# Index

**A**
- Abrasion resistance, 119
- Additives, 359, 360, 362, 364, 369
- Aesthetics, 119
- Afterglow, 340
- Alumina trihydrate, 332
- Aluminium hydroxide (ATH), 118, 332
- Asbestos, 222, 481
- Aspect ratio, 197, 199
- ATH. See Aluminium hydroxide (ATH)

**B**
- Battery separators, 303
- Bio-fillers, 316
- Biopolymers, 167
- Boehmite, 334
- Building and construction, 343
- Bulk molding compound (BMC), 122
- Bunsen burner test, 347

**C**
- Calcined clays, 162, 169–171
- Calcium carbonate, 457
  - crystal modifications of, 150
    - GCC, 156
    - PCC, 156–158
- Carbon black, 130, 132, 133, 139–142, 447
  - adhesion, 133
  - definition, 376
  - dispersion, 392
  - dual-phase blacks, 267–269
  - elastomer properties, 137
  - elastomers, reinforcement of, 279–288
  - electrical and thermal conductivity, 278, 382–384
  - filler-grade carbon blacks, 278
    - formation, principles of, 265–266
    - furnace black process, 266–267
    - global markets for, 264
    - graphitization procedure, 136
    - manufacturing process, 384–386
    - material characteristics, 379–382
    - microstructure, 270–271
    - morphological properties, 269–270
    - for pigmentation, 288
    - polymer composites, 386–396
    - porosity, 271–273
    - primary particle size, 135, 271–273
    - production, 264, 266, 273, 276
    - vs. silica, 143
    - size and shape, 273–276
    - solid contaminants, 278
    - structure, 273–276, 379, 380
    - surface-modified blacks, 269
    - surface properties, 277–278
    - unconventional sources, 269
    - use of, 263
    - UV protection, 288–290
- Carbon nano-tubes, 481
- Cellulose, 322
- Char, 348
- China clay, 162
- Clay
  - aspect ratio, 166
  - calcined, 162, 169–171
  - China, 162
  - definition, 162
  - flash calcined, 171
  - hard and soft, 167
  - secondary, 167
  - Clay mineral, 162
  - Coatings, 307, 310
  - Color pigment, 264
  - Color, talc, 197
Composite, polymer, 19
Composition dependence, of properties
  conductivity, 86
  rheology, 80
  stiffness, 80
  tensile property, 83
  yield strain, 82
Compound processing, 392–394
Conductive polymer composites
  carbon black-filled, 386
  uses, 377
Cone calorimetry, 347–350
Coupling agents, 133, 140, 143, 319, 323
Cristobalite, 427, 431, 433, 435

D
Decomposition temperature, 336
Deformation and failure, 76–77
Dental compounds, 242–243
Devulcanisation, 458–459
Differential scanning calorimetry, 335
Differential thermal analysis, 336
Dispersing agent, 120
Dispersion, 100, 108
Dual-phase blacks, 267–269

E
Elastomer filler, 23–24
  carbon black and, 279–288
  dispersion, 132–136
  dynamic properties of, 137–138, 285
  elastomer adhesion, 133–134, 136
  elastomer performance, 134
  filler structure, 136–137
  non-reinforcing, 128
  permanent structure, 132
  reinforcement mechanisms, 128, 285–288
  role of, 130
  semi-reinforcing, 128
  shape and structure, 131
  silica vs. carbon black, 143
  silicone elastomers, 144
  size and specific surface area, 131
  tire applications, 138–139
  transient structure, 132
Electrical conductivity, 387, 390, 420
Electric cables, 343
Electrostatic discharge (ESD)
  protection, 378

Endothermic decomposition, 334
Epoxy resins, 123, 218
Ethylene-vinyl acetate, 341
Exotherm control, 115
Extender pigments, 174

F
Fatty acid, 31, 33, 35
  coating in composites, 37–39
  saturated, 36–37
Feldspar, 429, 435
  applications, 236
  availability, 234
  definition, 232
  mineralogy, 233–234
  properties, 235
Fillers, 4
  composite sustainability, 442–443
  in polymer composite, 19–25
  particulate, 6–19
  recycling, 448–449
  silane treatment, susceptible
    types, 41
    surfaces, 31, 42
    treatment, 32
Film
  agricultural, 239–240, 433–436
  polyolefin, 233, 237, 426, 428, 433
  production process, 427
Flame retardancy, 118–119
Flash calcined clays, 171
Foams, 343
Fumed silica, 130, 144
Furnace black, 266–267, 278

G
Gas barrier, 421–422
Glass
  borosilicate, 450
  commercial, 450
  fibre, 450
  types, 449
Granulation, 458
Graphene, 477
Graphite, 476–477
  crystallinity, 408–410
  definition, 402
  manufacturing process, 403–407
  particle size, 410–411
  purity, 408
surface properties, 411
texture, 410
uses, 403
Greenhouse thermal management, 239–240, 434, 437
Ground calcium carbonate (GCC), 156
elastomers, 155–156
environmental impact and sustainability, 158–159
polymer applications of, 153–154
production, 152–153
properties, 153
thermoplastics, 154–155
thermosets, 155

H
Halloysite, 482
Halogens, 331
Heat
capacity, 338
conductivity, 356, 358, 359, 361, 365, 368, 372
distortion temperature, 198
management, 367
release rate, 347
Huntite, 332
Hydromagnesite, 332

I
Ignition, 330
Incandescence, 340
Infra-red adsorption, 174
Interfacial interactions, 55
interphase formation, 67–69
type and strength, 65–67
wetting, 70–71
Internal mixer, 105
Iron oxide, 247, 252

K
Kaolin, 162
Kaolinite, 162
Ko-kneader, 106–107

L
Lamellarity talc, 197, 198, 200
Lead glass, 450–451
Lewis and Bronsted acid sites, 167
Lignin, 323, 445
Limiting oxygen index, 344
Lubrication, 414–416

M
Magnesium carbonate, 332
Magnesium hydroxide, 332
Magnete, 246
chemistry, 247
electrical properties, 250
induction heating, 249
magnetic properties, 249–250
microwave properties, 252–254
properties, 247
safety, 247
surface chemistry, 247
thermal properties, 250–252
Metakaolin, 162, 170, 172
Mica
applications, 179
composition and properties, 180
definition, 178
muscovite, 183–185
phlogopite, 179–183
surface treatment, 188–193
Microporous polymer, 303
Microscale combustion calorimetry, 350
Microwave properties, of minerals, 252–254
Minerals, 7, 9, 16, 21, 360
Mixing, with filled polymers
high-intensity melt, 105–107
mechanism of, 99–100
mixture characterization, 104
premixing, 104
Modifer, surface
methods of using, 31–33
types, 35–37
Muscovite, 183–185

N
Nano-cellulose, 479–481
Nano-clays, 472–475
Nano-composites, 465
Nano-fibres, 479–482
Nano-fillers, 466, 468
Nano-particles, 465–466
Nano-plates, 470–472
Nano-starch, 478–479
Nepheline syenite, 233, 234, 236, 239, 430, 434–435
Nesquehonite, 333
Oil absorption, 120
Organo-silanes, 168, 173
   applications, 42
   with filler surfaces, 42
Organo-titanates (titanates), 46–47
Oxygen depletion calorimetry, 349

P

Particle shape, 12–14
Particle size, 9–11, 198, 200, 201
Particulate-filled polymers
   aggregation, 61–63
   anisotropic particles orientation, 63
   attrition, 61
   composition, 55
   consumption, 53
   interfacial interactions, 55
      (see also Interfacial interactions)
   micromechanical deformations, 76–78
   particle shape, 58
   particle size distribution, 56–57
   properties, 78–86
   segregation, 61
   specific surface area, 57
   structure, 55, 59
   surface free energy, 57
   surface modification, 71–76
   uses, 53
Particulate fillers
   epoxy resins, 123
   phenolic resins, 123
   polymethylmethacrylate, 123
   polyurethanes, 123
   properties in thermoset polymers
      abrasion resistance, 119
      aesthetics, 119
      cost saving, 115
      exotherm control and shrinkage reduction, 115
      flame retardancy, 118–119
      pre-cure mix, rheology, 120–121
      stiffness (modulus), 115–117
      thermal conductivity, 117–118
      thermal expansion, 117
      toughness, 119–120
      transparency, 121
   unsaturated polyester resins, 121–123
Percolation
   models, 396–398
   threshold, 389–392
Permeability, 200
Phenolic resins, 123, 221–226
Phlogopite, 179–183
Platelet, 178, 179, 188, 193
Polyamide (PA), 185, 216–218
Polymers
   composite, 19
   fillers and, 18
   GCC, 153–154
   intrinsically conducting p, 420
   PCC, 158
   polymer based papers, 303
   self-lubricating, 414
   thermal conductivity, 416–420
   types, 4, 7
Poly(methylmethacrylate) (PMMA), 123
Polypropylene (PP), 182, 184, 211–216
Polyurethanes, 123
Precipitated calcium carbonates (PCC)
   advantages, 156
   carbonation, 157
   double decomposition, 156
   environmental impact and sustainability, 158–159
   in polymers, 158
Precipitated silica, 138–143
   description, 295
   production, 295–296
   properties, 297–299
   safety, 299
   sustainability, 299
Processing window, 336
Proteins, 324
PUR R-RIM systems, 218
Purity, of talc, 197
Pyrolysis, 447, 455
   applications, 456–457
   properties, 455–456
Radiation, 348
Radiation shielding, 254, 255
Recycling, 123, 201, 441–442
   filler, 448–449
Reinforcement, 128, 130, 134, 144, 179, 211, 218, 279–288, 300, 310
Rheology, 101, 120
Rheology control agents, 304, 310–311
Rice hulls, 324–325
Rubber
   silicone, 306
   styrene-butadiene, 295
S
Secondary clays, 167
Sheet molding compound (SMC), 122
Shrinkage, 115
Silanes, 298
Silica
  fume, 308–309
  fumed, 304–308
  gels, 309–310
  precipitated, 295–304
Smoke, 340
Specialty filler, 246, 254
Starch, 321–322, 444
Stearic acid, 33, 35, 37
Stiffness (modulus), 115, 117
Surface modification, 71
  coupling, 73–74
  functionalized polymers, 74–75
  nonreactive treatment, 71–73
  soft interlayer, 75
Surface modifier
  methods, 31–33
  types, 35–37
Surface treatment, 188–193
  talc, 198, 200
Sustainability, 123, 350, 441–448

T
Talc
  definition, 196
  extraction and processing, 196
  grades, 197–198
  occurrence, 196
  polymer uses, 198–200
  properties, 197
  recycling in polyolefins, 459
  recycling issues, 201
Test methods, 343–346
Thermal expansion, 117
Thermogravimetry, 335
Thermoplastics, 19–23, 198, 201, 279
Thermoset plastics, 112
Thermosets, 24–25
Thixotropy, 310
Time to ignition, 347
Tires, 127, 137–143
Toughness, 119
Toxicity, 331
TPU, 193
Twin-screw extruder, 107

U
UL 94, 347
Ultracarb, 338
Unsaturated polyester resins (UPR), 121–123
UV stabilizer, 289

W
Wollastonite
  availability, 206
  definition, 205
  in epoxy resin, 218
  in fluoroelastomers, 226–229
  mineralogy, 205
  particle-size distribution, 208–209
  in phenolic resin, 221–226
  in polyamide, 216–218
  in polypropylene, 211–216
  properties, 207–208
  in PUR R-RIM, 218
Wood flour, 445–446
  applications, 318–320
  production, 317–318
Z
Zirco-aluminate, 47