

---

# Index

**A**

- Abaca fibers, uses, 459  
Abaca plant, 456, 458  
  stem stripping, 458  
Abrasion, resistance, 803  
Accessibility  
  bromine method, 569  
  solute exclusion, 583  
Acetaldehyde, 816  
Acetalization, bath, composition, 301  
Acetalization polyvinylalcohol, 294  
Acetic acid, 266  
Acetylation, jute and kenaf, 425  
Acetylene, 266, 816  
Acetyl group, jute and kenaf, 412  
Acetyl value, 784  
Acrolein, 817  
Acrylic fibers  
  apparel section, 931  
  asbestos replacement, 946  
  basic properties, 906  
  biocomponent fibers, 935, 936  
  biological resistance, 915  
  brake, clutch linings, 947  
  chemical resistance, 916  
  drying and collapsing, 888  
  dyeing, 934  
  electrically conducting, 950  
  fabric durability, 913  
  flammability, 916  
  fluorinated comonomers, 924  
  high bulk yarns, 935  
  hot water treatment, 911  
  hot-wet strength, 911  
  identification-test, 925  
  IR spectroscopy, 929  
  mechanical testing (Instron), 930  
  modulus, 910  
  moisture-absorbing fibers, 920  
  physical properties, 907  
  polymer characterization, 926  
    molecular weight, 926  
  prediction of fabric durability, 913  
  production, 954–956  
  Raman spectroscopy, 929  
  softness, 919  
  specialized products, 936  
  stress-strain curve, 910  
  sunlight resistance, 914  
  surface treatment, 923  
  tensile properties, 907  
  wear resistance, 911  
  whiteness, 923  
  x-ray fluorescence, 929  
Acrylic and modacrylic fibers  
  battery plate reinforcing parallels, 947  
  filament, apparel markets, 935  
  flame-resistant, 931, 936  
  industrial fibers, 932, 933  
  tubular, special uses, 947, 948  
  uses, 933  
Acrylic precursor fiber, 940  
Acrylic-reinforced cement, 946  
  uses, 946  
Acrylics vs. polyester, 932  
Acrylonitrile, 60, 427  
  preparation, 816, 817  
Acrylonitrile-vinylchloride copolymerization, 83  
Activation energy  
   $\epsilon$ -caprolactam polymerization, 47  
  polyamidation, 46  
N-Acyl lactam, 38  
Adipic acid  
  electrolytic coupling, 66  
Adiponitrile, 67, 68  
AH-salt, 70  
  preparation, 73  
Air filters, jute and kenaf, 437  
Alkali cellulose, 716  
  carbon dioxide, 710  
  transition (scheme), 721  
Alkali-spinning, polyamide, 300  
Alkali treatment, 508, 509  
Alkaline bath, polyamide, 304  
1-Alkyl-3-methylimidazolium, 674  
Alpaca, 371  
Alternating copolymer, 830  
Amide group, 113  
Amidine group, 40  
 $\epsilon$ -Aminocaproic acid, 64

Amino capronitrile, 67  
 4-Aminophenol, 988  
 Ammonium sulfamate, 120  
 Ammonium sulfate, coagulation agent, 298  
 Ammonium thiocyanate/ammonia, 541, 671  
 Ammoxydation, 60  
 Amorphous domain, 840  
 Amorphous phase, polypropylene, 204  
 Amorphous state, polyamide, 68  
 Angora rabbit fibers, 371  
 Anionic (acidic) dyes, 900  
 Anionic polymerization, lactams, 38  
 Anisotropic nature, 15  
 Anisotropy, 17  
*p*-aramids, 984  
 Annealing, polypropylene, 227  
 Antimony-halogen finishes, 595  
 Antimony oxide, 120, 193  
 Antioxidant PG, 679  
 Antiparallel  $\beta$ -pleated sheet, 389  
 Aramid fibers, wet spinning, 1005, 1006  
 Aramid producers, 979  
 Aramids, 34  
 compressive strength, 984  
 concrete reinforcement, 1021  
 creep, 984  
 crystallinity, homopolymer, 980  
 diacid and diisocyanate, 990  
 "direct polymerization," 992, 993  
 dry-jet wet spinning  
 operating conditions, 1006–1010  
 fiber skin-core structure, 1005  
 fiber polymer molecules orientation, 1007  
 filament, staple yarns, 1014  
 interfacial polymerization, 993  
 isotropic solution  
 films bi-oriented, 1009, 1010  
 films unidirectional, 1009, 1010  
 liquid crystal behavior, 1002  
 mechanical properties, 984  
 papers, films, 985  
 plasticized melt polymerization, 1000  
 polymerization methods, 993  
 Schötten–Baumann acylation, 989  
 solubility, 1001  
 solution polymerization, 995  
 reaction conditions, 995–998  
 side reactions, 996, 997  
 solubilizing aids, 999  
 solvents, 998  
 solutions,  
 rheological properties, 1003  
 uses, 1013  
 UV light absorption, 981

vapor-phase polymerization, 999  
 water absorption, 981  
***m*-Aramids**  
 core structure, 1015  
 dry spinning, 1004  
 electrical application, 1015, 1016  
 filters, 1015  
 flame resistance, 1013, 1014  
 protective apparel, 1013, 1014  
 spinning, 1001  
***p*-Aramids**, 1013, 1014  
 fibers  
 ballistic protection, 1017  
 composite armor systems, 1017  
 softarmor systems, 1017  
 composite materials, 1019  
 core structure, 1022  
 fiber optics - electro cables protection, 1019  
 pipe reinforcement, 1021  
 printed wiring boards, 1022  
 protective apparel, 1018  
 pulp, 1011  
 brake linings and clutch facings, 1022  
 gaskets, 1023  
 sealants and adhesives, 1024  
 reinforcing agents, 1018  
 ropes and cables, 1020  
 spinning from reaction mixture, 1001  
**Atactic**  
 polypropylene, 150  
 polystyrene, 249  
 Average molecular weights, 42  
 Average orientation, crystalline regions, 205  
**Avrami**  
 equation, 94  
 parameter, 231  
  
**B**  
**Banana fiber**  
 Barus effect, 165, 897  
 uses, 459  
 Beckmann rearrangement, 63  
 Bending modulus, 802, 803  
**Bicomponent fibers**, 23, 123, 192  
 Polyvinylalcohol/polyvichloride, 311, 312;  
*see also* polychlal  
**Bicomponent spinning**, 200  
**Biocompatibility**, 18  
 Biodegradability polyvinylalcohol, 309  
 Bioengineered cotton, 525  
 Biotech cotton, 524  
**Birefringence**  
 factor, 100  
 vegetable fibers, 491

- Bis(4-aminocyclohexyl)methane, 59  
1,3-Bis(hydroxymethyl)-4,5-dihydroxy-imidazolidinone-2, 592  
Blends, polypropylene, 249  
Block copolymers, 279  
Borax, 545  
Boric acid, 595  
Bragg equation, 98  
Branching, 20  
  radical polymerization, 271  
Bulking, poly(ethylene terephthalate), 12  
Bulk polymerization  
  acrylonitrile, 818, 822, 837  
  autocatalytic effect, 825  
  propylene, 156  
Butadiene-1,3, carboxylation, 67  
Byssinosis, 645
- C**
- Calcium oxalate, 482  
Calcium thiocyanate, 671  
Callose- $\beta$ -(1→3)-D-glucan, 534  
Camel fibers, 371  
Caprolactam, solid-phase polymerization, 72  
Caprolactam sulfate, 64  
 $\epsilon$ -Caprolactone, 18  
Capryllactam, 56  
Carbon disulfide, 716  
Carbon fibers, 940  
  carbonization, 943  
  pricing, 945  
  stabilization process, 941, 942  
  structure models, 944, 945  
  three-step process, 941  
Carbon and graphite fibers, Young's modulus, 939  
Carbonate process, 710  
Cashgora goat fibers, 371  
Cashmere, 371  
Cationic (basic) dyes, 900  
Cationic polymerization, lactams, 40  
Cell membrane complex (CMC), interactions, 349  
Cellbiose, 553, 556  
  conformational analysis, 556  
  hybrid modeling, 557  
  molecular dynamics, 556  
  residue, 547  
Cellulose, 412, 477, 608, 775  
Cellulose II, 564  
Cellulose III and III<sub>I</sub>, 564  
Cellulose IV, 564  
Cellulose  
  acetylation catalyst, 579  
  acid degradation, 603  
  in alkaline medium, 606, 607  
  amine-salt process, 709  
  anisotropic solutions, 669  
  anisotropic and isotropic solutions, 608  
  atomic force microscopy (AFM), 563  
  average degree of polymerization (DP), 719  
  biological deterioration, 608  
  birefringent solution 698  
  bromine accessibility method, 560–570;  
    *see also* Accesibility  
  carbamate, 703, 705  
    wet-spinning 708; *see also* Spinning process  
  carboxymethylation, 590  
  cellobiohydrolases, 616  
  cellulases, 616  
  conversion I<sub>α</sub>→I<sub>β</sub>, 562  
  conversion I→II, 565  
  crystal structures I–IV, 558  
  cyanoethylation, 591  
  degradation, 601  
  degree of polymerization, 601, 671  
  depolymerization, 779  
  determination of –CHO, carbonyl and  
    –COOH groups, 602, 603  
  distribution of molecular weights, 719  
  etherification, 590  
  experimental model, 553  
  flame retardants, 612, 613  
   $\beta$ -(1→4)-D-glucan, 534  
  endo- and exo-1,4- $\beta$ -glucanases, 116, 617  
  hydrogen bonds, 673, 776  
  kinetic study-pyrolyses, 611  
  liquid ammonia, 389  
  N-methylmorpholin N-oxide, 688–691  
  moisture content, 778  
  noncrystalline, 565  
  orientation primary hydroxyl  
    groups, 561  
  oxidative depolymerization, 614  
  peeling reaction, 605, 607  
  phosphoric acid, 698  
  photosensitized degradation, 614  
  polymorphic forms, 542, 668  
  pretreatment with ZnCl<sub>2</sub>  
  purity, 777  
  pyrolysis, 610, 611  
  pyrolysis products, 610  
  reactivity, 777  
  scorch temperature, 613  
  sheet density, 778  
  smoldering combustion, 613  
  steam explosion-sodium hydroxide-water  
    thermal decomposition, 610  
  xanthate, 723

Cellulose acetate and triacetate, 779  
 acetic acid recovery, 784  
 acetic acid system, 781  
 acetylation-batch type, 782  
 cigarette filters, 806, 807  
 crystallinity, 795  
 die-swell, 790  
 disperse dyes, 803, 804  
 dope preheating, 790  
 dry-spinning, 788; *see also* Dry-spinning fibers, 21  
   heat resistance, 798  
   heterogeneous system, 782  
   melt spinning, 792  
   moisture regain, 796  
   tenacity, 798  
 flake drying, 783  
 flake washing, 783  
 haze and color, 785  
 homogeneous process, 782  
 hydrolysis, 783  
 imbibition, 798  
 intrinsic viscosity, 785  
 methylene chloride, 782  
 miscellaneous applications, 807  
 precipitation, 783  
 pretreatment, 781  
 properties, 793  
 solubility, 784  
 solvent recovery, 792  
 spinneret design, 790  
 spinning parameters, 791  
 stain recovery, 802  
 stress-strain curve, 799  
 sulfate linkage, 779  
 uses, 806, 807  
 wet spinning, 792; *see also* Wet spinning  
 wet tenacity, 801  
 Chain configuration, polyvinylacetate, 277  
 Chain radical, 266  
 Chain scission, 115, 601  
 Chain transfer, 820, 821  
   backbiting, 281  
   radical polymerization, 268  
 Change of free energy, 700  
 Char, 120  
 Characterization of polymers, methods, 44  
 "Chardonnet," "Basancon silk"  
 Chemical homogeneity, 830  
 Chemical resistance, 321  
 Cigarette tow, 792  
 Citrulline, 356  
 Clearing temperature, 699  
 Cleavage, glucosidic linkage of, 610

Coagulant, 870  
 Coagulation, 872, 873  
   in polyglycoles, 892  
 Cocoon, 384  
 Coefficient, Huggins; Kraemer, 43  
 Coir, 472  
   properties, 472  
   uses, 474  
 "Cold drawing on stretching," 10  
 Colligative properties, 926, 927  
 Collodion, 713  
 Color stability, 187  
 Commingling jet effect, 87  
 Composites, jute, 433  
 Composition drift, copolymer  
   composition, 832  
 Condensation polymers, 34  
 Condense-spinning, polyvinylchloride, 318  
 Condensing agents, 993  
 Conformational strain, lactams, 39  
 Conjugate spinning, 919  
 Continuous process, dispersion  
   polymerization-acrylonitrile, 835, 836  
 Continuous stirred tank, 834  
 Controlled-rheology resin, polypropylene, 157  
 Copolymerization, 828  
 Copoly(p-phenylene/3,4'-diphenyl ether  
   terephthalamide), 977, 978  
 Copoly(vinyl chloride-vinyl acetate), 313  
 Corona discharge, 619  
 Cortical cell, 333, 342  
   distribution, 372  
 Cotton  
   acetylation, 597  
   antimicrobial resistance, 615  
   average ordered fraction, 567, 573  
   bale, 628  
   biologically active conjugate, 599  
   biopolishing, 618  
   bleaching, 62  
   cellulose modification, 617  
   chemical properties, 584  
   classification system, 635–638  
   color, 631, 634  
   corona treatment, 619  
   I<sub>α</sub>, I<sub>β</sub> crystal structures, 562  
   cuticle  
   desizing, 620  
   dust, 647  
   enzyme-chemical modification, 619  
   fabrics applications, 642, 644  
   fiber  
    classification, 628, 629  
    length, 633

- morphology, 575  
strength, 633  
fineness, 622  
formylation method, 571  
fungicides, 616  
general description, 524  
grad, 630  
inorganic acid esters, 599  
linear density, 633  
lumen, 543  
maturity, 621, 622  
maturity determination of, 622  
maturity; indirect method, 622  
mercerization, 542, 620; *see also* Mercerization  
mineral acids, 510  
naturally colored, 525  
nep, 632  
noncellulosic constituents, 537  
organic acids, 538  
pectin substrates, 538  
pigments, 621  
Pima and Upland grade standards, 631  
pore structure, 583  
production; consumption, markets, 639  
quality parameters, 629  
reactive deys, 621  
scouring, 620  
singeing, 620  
sodium hydroxide treatment, 538  
soluble sugars, 538  
solvents for, 541, 542  
tensile strength, 623  
wax, 537  
CR 144 light stabilizer, 181  
Crack propagation, 445  
Crimp, 85, 625, 891  
  bicomponent yarns, 891  
  texturing, 86  
Cross-linkage  
  polyvinylacetate, 292  
  reaction, 592  
Cross section, SEM, 875, 876  
Crystal structure, unit cell polyamide, 284  
 $\alpha$ - and  $\gamma$ -Crystalline content, polyamides, 102  
Crystalline domain, 840  
Crystalline index, 209  
  polypropylene, 213  
Crystalline orientation, 220  
  function polypropylene, 210  
Crystalline phase, polypropylene, 204  
Crystalline state, polyamides, 88  
Crystallinity  
  change, 121  
  density, 101  
  polyvinylacetate, 265  
  polyvinylalcohol, 279  
Crystallite size, 247  
Crystallization  
  kinetics, 253  
  rate poly(ethyleneterephthalate), 8  
  PP-MM nanocomposite, 253  
Cumen hydroperoxide, 838  
Cuprammonium  
  process 675, 708, 709, 714  
  rayon, 714  
Cupriethylene diamine (CUEN) hydroxide, 541  
Cuticle, 532  
  cells, 333  
Cyclic oligomers, polyamides, 71  
Cyclization, caprolactam 51  
Cyclohexane  
  carboxylic acid, 59  
  oxidation, 65  
Cyclohexanone, 59  
  lactam production, 66  
  oxime, 59–62  
*cis*- and *trans*-1,4-Cyclohexane-dimethanol, 15  
Cyclohexenyl acetate, 64  
Cysteic acid, 363, 370  
Cystein, 357  
Cystine, 357  
  content in fibers, 370  
Cytoskeleton, 535
- D**
- Deamination, polyamides, 114  
Decarboxylation, polyamides, 114  
Decomposition temperature, aramids, 98  
Decortication, machine, 459, 469  
Degradation(thermal),  
  poly(ethyleneterephthalate), 5
- Degree  
  chain orientation, 904  
  crystallinity  
    coir, 487  
    polypropylene, 209  
    polyvinylacetate, 287  
  polymerization, 269, 819  
    cellulose, 488, 489  
    undegraded cotton, 776  
  substitution (DS), 778  
  swelling, polyvinylacetate, 292
- Denier, 792  
Denier per filament (dpf), 2, 792  
Density, polyvinylacetate, 289  
Desulfation, 784  
Dew retting, 466  
Dialysis membrane, 709

- 3,4'-Diaminodiphenylether, preparation  
(3,4'-POP), 988
- Diammonium phosphate, 595
- Dicotyledons, 410
- 1,4-Dicyanobutene-2, 69
- Dielectric constant, 627
- Diethyleneglycol in poly(ethyleneterephthalate), 5
- Diethyl oxalate, 58
- Differential scanning calorimetry (DSC),  
poly(ethyleneterephthalate), 5
- Dilute alkali, 507
- N,N*-Dimethylacetamide (DMAc), 669, 919, 981,  
999, 1001, 1004
- N,N*-Dimethylacetamide/lithium chloride, 541
- Dimethylamin, 729
- N,N*-Dimethylformamide, 818, 1004
- 1,3-Dimethyl-2-imidazolidinone/lithium  
chloride, 541
- Dimethylsulfoxide, 818
- Dimethyl terephthalate, 3
- 1,3-Dinitrobenzene, 988
- 2-Dioxanone, 18
- Disc refiner, 780
- Disperse dyes, 900
- Dispersion polymerization, 818, 826
- Distribution, molecular weights, 817
- Disulfide cross-links, reduction, 357
- Dithiothreitol, 351
- Dodecanedioic acid, 58, 59
- $\omega$ -Dodecanolactam, 58
- Donnan effect, 602
- Double steeping process, 722
- Drawing
- polyvinylacetate, 299
  - polypropylene, 199
- Draw ratio, 81
- Poly(ethyleneterephthalate), 11
- Draw
- resonance, 170
  - twister, 199
- Dry-spinning, 871 874
- Nylon-4, 56
- polyvinylacetate, 306
- polyvinylchloride, 313, 316
- Dry vs. wet spinning, 871, 874
- DSC, polypropylene, 233
- Dye, 21
- diffusion, 903
  - sites, 902
- Dyeability, polypropylene, 147
- Dyeing, 113, 620, 803
- characteristics, 804, 805
  - ion-exchange equilibrium, 902
  - nylons, 107
  - package, piece, 900
- pore model, 905
- retarding agents, 904
- skein, stock, 900
- E**
- Elastic recovery, 626
- Electrical resistance, 628
- fibers, 493
- Electrolytic coupling, catalysts, 66
- Electronic structure, amide group, 88
- Electrophoresis, 371
- Electrospinning process, 710
- Ellagic acid, 691
- Elongation at break, 625
- poly(ethyleneterephthalate), 11
- Emulsion polymerization, 818, 825
- Emulsion spinning, 311
- End groups, 46
- analysis, 926
- Endocuticle, 333, 340, 341
- Endotoxin, 646
- End, uses, PPE, 181
- Energy quencher, 181
- Energy transfer agent, UV stability, 180
- Entanglement density,
- poly(ethyleneterephthalate), 7
- Enthalpy, fusion, 101, 854
- Enzymes, 348, 618
- vegetable fibers, 512
- Epicuticle, 337
- Equilibrium constant, polycondensation, 36
- Esterification, cellulose, 778
- Ethylene, 266
- Ethylenediamine, 709
- Ethylene glycol, 3
- Ethyleneoxide, 591
- Exocuticle, 333, 340
- Extraction, proteins, 351
- Extensional viscosity, 897
- Extent reaction, polycondensation, 41
- Extrusion, high-temperature, 185
- F**
- Fabric "break-open," 1014
- False-twisting, 13, 86
- poly(ethyleneterephthalate), 12
- False viscosity effect, 785
- "Feel," "drape," "handle," 20
- Fiber 66
- Fiber
- cross section, 79
  - elongation, polyamides, 81
  - future trends, 951
  - light stability, 807
  - morphology, poly(ethyleneterephthalate), 3

- properties vs. spinning conditions, 206, 207  
reinforced cement (FRC), 326  
ribbon width, 624  
saturation point, 587  
strength, 984  
thermoplastic blends, 443  
Fibrils, 1010  
Fibrillation, Lyocell fibers, 697, 703;  
    *see also* Lyocell fiber  
Filament  
    cross-section shape, 899  
    diameter oscillation, polypropylene, 201  
Filter value, 687  
Flame retardance, polyvinylchloride, 321  
Flame retardant, 119  
    antimony trioxide, 596  
    decabromodiphenyl ether, 596  
    hexabromocyclododecane, 596  
Flame suppression, 1,2,3,4-butanetetracarboxylic acid-citric acid, 597  
Flaming combustion, 593  
Flamstob NOR 116, 194  
Flax  
    plant, 463  
    plant stem, 464  
    uses, 467  
1-Fluoro-2,4-dinitrobenzene, 361  
Force to break, 624  
Formaldehyde, 647  
Formalization, polyvinylacetate fiber, 265  
     $\beta$ -form polyamide, 91  
Free, radical initiator, 266  
Funiculus, 530
- G**  
Gas-phase polymerization, propylene, 156  
Gel  
    dyeing, 900  
    melting, 853  
Gel permeation chromatography (GPC), 541  
Gel  
    spinning, polyethylene, 243  
    state spinning, 892  
Gelation, 872, 873  
    polyacrylonitrile, 865  
Geotextiles, 435; *see also* Juta and kenaf  
Glass transition temperature, 861  
    aramids, 981, 984  
    *B. mori* silkworm cocoon  
    Kodel  
    nylon-6,T  
    polyamides, 96, 73  
    poly(ethyleneterephthalate), 3, 22  
polypropylene, 160, 215  
    polyvinylacetate, 288  
Glycolic acid, 18  
1,4- $\beta$ -Glycoside linkage, 720, 775  
Glycosidic bond, 601  
Gossypium  
    *G. aboreum*, 524  
    *G. barbadense*, 524  
    *G. herbaceum*, 524  
    *G. hirsutum*, 524  
Grading, jute and kenaf, criteria, 422  
Graphite fibers, 940  
Graphitization, carbon fiber, 943  
Guncotton, 599
- H**  
“Hackling,” 467  
Half-cystin, 355  
Hammer mill, 780  
Hard armor, 18  
Hard fibers, 455  
Hard keratin IFs, 343, 346  
“Head” to “head” addition, vinyl acetate, 277, 278  
“Head” to “tail” insertion, polypropylene, 150  
Heat-shrinkage, poly(ethyleneterephthalate), 11  
Heat stabilizers, 869  
Heat treatment, polyvinylacetate fibers, 264  
Heavy-metal stains, wool, 343  
Helical conformation, 366  
Helical staple, three dimensional, 235, 237  
Helix, 552  
Hemicellulose, 412, 477, 507, 721, 776  
Hemp, 470  
    fiber extraction, 471  
    fiber uses, 470, 471  
Hemp stalks, retting, 471  
Henequen, 462  
Henequen fibers, uses, 462  
Herbicides, 540  
Hermans orientation factor, 487, 488  
Hermans’ RMS spiral angle, 420  
“Heterofil” fibers, 23  
Heterogeneous copolymerization, 833  
Hexandiol-1,6, 67  
Hexamethylenediamine  
    from acrylonitrile, 69  
    from butadiene, 69  
High-modulus fibers, 15  
High-performance cellulose fibers, 700  
High-shrinkage polypropylene fibers, 247  
    uses, 248  
High-speed spinning, 84  
High-strength synthetic fibers, 245  
High-sulfur proteins, 354

High-velocity melt, 892  
 Hindered amine light stabilizers (HALS), 178  
 Holocellulose, 419  
 Hookean region, 366  
 Hook's law, 625  
 Hunter colorimeter, 785  
 HVI system, 639  
 Hydrated melts, 861  
 Hydrazine, 709  
 Hydrocellulose, 510, 544, 601, 604  
 Hydrogels, 397  
 Hydrogen bonding, 801, 720, 980, 984  
 Hydrogen bonds, 585  
   polyamides, 88, 89, 91, 92  
   polyvinylalcohol, 292, 300  
 Hydrogen peroxide, wool bleach, 358  
 $\epsilon$ -Hydroperoxy- $\epsilon$ -caprolactam, 117  
 Hydrophobic bond, 585  
 Hydrophobicity, wool, 338  
 Hydrophobic vs. hydrophilic, 793  
 Hydroxyl amine sulfate, 61  
 2-Hydroxybiphenyl, 22  
 3-Hydroxyvaleric acid, 18  
 Hypochlorite, 430

**I**

Ideal copolymerization, 830  
 Imide moiety, 38  
 Induction period, radical polymerization, 268  
 Inherent viscosity, poly(ethylenterephthalate), 4  
 Initiator, 36  
 Inner root sheath, protein composition, 356  
 Instability, polymer flows, 170  
 Interfacial polycondensation, reaction conditions, 994, 995  
 Interfacial polymerization, 35  
 Intermolecular bonds, bonds, 351  
 Intrachain disulfide bonds, 351  
 Intrinsic viscosity, 20, 42  
   poly(ethylenterephthalate), ionic liquid, 673  
 IR, wool, 336  
 isophthaloyl-N,N-bis(valerolactam), 1000  
 isophthaloyl chloride, preparation, 988  
 isotactic polypropylene, 150

**J**

Jet  
   streach ratio, 872  
   texturing, 85  
 Jute, 406  
   bleaching process, 430  
   charcoal, 449

color fastness, 431  
 composite with thermoplastic, 443  
 cyanoethylation, 427  
 dyed, 431  
 presence of lignine, 429  
 reaction with maleic anhydride, 449  
 retting, 408  
 woolenization, 432  
 Jute and kenaf  
   chemical modification, 425  
   composition, 414  
   fiber quality, 423  
   fiber structure, 409  
   grading, 422  
   inorganic matrix composites, 443  
   light interaction, 430  
   moisture effect, 430  
   photochemical degradation, 428  
   physical properties, 421  
   reinforcing fillers, 444  
   tensile properties  
   uses, 423, 424, 433, 434  
   filters, 437  
   geotextiles, 435  
   molded products, 439  
   nonstructural composites, 438  
   packaging, 439  
   pulp and paper, 440  
   sorbents, 438

**K**

Kenaf, 406  
   acetylation, 444  
   fiber structure, 409  
   polypropylene composite, 444  
   succinicanhydride modification, 448  
 Keratin proteins, 351  
 Kevlar pulp, 1011  
 Kinetic parameters, polyamides, 49  
 Kinetic scheme, radical polymerization, 818

**L**

Lactams, 36, 88  
 D-Lactic acid, 18  
 Lamellae, polypropylene, 214  
 Light  
   induced degradation, 114  
   stability, 869  
   stabilizers, 118  
 Lignin, 412, 477  
 Lignin,  
   coir, hemp, sisal, 479  
   flax, 479  
 Limit oxygen index (LOI), 916

- Limiting viscosity number, 281; *see also* Intrinsic viscosity  
Linear polymer,  $\beta$ -D-glucopyranose, 536  
Linen cross-linking, 511  
Lint, linters, 527  
Lipid moiety in CMC, 349  
Liquid NH<sub>3</sub> treatment, 508, 509  
LIST process, 682, 683, 684–687  
Llama fibers, 371  
Long air quench melt spinning, 196  
Long-staple filter, 455  
Long-term thermal stability, 178  
Lorentz–Lorenz equation, 100  
Low-sulfur proteins, 352  
Lubricants, 19  
Lubrication wheel, 789  
Lyocell fibers  
  alcohols as coagulants, 675, 696  
  dry-jet wet spinning, 691  
Lyocell process, 675, 679, 681, 692  
Lyocell vs. viscose fibers, 694  
Lysinoalanine, cross-links, 36
- M**
- Macrofibrils, 343, 585  
Macrovoids, 874  
Mammalia fibers  
  chemical composition, 370–372  
  high-sulfur proteins, 353  
Manila hemp, *see* Abaca  
Mark-Houwink equation, 5, 43  
Mass specific resistance, 628  
Mechanical properties, polyamides, 107  
Medulla, 347  
Medullary index, 347  
*Melt*-blowing process, 202  
Melting, copolymers, 857–860  
Melting point, polyamides, 79  
Melt index, melt flow rate (MFR), 158  
Melt spinning,  
  liquid crystalline polymers, 16  
  morphology development, 9  
  polyamides, 78  
  polypropylene, 196  
  polyvinylacetate, 196  
  polyvinylchloride, 313, 321  
  semicrystalline polymers, 10  
Melt temperature, polyamides, 94, 95  
Membrane osmometry, 927  
Mercaptoethanol, 351, 357  
Mercerization, 508, 546, 587  
Mercuric acetate, antimicrobial action, 513  
Mercury porosimetry, 879, 888  
Metallocene catalysts, 151, 153, 154  
Metering pump, 196  
2-Methyleneglutaronitrile, 70  
Methyl ethyl ketone, 784  
4-O-Methylglucuronoxylan, 786  
N-Methylmorpholine-N-oxide, 541, 669, 676, N-Methylmorpholine-N-oxide  
  chemical properties, 678  
  preparation, 676, 678  
N-methylolpropionamide, 595  
N-Methyl-2-pyrrolidone, 981, 991, 1001  
Micelle, 825  
Microfibers, 25  
Microfibrillar structure, 109  
Microfibrils, 214, 545, 585  
Microtubules, 535  
Microvoids, 877  
Microvoid size, copolymer acrylonitrile-methyl acrylate, 887  
Microvoid structure, 879  
Miller indices, cellulose, 560  
Mineral acids, pure cellulosic fiber, 510  
Mineral acid treatment, vegetable fibers, 509  
Miscellaneous applications, polypropylene, 148  
Modacrylics, 817, 834  
Modulus, 11  
Modulus,  
  polyamides, 84  
  poly(ethyleneterephthalate), 3  
  nylon-6, 111  
Mohair, 371  
Moisture uptake, polyethyleneterephthalate, 21  
Molecular orientation, liquid crystalline polymers, 15  
Molecular weight 817; *see also* Molecular weight distribution  
Molecular weight, poly(ethyleneterephthalate), 5  
Molecular weight distribution, 543, 928  
Molecular weight distribution  
  most probable, 282  
  Nylon-6  
  Poly(ethyleneterephthalate), 7  
   $\alpha$ -Monoclinic crystalline structure,  
    polystyrene 244  
Monomer reactivity ratios, 828, 829  
Montmorillonite, 252  
Morphology, acrylonitrile copolymers, 850  
Morphology, swelling behavior, 851  
Poly(*m*-phenylene isophthalamide) (MPDI), triclinic unit cell, 979
- N**
- Nanocomposites  
  polyamides, 74  
  polypropylene, 251

Naphthalene-2,6-dicarboxylic acid, 15  
 “Neck,” 10  
 Necking, polypropylene, 214  
 Newtonian fluid, 208  
 Nickel stabilizer, 187  
 Nitration method, determination  
     DP cellulose, 601  
 Nitrocellulose, 713  
 Nitrosyl chloride, 62  
 Nitrosyl sulfuric acid, 65  
 Nomenclature polyamides, 35  
 Nylon-66, 33  
 Nylon-6, density, 92

**O**

Optical cables, 18  
 “Organic” cotton, 525, 526  
 Orientation, 199  
 Orientational functions, 205  
 Oriented fibrillar structure, 884  
 Orlon, 813  
 Orthocortex, 355  
 Osmium tetroxide, 343  
 Ovule, 530  
 Ox-a-chromanol stabilizer (PBDP), 689  
 Oxycellulose, 601

**P**

Paper industry, 149  
 Parameters K and a, 43, 282; *see also*  
     Mark–Houwink equation  
 Pectin, 475  
 Pentaerythritol, 20  
 Peracetic acid, 63, 358, 511  
 Perchloric acid, 779P  
 Performic acid, 358  
 Perlok spinning, polyvinylacetate, 325  
 Phase diagram, cellulose-liquid ammonia, 589  
 Phase separated fibers, polyvinylacetate, 309  
 Phase separation, 872, 873  
 Phase separation, mechanism, 874  
 Phenolic antioxidants, 176  
 Phenol, oxidation, 66  
*m*-Phenylene diamine (MPD), preparation, 987  
*p*-Phenylene diamine (PPD), preparation,  
     987, 988  
 Phenylglycidyl ether, 19  
 Phosphoric acid, 674  
 Pigments, 147, 175, 184  
 Pigments  
     color stability, 187  
     effect on photostability, 189, 190  
 “Pilling,” polyester, 19  
 “Pills,” 921  
 Pinpicker, 780

Plasma modification, 193  
 Pleat-retaining properties,  
     (poly(butylenes terephthalate), 14  
 Polyacrylonitrile  
     branching, 822  
     chain irregularity, 842  
     degradation reaction, 852  
     dynamic-mechanical properties, 862  
     glass transition temperature, 861, 862  
     melting, 852  
     melting-like transition, 853  
     nitrile dipolar interaction energy, 842  
     single crystals, 846  
     solvents, 864  
     stereoregularity, 840, 841  
     “two dimensional liquid crystalline like”  
         structure, 840  
     two-phase morphology, 847  
     water system spinning, 893  
     wet spinning, 869  
 Polyamides  
     block copolymers, 73  
     end uses, 124, 125  
 Poly[5-amino-2-(*p*-aminophenyl) benzimidazole  
     terephthalamide] (SVM), 977  
 Poly(butylene terephthalate) (PBT), 2, 14  
 Polycaprolactam, 47  
 Polycaprolactam, high molecular weight, 72  
 Polychlal, 312  
 Polydispersity index, 44  
 Polyenantholactam, 56  
 Poly(ethylene adipate), 22  
 Plyethyleneglycols, 119  
 Poly(ethylene naphthalate) (PEN), 2  
 Polyethylene oxide (PEG), 21  
 Poly(ethyleneterephthalate) (PET), 2  
 Poly(ethyleneterephthalate)  
     antimony trioxide ( $Sb_2O_3$ ) catalyst, 4  
     molecular weight, 4  
     oligomers, 4  
     physical properties, 14  
 Poly(hexamethylene adipamide), 45  
 Poly(3-hydroxybutyric acid), 18  
 Polylactams, 88  
 Poly(lactic acid) (PLA), 2, 25  
 Polymer blends, 249  
 Polymer blends, dyeing, 192  
 Polymer cleanliness, 5  
 Polymerization  
     bulk, 273  
     emulsion, 273  
     solution, 273  
     suspension, 273  
 Polymerization degree, polycondensation, 36;  
     *see also* Polydispersity index

- Polymerization kinetics, polyamides, 40  
Polymerization mechanism, polypropylene, 151  
Polymerization of acrylonitrile, inorganic salt, 818  
Polymorphism, in polyamides, 90  
Polynosic rayon, 761  
Poly(*m*-phenylene isophthalamide), 977, 978  
Poly(*p*-phenylene terephthalamide), 978  
Polypropylene, 149  
Polypropylene blends, 249  
Polypropylene, isotactic, 142  
Polypropylene, stability thermal and UV, 174  
Poly(propylene terephthalate) (PPT), 2, 14, 24  
Polysiloxane, finish, 24  
Polyvinylacetate hydrolysis, autocatalytic reaction, 275  
Polyvinylacetate, methanolysis-hydrolysis, 274  
Polyvinylalcohol, tacticity, 280  
Polyvinyl-cellulosic fibers, 615  
Polyvinylchloride, 313  
Polyvinylchloride/acetone-carbon disulfide solvent, 320  
Polyvinylchloride fibers, applications, 325  
Polyvinylchloride grafted polyacrylonitrile, 323  
Polyvinylchloride/polyvinylalcohol fibers, 310  
Pore size distribution, 879  
Porosity, molecular probes, 583  
Precipitation polymerization, 822  
Pressley tester, 624  
Pressure dyeing, 22  
Primary crystallization, 121  
Propagation reaction, polyamides, 38  
1,3-Propanediol, 14  
 $\beta$ -Propiolactam, 56  
Propylene, 149, 817  
Protofibrils, 345  
Pseudocrystallinity, polyacrylonitrile, 840  
Puckered ring, 775  
Pump block; spin beam, polypropylene, 196  
2-Pyrrolidinone, 56
- R**  
Radical formation, in polypropylene, 175, 176  
Ramie,  
  degumming, 467, 469  
  extraction, 468  
  uses, 470  
Raschig process, 61  
Rate,  
  crystallization, polypropylene, 231  
  polycondensation, 37  
  polymerization, 819  
    polyethylene, 152
- Rayon, 715  
  cuprammonium, viscose, 758, 759  
  fibers structure, 748  
  process, 711  
Reaction rate constant, polyamides, 48  
Reactive dyeing, 593  
Rectangular spinneret-pack assembly, 236  
Recycling, polyester, 26  
Redox initiation, 826  
Relaxation, 890  
Reprocessed silkworm silk, 397, 400  
Residual water  
  polyamides, 71  
  polyvinylacetate, 300  
Resilience, 626  
  poly(butylene terephthalate) (PBT), 14  
  polyvinylacetate, fibers, 302  
Retting  
  flax stalks, 462  
  ultrasonic energy, 466  
Rheological properties, polypropylene, 161–163  
Rheovibron, 862  
Rigidity, fiber, 627  
Ring-opening polymerization, 34, 37  
  caprolactam, 47
- S**  
SAXS, microvoids, 879  
Scherrer equation, 99  
Schiff base, 115  
Schöffen-Baumann acylation, reaction mechanism, 990  
Schweizer reagent, 708  
Screw extrusion, 196  
“Scutched flax” or “line,” 467  
Scutching, flax, 466  
Secondary cellulose acetate, 780  
Secondary wall, immature, 580  
Self-bulking fiber, 24  
Self-crimping yarn, 24  
SEM, 251  
  flax, 484  
  polystyrene-polypropylene blend, 251  
  ramie, 484  
Semi batch polymerization, 834  
Shear modulus  
  liquid crystalline polymers, 18  
  vegetable fibers, 502  
Shear rate, 166, 1004  
Sheat-core spinning, 919  
Sheet film extrusion, polypropylene, 203  
Shish-kebab structure, polypropylene, 204  
Shrink-proof wool, chlorination, 358

Silica, 252  
 Silk I, II, III, 390, 391  
   biomedical uses, 400  
   crystalline forms, 390  
 DSC, 388  
   fibers, mechanical properties, 387  
   formation, secondary structure, 393  
   semicrystalline material, 389  
   in vivo processing  
 Silkworm, *Bombyx mori*, 384  
 Silkworm cocoon silk, 385  
   chemical composition, 388  
   reprocessed, 395  
 Single-fiber, tensile tester, 624  
 Sisal fiber, uses, 460  
 Sisal plant, fiber extraction, 460, 462  
 $\beta$ -Sitosterol-glucoside, 535  
 Size distribution of pores, polyacrylonitrile copolymers, 881  
 Size exclusion chromatography (SEC), 928;  
   see also GPC  
 Slurry process, polypropylene preparation, 155  
 Small angle x-ray analysis, 222  
 Smoldering combustion, 593  
 Sodium bisulfite, 358  
   cellulosate, 720  
   cellulose xanthate, 716  
   chlorite, 477, 510, 511  
   methallyl sulfonate, 817  
   styrene sulfonate, 817  
   sulfate  
     coagulation bath, 298  
     sulfophenylmethallyl ether, 817  
 Soft ballistic protection, 18  
 Soft fibers, 455  
 Solution polymerization, 818–822  
   chain transfer, 837  
   spinning, 837  
 Sonic modulus, polymer chain 885  
 Speciality rayons, 763–764  
 Species of cotton, 524  
 Specific gravity, vegetable fibers, 489  
 Specific stress (tenacity), 624  
 Spherulites, 94  
 Spider silk, types, 386  
 Spin  
   finish, 81  
   pack, 197  
 Spinline stress, poly(ethyleneterephthalate), 8  
 Spinnability, 893, 894, 899  
 Spinnaret, 540, 788  
   polyamide, 78  
   poly(ethyleneterephthalate), 6  
   polypropylene, 197

Spinnarette, 714  
 Spinning, liquid crystal polyester, 16  
 Spinning process, 84  
 Spiral angle, jute and kenaf,  
   “Splittable pie” technique, 25  
 Spun-bonding process, 201  
 Stabilizer, n-propyl gallate, 689, 691  
 Stabilizers, 144  
 Stamcarbon, 61  
 Standard enthalpy ( $\Delta H_P^\circ$ ), polycondensation, 39  
 Standard entropy ( $\Delta S_P^\circ$ ), polycondensation, 39  
 Staple  
   fiber, 12  
   spinning line, 14  
 Static charge, poly(ethyleneterephthalate), 20  
 Stationary state, radical polymerization, 267  
 Steeping, decrease in degree of polymerization, 721  
 Stelometer, 624, 625  
 Step-growth polycondensation, 41  
 Stereospecific polymers, 141  
 Storage life, 706  
 Stress calculation, 206  
   “Stress in motion”, 625  
 Stress relaxation, 227  
 Stress-stain  
   characteristic, vegetable fibers, 496  
   curve, 624  
   polypropylene, 217  
 Structural changes, DSC technique, 859  
 Structure  
    $\alpha$ -polyamides, 88, 89, 91, 92  
    $\gamma$ -polyamides, 88, 92  
   5-Sulfoisophthalic acid, 22  
   Sulfuric acid, 779  
   Sunn stalks, retting, 472  
   Sunn, uses, 471  
   Surgical sutures, 18  
     polyvinylacetate, 263  
   Swelling, vegetable fibers, 491, 506  
   Synergises, 183

**T**  
   “Tail”-to-“tail” addition, vinyl acetate, 278  
 Take-up speed, 83, 84, 897  
   polyamides, 80  
   polypropylene, 198, 209  
 Tenacity, 11  
   lignin content, 490, 500  
   poly(ethyleneterephthalate) fibers, 12  
   polypropylene fibers, 226  
   polyvinyl acetate fibers, 290, 299  
 Tensile modulus, liquid crystalline polymers, 16, 18

Tensile properties, vegetable fibers-moisture content, 498  
Tensile strain, 625  
Tensile strength, polyamides, 109  
Terephthalaldehyde, 302  
Terephthalic acid, 3, 4  
Terephthaloyl chloride (TCI), preparation, 988  
Termination, by coupling and disproportionation, 267  
Tetrakis(hydroxymethyl) phosphonium chloride, 595  
Tetramethylene diamine, 58  
Tex, 792  
Tex per filament, 792  
Textiles, 806  
Tex system, 624  
Thermal insulation, 24, 236  
Thermal stability, *B. mori* silkworm cocoon, 388  
Thermo-oxidative degradation, 114  
Thermotropic aromatic polyesters, 17  
Thermotropic polyesters, 15, 16  
Thiocyanates, 709  
Thioglycolic acid, 343, 351, 357  
Tire cord, 12  
Titer, 86  
Toughness, 627, 802  
Tow bundle, 864  
Transacylation, polyamides, 50  
Transamidation, polyamides, 50  
Transfer to polymer, radical polymerization, 269  
Transgenic cotton, 524  
Transmission electron microscopy (TEM), 341, 343, 349  
distribution microvoid size, 879  
mammalian fibers, 372, 373  
Triboelectricity, 322  
Trifluoroacetic acid, 670  
Triphenyl phosphite, 992  
Tris (2,3-dibromopropyl)phosphate, 595  
Tuxing, 459  
Two-phase, semicrystalline polymers, 839, 840  
Two-stage, drawing, 239

**U**

Ultrasuede, 25

Urea, 705

Urea-formaldehyde resin, 513

U.S. HVI system, 629, 630

global marketing system, 630

UV stability, polypropylene, 144

UV stabilizers, polypropylene, 142

**V**

Vapor pressure osmometry (VPO), 927

Vegetable fibers, chemical composition, 475-177

dyeing, 514

moisture absorption, 490

Vinyl acetate, polymerization, 282, 293

Vinyl alcohol, 262

Vinyl bromide, 817, 931

Vinyl chloride, 931

mixed-gas method, 315

low temperature polymerization, 316

oxychlorination, 313

suspension polymerization, 315

Vinylidene chloride, 817, 922, 931

N-Vinylpyrrolidone, 919

Vinyon N, 814

Viscometry, 42

Viscose rayon, 716

aging

hydrolysis, 722

oxidation, 722

all core structure, 752

all skin structure, 752

batch process

description, 733

belt xanthator, (CBX), 732, 737

cellulose II, IV, 750

classification of fibers, 744

continuous process description, 733

cross-section shape, 754-756

filtration, 725, 793

final processing, 742

high wet-modulus, 718

Hottenroth number, 726

hydrogen sulfide formation, 729

industrial yarn, 757-758

Maurer-Buss Contisulf process, 738

mixing, 725

modal, 763

modifiers, 752

list of, 731

modifiers-spin-bath, 729-731

press weight ratio (PWR), 735

production, 732

properties, 756

ripening, 725

reaction involved,

Salt index (SI), 726

shredding, 722

spinnerette, jet, 740

spinning machine, 720, 740

spinning, xanthate decomposition, 727

steeping, 720

transxanthation, 728  
 uses, 760–763  
 xanthation, 723  
 x-ray diffraction pattern, 750  
 Viscosity average ( $M_v$ ), 927, 928  
 Voids, 228

**W**

Waal's forces, polyamides, 88, 89  
 "Wash-and-wear," 793  
 Water-Quench melt spinning, polypropylene, 200  
 WAXS, orientational process, 885  
 Weissenburg number, 168  
 Wet-spinning, 696  
 polyvinylacetate, 297  
 polyvinylchloride, 320  
 Wet stretching, 883  
 White crumb, 716  
 Wide-line NMR measurement, 840  
 Winding, 87  
 Wool,  
 acidic hydrolysis, 360  
 alkaline hydrolysis, 359  
 chlorination, 359  
 $\beta$ -conformation,  $\alpha$ -helical conformation, 367  
 cross-linking, 362  
 equilibrium water content, 368, 369  
 esterification, 362  
 flammability, 364  
 load-extension curve, 365  
 Merino, 340  
 photodegradation, 363  
 reaction (amino acid side chains), 362  
 water absorption, 368

Woolenization, stability of crimp, 433  
 Work of rupture, 624  
 Wrinkle resistance, 592  
 polycarboxylic acid and catalysts, 598

**X**

Xanthation  
 by-products, 724  
 side-reaction, 724  
 X-ray diffraction, 205, 301, 840  
 banana, 482, 488  
 cellulose, 559  
 coir, 487, 488  
 flax, 484  
 hemp, 486  
 polyacrylonitrile, 843–845  
 polyamides, 92, 98, 103  
 polypropylene, 160  
 polyvinylacetate, 263, 284  
 ramie, 485  
 sisal, 482  
 wool, 345, 366  
 X-ray photoelectron spectroscopy,  
 wool, 336

**Y**

Yak fibers, 373  
 Yield point, 625  
 Young's modulus, 626  
 jute and kenaf, 421

**Z**

Ziegler–Natta catalyst, polypropylene, 153  
 Zirconium tetrafluoride, 153

