based sensors 340
 white fluorescent hydrogel 293
 Woodward–Hoffmann (WH) rules 8, 74
 wrinkled conductive thin films for wearable electronics 167–173
 wrinkled electrochemical sensors 173–175

X

- xanthan gum- Fe^{3+} /PAAm-glycerol
organogels 353
- X-ray-responsive diselenide
polymer-based nanocarriers
147

Z

- zero average contrast (ZAC) method
223, 266, 267, 270
- zero-dimensional carbon-based
fluorescent nanomaterials 56
- zwitterionic indolium species 18

