

Index

a

absorbance 215
 absorbers, electromagnetic wave 226
 absorption loss 213
 absorption-transferring process 220, 221
 acidity, Lewis 80
 acids
 – acid-catalyzed curing 168
 – layered silicic 132
 – tannic 196
 acrylic matrix 183
 acrylic rubber 119
 activated monomer (AM) mechanism 22
 activation energy 80, 82, 83
 acyphosphine oxide 50
 adsorbents, HPBs 157–161
 adsorption capacity, hydrogels 173
 adsorption isotherms 160, 161
 agglomeration 80
 alcoholysis 193
 alignment, clay platelets 120
 aliphatic diamine 116
 aliphatic epoxy monomer 20
 aliphatic epoxy resins 197
 aliphatic HPBs 148
 aliphatic polyester (APES) 144
 alkoxides 32, 33
 alkoxysilane 18
 alkyl ammonium ions, primary 110
 alkyl groups, hydroxy 51, 52
 aluminosilicates, MMT, *see* montmorillonite
 amine catalysts, functional 58
 3-aminopropyltrimethoxysilane (APTMS)
 88, 92, 94
 ammonium cations, quaternary 58
 ammonium ions 9
 – primary alkyl 110
 anhydride curing 168
 anhydride matrix, epoxy/ 123

antimicrobial coatings 179

antimicrobial surfaces 149–157

AOETMA 50

APDMMS 50

Arrhenius relationship 72

aspect ratio

 – SWCNTs 228

 – vermiculites 6, 7

b

Bacillus subtilis 156, 157, 179
 bacteria 155, 179
 basal plane spacing 11
 benzoxazine, quaternized monomers 170
 bilayer, local 9
 bio-based epoxy/clay nanocomposites
 189–209
 bio-based polyphenol hardener 196
 bio-derived clay-UP nanocomposites
 144
 biochemical oxygen demand 204
 biocidal agents 155
 biodegradability 204
 – nanocomposites 144
 bisphenol, limonene 195
 bisphenol A diglycidyl ether 2, 117, 123,
 189
 blending 220, 221
 – melt 166
 boehmite 29
 bottom-up UV-cured epoxies 32–35
 branched polyol 53
 branching, HPBs 147
 bridge interaction 172
 bulk-initiated method 175
 butadiene rubbers 181
 butanediol 46
 BzC16 3, 8–11
 BzC18OH 8–11

c

- C18-Swy MMT 44, 45
- carbon nanotubes (CNTs) 223–229
 - MWCNTs, *see* multiwalled carbon nanotubes
 - SWCNTs, *see* single-walled carbon nanotubes
- catalysts
 - functional amine 58
 - Grubbs 174, 175
 - petroleum-based 190
- cation exchange capacity (CEC) 4, 6–8
- cationic disinfectants 155
- cationic polymerization 176
 - ring-opening 21, 168
- cations
 - exchangeable 45
 - organoammonium 43
 - quaternary ammonium 58
 - soft 43
 - , *see also* ions
- CE (3,4-epoxycyclohexylmethyl-3',4'-epoxycyclohexane carboxylate) 23
- cell phones 226
- cellulose
 - decomposition 92–95
 - nanocomposites 76–88
- ceramic fillers 19
- chain extenders 41
- chain transfer agent 168
- char yield 136–139
- chemical-controlled curing 84
- chemiluminescence (CL) emission 154, 155
- chemistry
 - colloidal 17
 - PUs 41
 - thiol-ene 180
- chitosan 177
- clay minerals 131–135
- clay nanocomposites 28
 - bio-based 144, 189–209
 - epoxy- 117
 - ESO 113
 - HPBs 147–163
 - mechanical performance 109–128
 - phenol-formaldehyde/ 169
 - polybenzoxazine/ 169, 170
 - polysulfone/ 174
 - preparation 166–176
 - PU- 39–67
 - SMC 113
 - UPR hybrid 129–146
- clays
 - dispersions 39–67
- excess 203
- exchangeable cations 45
- intragallery space 56
- Lewis acidity 80
- organo-, *see* organoclays
- organophilic character 153
- platelet alignment 120
- polar 120
- SMC 113
- smectite 132
- surface-modified 133–135, 147–163
- tensile modulus 56, 57
- click reaction, cycloaddition 182
- Cloisite 30B 26, 27, 46
- coatings
 - antimicrobial 179
 - epoxy 34
 - epoxy–vermiculite nanocomposites 2
- coercivity 159
- colloidal chemistry 17
- complex permittivity 222, 226
- composite films 5, 6
- condensation
 - ceramic fillers 19
 - sol–gel process 32
- conducting nanocomposites 211–237
- conductivity, electrical 215
- conjugated polymers 219
- contact-specific surface area 115
- conventional thermogravimetry (CTG) 90–95
- creep-resistant materials 1
- critical load 27
- critical strain, relative 119, 120
- critical stress, relative 122
- cross-link density 130, 136–139
- cross-linking
 - conducting nanocomposites 216
 - epoxide groups 1
 - polymerization 174
- Cr(VI) water treatment 157–161
- CTG (conventional thermogravimetry) 90–95
- cure kinetics 72–74, 76–88
- cured epoxies
 - bio-based 197–200
 - UV- 17–37
- curing
 - acid-catalyzed 168
 - diffusion-controlled 84
 - layer-by-layer 24
- cycloaddition click reaction 182
- cycloaliphatic epoxy monomers 20

d

deagglomeration 3
 decomposition, cellulose 92–95
 decomposition peak 90, 91
 deformation mechanism 116
 degradation kinetics 72–74, 88–98
 degree of conversion 72, 83
 delamination 3, 4
 – time 8
 dendritic polymers 147
 density, cross-link 130, 136–139
 derivative TG (DTG) 90–93
 dialkoxycarbenium ions 23
 diamine, aliphatic 116
 dicyandiamide (DICY) 189, 190
 dicycloaliphatic epoxides 30
 dielectric constant 221
 dielectric permittivity 215
 differential scanning calorimetry (DSC)
 70
 – temperature-modulated 74, 75, 84–88
 diffusion-controlled curing 84
 diglycidyl ester of dimer acid (DGEDA) 191,
 192
 diglycidyl ether of bisphenol A (DGEBA) 2,
 117, 123, 189
 diglycidyl ether of isosorbide 192
 diisocyanates 41, 46
 – PMDI 48
 diol-functionalized MMT, PU chains
 171
 4,4'-diphenyl methane diisocyanate (MDI)
 41, 53–56
 direct photoinitiation method 28
 disinfectants, cationic 155
 disordered morphology 115
 dispersed phase, dimensions 17
 dispersions
 – clay 39–67
 – PU 43
 distance
 – interlayer 44
 –, *see also* spacing
 DMF 11
 double bond conversion 152
d-spacing 11
 – HPBs 150
 DTG (derivative TG) 90–93
 dynamic loss processes 213
 dynamic mechanical analysis (DMA)
 98–100
 dynamic vitrification temperature 86, 87
 dynamical mechanical thermal analysis
 (DMTA) 111–114

e

EGPs (exfoliated graphite platelets) 31
 elastic modulus 114, 136–139
 elastomers, thermoplastic polyurethane 42,
 43
 electrical conductivity 215
 electrical properties 211–237
 electromagnetic interference (EMI) shielding
 211–237
 electromagnetic wave absorbers 226
 electron transfer and polymerization process
 180
 elongation
 – nanocomposites 100, 101
 – at failure 136–139
 end groups, vinylic 148
 epichlorohydrin (ECH) 189
 epoxides
 – dicycloaliphatic 30
 – photopolymerization 20–23
 epoxidized lignocresol 194
 epoxidized linseed oil (ELO) 191, 192
 epoxidized soybean oil (ESO) 191, 204, 205
 – clay nanocomposites 113
 epoxidized vegetable oil 204, 205
 epoxies
 – (cyclo)aliphatic monomers 20
 – coatings 34
 – epoxy–clay nanocomposites 117
 – epoxy–vermiculite nanocomposites 1–16
 – epoxy/anhydride matrix 123
 – hardeners 190–200
 – UV-cured 17–37
 epoxy functions 20
 epoxy group, dialkoxycarbenium ions 23
 epoxy resins 2, 167
 – aliphatic 197
 – bio-based 189–209
 – graphene/epoxy composites 230, 231
 – PANI/ 220–222
 3,4-epoxycyclohexylmethyl-3',4'-
 epoxycyclohexane carboxylate (CE) 23
 esters
 – DGEDA 191, 192
 – vinyl 143
 ethers
 – bisphenol A diglycidyl 2
 – DGEBA 2, 117, 123, 189
 – diglycidyl ether of isosorbide 192
 – glycidyl 20
 – hexanedioldiglycidyl 34
 – PGPE 198–204
 excess clay 203
 exchangeable cations 45

- exfoliated graphite platelets (EGPs) 31
 exfoliated morphology 26, 134
 exfoliated platelets 7
 exfoliated structure 54, 167
 exothermic peak temperatures 76, 77
- f**
 far-field conditions 212
 feed ratio 198, 199
 fillers 5, 6
 – ceramic 19
 – conducting network 218
 – micro- 109
 – modified 10
 – nano-, *see* nanofillers
 – PU-nanocomposites 43
 films, composite 5, 6
 fire growth rate index (FIGRA) 141
 flame retardance 141–144
 flexural modulus 136–139
 foams, PU 43
 formaldehyde-based nanocomposites 69–108
 – phenol/clay 169
 formaldehyde-based thermosetting polymers 69
 fracture toughness 120–123, 136–139
 free radical polymerization 176
 Freundlich process 161
 friction, molecular 213
 FT-IR analysis, MWCNTs 88–90
 functional amine catalysts 58
 functionalities, polar 47
 functionalized graphene, solution processable 230, 231
 functionalized graphene sheets (FGS) 30, 31
 functionalized nanoparticles 30
- g**
 gallery onium ions 118
 gel-like structure 135
 gelation 78
 glass-transition temperature 112, 114, 136–139
 – HPBs 152
 glassy matrix 112, 116, 117
 glassy state 86
 glucose oxidase 183, 184
 glycidyl ether 20
 gold nanocomposites 181–184
 Gram-negative bacteria 155, 179
 Gram-positive bacteria 179
- graphene 71
 – FGS 30, 31
 – nanocomposites 229–231
 graphite 229
 graphite platelets, EGPs 31
 green nanocomposites 168
 groups
 – epoxy 23
 – ester carbonyl 23
 – hydroxy alkyl 51, 52
 – hydroxy ethyl 47, 48
 – hydroxyl methyl 89
 – methylo 54
 – vinylic end 148
 Grubbs catalyst 174, 175
- h**
 hard matrix 112
 hardeners, epoxy 190–200
 heat capacity 85, 86
 heat flow 72, 75
 – nonreversing 85, 86
 – reversing 85, 86
 heat of reaction 78
 HEMA 151–157
 hexanedioldiglycidyl ether (HDGE) 34
 H_2O_2 treatment 3
 hybrid materials
 – conducting nanocomposites 211
 – organic–inorganic 18
 hybrid nanocomposites
 – toughened UP resin 142
 – UPR/clay 129–146
 hydrogels
 – adsorption capacity 173
 – thermoresponsive 182
 hydrolysis
 – ceramic fillers 19
 – sol–gel process 32
 hydroperoxides 154
 hydrophilicity 159
 hydroxy alkyl groups 51, 52
 hydroxy ethyl groups 47, 48
 hydroxyl methyl groups 89
 hyperbranched polymers (HPBs) 147–163
 – structure 150
- i**
 immersion, monomer 167
 impact strength 136–139
in situ polymerization 19, 166
 – intercalative 131
in situ template synthesis 131

inorganic volume fraction 4
 integrity 228
 intercalated morphology 25, 134
 intercalated structure 54, 167
 intercalation 170
 interfaces, organic inorganic 111
 interference, electromagnetic 211–237
 intergallery surface-initiated method 175
 interlamellar spacing 117, 153
 Interlayer distance 44
 internal reflections, multiple 212–214
 interparticle contact 218
 intragallery space 56
 intrinsically conducting polymers (ICPs) 211, 218–223
 iodonium ions 190
 ion exchange 4, 5
 ions
 – ammonium, *see* ammonium ions
 – dialkoxycarbenium 23
 – gallery onium 118
 – iodonium 190
 – sulfonium 190
 –, *see also* cations
 iron oxide nanoparticles 30
 isobutylene–isoprene rubbers 181
 isoconversional analysis, CTG 94, 95
 isoconversional equation 74
 isoconversional method 83, 84
 isocyanates 44
 isodimensional nanoparticles 39
 isosorbide, diglycidyl ether 192

k

kayak 24
 kinetics
 – cure 72–74, 76–88
 – degradation 72–74, 88–98
 – sol-gel process 33
 – thermal 72–100
 Kissinger method 74, 80–83
 kraft lignin 193

l

lamellar silicates 25
 lamination, “wet edge” 25
 laws and equations
 – Arrhenius relationship 72
 – degree of conversion 72
 – isoconversional equation 74
 – total shielding effectiveness 212
 layer-by-layer curing 24
 layered silicic acids 132

layered structure 131, 132
 layers, graphene 229
 Lewis acidity, clays 80
 light-induced synthesis 178, 179
 lignocresol, epoxidized 194
 limonene bisphenol (LBP) 195
 limonene diepoxyde (LMDE) 191
 linear heating rate 75
 linseed oil, epoxidized 191, 192
 liquid composite molding (LCM) 141
 liquid-rubber state 86
 load, critical 27
 local bilayer 9
 localized reactions 24
 loop interaction 172
 loss, absorption 213

m

magnetic permeability 215
 magnetic sorbents 157
 maleinization 27
 MAOETMA 50
 MAPDMMS 50
 materials 39
 – EMI shielding 215, 216
 – thermosetting polymeric 1
 matrices
 – acrylic 183
 – epoxy/anhydride 123
 – glassy 112, 116, 117
 – hard 112
 – interactions with nanoclays 172
 – particle/matrix interaction 115
 – polymeric 17
 – rubbery 112, 116, 117
 – soft 112
 – UP 110
 MDI (4,4'-diphenyl methane diisocyanate) 41, 53–56
 mean particle size 5, 6
 mechanical analysis
 – DMA 98–100
 – DMTA 111–114
 mechanical properties 100–103, 109–128, 135–141
 melamine-formaldehyde (MF) resins 69, 70
 melt blending 166
 melt intercalation 131
 metal nanocomposites
 – polysulfone/ 184, 185
 – preparation 176
 – UV-cured 35
 metal salts 178

- methacrylates 49
- methods and techniques
 - AM mechanism 22
 - direct photoinitiation method 28
 - isoconversional method 83, 84
 - Kissinger method 74, 80–83
 - LCM 141
 - model-free kinetics method 83
 - multiheating rate methods 73, 82
 - Ozawa method 73, 80–83
 - sequential/simultaneous mixing 173
 - steam explosion method 194
- methyl modifiers 48
- methylool groups 54
- MF resin/clay/cellulose nanocomposites, cure kinetics 76–80
- microfillers 109
- microhardness 157
- microstructure, fillers 5, 6
- millling 3, 7
- minerals, clay 131–135
- MIRs (multiple internal reflections) 212–214
- mixing, sequential/simultaneous 173
- modelfree kinetics method 83
- modifications, organic 39–67
- modified fillers 10
- modifiers, (non)reactive 43, 44
- modulated TG (MTG) 75, 76, 95–98
- modulus
 - elastic 114, 136–139
 - flexural 136–139
 - relative Young's 117
 - storage 98, 99, 112, 113, 136–139, 202
 - tensile 56, 57, 103, 198, 199
 - UTM 136–139
 - Young's 114–118, 136–139
- molding, liquid composite 141
- molecular friction 213
- monolayer adsorption 161
- monomers
 - immersion 167
 - multifunctional 147
 - quaternized 170
- montmorillonite (MMT) 40
 - C18-Swy 44, 45
 - diol-functionalized 171
 - epoxy-vermiculite nanocomposites 2
 - Na-MMT 200, 201
 - OMM 204
 - OMMT 134, 135
 - organic-MMT content 121
 - polydicyclopentadiene/MMT nanocomposites 175
 - sodium 27, 28, 133, 171
 - UP-MMT nanocomposites 140
- morphology 165
 - disordered 115
 - exfoliated 26, 134
 - intercalated 25, 134
- MUF (melamine-urea-formaldehyde) resins 69, 70
- multifunctional monomers 147
- multiheating rate methods 73, 82
- multiple internal reflections (MIRs) 212–214
- multistep reactions 96
- multiwalled carbon nanotubes (MWCNTs) 30, 31, 71, 72, 223–225, 227
 - PF resin/MWCNT/cellulose nanocomposites 88–100
 - surface-modified 88–90
- n**
- nanocomposites
 - biodegradable 144
 - clay, *see* clay nanocomposites
 - CNT-based 223–229
 - conducting 211–237
 - epoxy-vermiculite 1–16
 - formaldehyde-based 69–108, 169
 - graphene-based 229–231
 - green 168
 - hyperbranched polymers 147–163
 - ICP-based 218–223
 - magnetic behavior 159
 - metal 176
 - MF resin/clay/cellulose 76–80
 - PF resin/clay/cellulose 80–88
 - PGPE 198–204
 - polydicyclopentadiene/MMT 175
 - polymer, *see* polymer nanocomposites
 - polysulfone/metal/ 184, 185
 - precursors 40
 - preparation 4, 5, 165–188
 - PU-clay 39–67
 - rubber/silver 181
 - thermal stability 91
 - UP-MMT 140
 - UV-cured epoxies 17–37
 - UV-cured metal 35
 - VEO 143
- nanofillers
 - EMI shielding 215, 217, 218
 - HPBs 148
 - reinforcing 109

nanoparticles
 – functionalized 30
 – iron oxide 30
 – isodimensional 39
 – , *see also* particles
 nanosheets 17, 39, 40
 nanotubes 17, 39, 40
 – CNTs 223–229
 – MWCNTs, *see* multiwalled carbon nanotubes
 – SWCNTs, *see* single-walled carbon nanotubes
 nanowhiskers 17, 39, 40
 network
 – conducting 218
 – percolating 224
 network analyzers, SNA/VNA 214
 nonreactive modifiers 43, 44
 nonreversing heat flow 75, 85, 86

o

octadecylammonium-modified montmorillonite (OMM) 204
 octahedral sheet 131, 133
 one-tail modifiers 48
 onium ions, gallery 118
 organic–inorganic hybrids 18
 organic inorganic interface 111
 organic-MMT content 121
 organic modifications 39–67
 organically modified MMT (OMMT) 134, 135
 organoammonium cations 43
 organoclays 44
 – modifier structures 55
 organophilic boehmite 29
 organophilic character, treated clays 153
 organovermiculites 10
 oscillatory temperature forcing function 76
 OX-MWCNTs 92, 97
 Ozawa method 73, 80–83

p

PANI–DBSA 220, 221
 PANI–PTSA 223
 particles
 – mean size 5, 6
 – particle/matrix interaction 115
 – , *see also* nanoparticles
 PBS (poly(butylene succinate)) 53
 peak, exothermic 76, 77
 peak heat release rate (PHRR) 141
 PEGDMA 151–157
 PEI (polyethyleneimine) 158–161

percolating network 224
 permeability 215
 – relative 212
 permittivity
 – complex 222, 226
 – dielectric 215
 petroleum-based catalysts 190
 PF resin/clay nanocomposites 169
 PF resin/clay/cellulose nanocomposites, cure kinetics 80–88
 PF resin/MWCNT/cellulose nanocomposites 88–100
 phenol-formaldehyde (PF) resins 69
 phenolic resins 168, 169
 photoinitiation 28
 photopolymerization 149
 – epoxides 20–23
 photosensitizers 21
 plasticizing effect 118
 plastics, thermosetting 130
 platelets
 – alignment 120
 – EGPs 31
 – exfoliated 7
 – thickness 132
 PNCs (polymer nanocomposites) 39–41
 – UV-cured epoxies 17–37
 polar clays 120
 polar functionalities 47
 polyamines 189
 polyaniline 219
 polybenzoxazine/clay nanocomposites 170
 poly(butylene succinate) (PBS) 53
 polydicyclopentadiene/MMT
 – nanocomposites 175
 polyester
 – aliphatic 144
 – resins 129
 polyethyleneimine (PEI) 158–161
 polyglycerol polyglycidyl ether (PGPE) 198–204
 polymer–gold nanocomposites 181–184
 polymer-layered silicate nanocomposites 109
 polymer nanocomposites (PNCs) 39–41
 – UV-cured epoxies 17–37
 polymer–silver nanocomposites 177–181
 polymeric 4,4'-diphenyl methane diisocyanate (PMDI) 48
 polymeric materials, thermosetting 1
 polymeric matrices 17
 polymerization
 – and electron transfer 180
 – cationic 176

- cationic ring-opening 21, 168
- cross-linking 174
- free radical 176
- *in situ* 19, 166
- intercalative 131
- radical-initiated 22
- RAFT 182, 183
- polymers**
 - dendritic 147
 - formaldehyde-based thermosetting 69
 - hyperbranched 147–163
 - ICPs 211, 218–223
 - thermoset 165
- polyols** 41
- branched 53
- polyphenol hardener** 196
- polysulfone/clay nanocomposites** 174
- polysulfone/metal nanocomposites** 184, 185
- poly(tetramethylene glycol)** 53, 54
- polyurethanes (PUs)**
 - clay nanocomposites 39–67
 - dispersions 43
 - foams 43
 - interaction with MMT 171, 172
 - thermoplastic elastomers 42, 43
 - thermoset 42, 43
- precursors, nanocomposite** 40
- preparation**
 - clay nanocomposites 166–176
 - metal nanocomposites 176
 - nanocomposites 4, 5
 - , *see also synthesis*
- primary alkyl ammonium ions** 110
- Pseudomonas aeruginosa* 156, 157, 179
- PUs, *see* polyurethanes**
- 2-pyrone-4,6-dicarboxylic acid** 195

- q**
- quaternary ammonium cations** 58
- quasi-Newtonian behavior** 29
- quaternized benzoxazine** 170

- r**
- radical-initiated polymerization** 22
- RAFT polymerization** 182, 183
- reaction rate** 72
- reactions**
 - alcoholysis 193
 - condensation 19, 32
 - cycloaddition 182
 - hydrolysis 19, 32
 - localized 24
 - maleinization 27
- multistep 96
- polymerization, *see* polymerization
- reactive modifiers** 43, 44
- reflectance** 213
- reflection coefficient** 224
- reflection shielding** 212, 213
- reinforced UP nanocomposites** 130, 131
- reinforcing nanofillers** 109
- relative critical strain** 119, 120
- relative critical stress** 122
- relative permeability** 212
- relative Young's modulus** 117
- resins**
 - aliphatic epoxy 197
 - epoxy, *see* epoxy resins
 - MF 69, 76–80
 - PANI/epoxy resin 220–222
 - PF 69, 70, 80–100
 - phenolic 168, 169
 - polyester 129
 - toughened UP 142
 - UP 129–146
- resole PF resins** 84–86
- tensile strength 102, 103
- viscosity 88
- resorcinol-formaldehyde (RF) resins** 69
- reversing heat capacity** 85, 86
- reversing heat flow** 85, 86
- rigidity** 114–118
- rubber**
 - acrylic 119
 - rubbery matrices 112, 116, 117
 - silicon 181
 - silver nanocomposites 181

- s**
- salts, metal** 178
- scalar network analyzers (SNA)** 214
- scratch resistance test** 27, 28
- sequential mixing** 173
- sheets**
 - FGS 30, 31
 - graphene 229
 - nano- 17, 39, 40
 - octahedral 131, 133
 - tetrahedral 131, 133
- shielding, EMI** 211–237
- shielding effectiveness, total** 212
- silane-modified clay (SMC)** 113
- silane treatment** 121
- silicate nanocomposites, polymer-layered** 109
- silicates, lamellar** 25
- silicic acids, layered** 132

- silicon rubbers 181
- silver nanocomposites 177–181
- simultaneous mixing 173
- single-walled carbon nanotubes (SWCNTs)
 - 71, 223, 225–228
 - sinusoidal modulation 75
 - skin depth 213
 - smectite clays 132
 - sodium borohydride 177
 - sodium dodecyl sulfate (SDS) 90
 - sodium montmorillonite (Na-MMT) 27, 28
 - PGPE 200, 201
 - PU chains 171
 - structure 133
 - soft cations 43
 - soft matrix 112
 - sol–gel process 32, 33
 - solution intercalation 131
 - solution processable functionalized graphene (SPFG) 230, 231
 - sonication 4
 - sorbents, magnetic 157
 - sorbitol polyglycidyl ether (SPE) 191
 - sorption behavior, UP nanocomposites 142
 - soybean oil, epoxidized 113, 191, 204, 205
 - spacing
 - basal plane 11
 - interlamellar 117, 153
 - , *see also* distance
 - d*-spacing 11
 - HPBs 150
 - sporeforming bacteria 179
 - stability, thermal 91
 - Staphylococcus aureus* 179
 - steam explosion method 194
 - storage modulus 98, 99, 112, 113, 136–139
 - temperature dependency 202
 - strain
 - at break 118–120
 - relative critical 119, 120
 - stress
 - at break 120–123
 - relative critical 122
 - yield 135
 - structural control 147
 - structure
 - bio-based epoxy resins 191
 - CE 23
 - conducting polymers 219
 - epoxy functions 20
 - exfoliated 54
 - gel-like 135
 - HPBs 150
 - intercalated 54
 - intercalated/exfoliated 167
 - layered 131, 132
 - modifiers 48, 49
 - Na-MMT 133
 - structure–property relationship 39
 - surfactants 51
 - sulfonium ions 190
 - surface area, contact-specific 115
 - surface-modified clays 133–135
 - hyperbranched polymers 147–163
 - surface-modified MWCNTs 88–90
 - surface-modified vermiculites 10
 - surfaces, antimicrobial 149–157
 - surfactants
 - SDS 90
 - structure 51
 - surfmers 149
 - suspensions, fillers 11
 - SWCNTs (single-walled carbon nanotubes)
 - 71, 223, 225–228
 - swelling 142
 - organoclays 44
 - synthesis
 - conducting nanocomposites 216, 217
 - light-induced 178, 179
 - t**
 - tactoids 26
 - tail interaction 172
 - tannic acid (TA) 196
 - temperature
 - dynamic vitrification 86, 87
 - glass transition 112, 114, 136–139
 - temperature-modulated DSC (TMDSC) 74, 75, 84–88
 - in situ* template synthesis 131
 - tenacity 123
 - tensile modulus 103, 198, 199
 - clays 56, 57
 - ultimate 136–139
 - tensile strength 101–103, 198, 199
 - UTS 136–139
 - TETA (triethylenetetramine) 189, 205
 - tetraethoxy-orthosilicate (TEOS) 33, 34
 - tetraethylenepentamine (TEPA) 2, 9
 - tetrahedral sheet 131, 133
 - theories and models
 - deformation mechanism 116
 - EMI shielding 212–214
 - TMDSC 74, 75
 - thermal kinetic analysis 95–98
 - thermal properties

- clay-UP nanocomposites 135–141
- formaldehyde-based nanocomposites 69–108
- thermal stability 91
- thermogravimetric analysis (TGA)
 - epoxy-vermiculite nanocomposites 5, 9, 10
 - HPBs 150, 151
 - thermogravimetry
 - conventional 90–95
 - DTG 90–93
 - MTG 75, 76, 95–98
 - thermoplastic polyurethane elastomers (TPUs) 42, 43
 - thermoreponsive hydrogels 182
 - thermoset formaldehyde-based
 - nanocomposites 69–108
 - thermoset polymers 1, 165
 - formaldehyde-based 69
 - thermoset PUs 42, 43
 - thermosetting plastics 130
 - thiol-ene chemistry 180
 - top-down UV-cured epoxies 24–31
 - total reaction heat 72
 - total shielding effectiveness 212
 - toughened UP resin 142
 - toughness, fracture 120–123
 - transmittance 213
 - triethylenetetramine (TETA) 189, 205
 - trimethylol propane (TMP) 41, 54
 - two-port VNA 214
 - two-tail modifiers 48

u

 - ultimate tensile modulus (UTM) 136–139
 - ultimate tensile strength (UTS) 136–139
 - unsaturated polyester resin (UPR), hybrid
 - clay nanocomposites 129–146
 - unsaturated polyester (UP) matrix 110
 - urea-formaldehyde (UF) resins 69

v

 - UV-cured epoxies 17–37
 - UV-cured metal nanocomposites 35

w

 - vector network analyzers (VNA) 214
 - vegetable oil, epoxidized 204, 205
 - vermiculites
 - epoxy-vermiculite nanocomposites 1–16
 - surface-modified 10
 - vinyl ester oligomer (VEO) nanocomposites 143
 - vinylic end groups 148
 - viscoelasticity analysis 111–114
 - viscosity
 - aliphatic epoxy resins 197
 - resole PF resins 88
 - vitrification 78, 86

x

 - water treatment, Cr(VI) 157–161
 - WAXRD
 - epoxy-vermiculite nanocomposites 5, 11–13
 - organoclay swelling 44
 - “wet edge lamination” 25
 - whiskers, nano- 17, 39, 40
 - wood chip 193

y

 - yield stress 135
 - Young's modulus 114–118, 136–139
 - relative 117