

Supplementary Information

Index – 577

Index

A

AA-monomer 166, 175
 ABA-block copolymers 267, 488
 AB-monomer 166, 175
 A₂B monomer 178
 Abrasion resistance 485
 ABS terpolymer 351
 Acid catalyzed esterification 183
 Acrylic acid 175
 Acrylic ester 265
 Acrylo nitrile 265
 Acrylonitrile-butadiene rubber (NBR) 486
 Acrylonitrile-butadiene-styrene copolymers (ABS) 397
 Activated monomer 252, 333
 Activated-monomer mechanism 327–328
 Active ingredients 511–513
 Active species 246
 Additives 5, 421, 440, 441
 Adhesion 474
 Adhesives 474–476
 Adipic acid 189
 ADMET 313
 Aerobic decomposition 545
 Aerogels 464–466
 Ageing 418
 Agglomeration 498
 AH salt 176
 AIBN initiated polymerization 211
 Alcoholate 338
 Alfin process 404
 Aliphatic polyamides (PA) 189–191
 All *trans* conformation 13
 Alternating copolymerization 356–359
 Alternating copolymers 15, 350
 Aluminum alkyl 294
 4-amino benzoic acid 193
 6-amino hexanoic acid 189
 Ammonium ion 332
 Amorphous 94
 Amphiphilic block copolymers 257, 499
 Amphiphilic polymers 507
 Amphotropic 516
 Anaerobic 546
 Anionically charged 494
 Anionic living polymerization 264

Anionic polymerization 6, 246
 – competition between ion pair and free ions 277
 – initiation 265
 – intrinsic termination of MMA 274
 – introduction of –COOH end groups 273
 – introduction of –NH₂ end groups 273
 – introduction of –OH end groups 273
 – in non-polar solvents 280–281
 – reaction mechanism 264–265
 Anionic ring opening polymerization 336–337
 Anion splitting 254, 257
 Ansa-metallocene 305
 Antioxidants 422, 485
 Antipodal stereochemistry 304
 Antistatic agents 160
 Applications
 – automobile industry 3
 – construction industry 3
 – electronics industry 3
 – packaging industry 3
 Aromatic polyamide 191–194
 Arrhenius equation 131, 219, 220
 Associative thickeners 509
 Atactic 151, 156
 Atactic polypropylene (at-PP) 13, 299, 305–306
 Atom transfer radical polymerization (ATRP) 238–240
 Average functionality 180
 Avrami equation 115, 116
 Ax₂B-monomer 175
 Azeotrope 354
 Aziridine 248
 Azo compounds 207, 209

B

Back-biting 254, 328, 336
 BASF band process 390
 Basic processes of polymerization 211–212
 – chain growth 211
 – initiation 211
 – termination 211
 Basis equations for the radical polymerization 214
 Baytron® 562
 BB-monomer 166, 175

Benzoin ether 210
 β-H elimination 254
 β-hydride-elimination 297
 β-hydride-elimination transfer. See β-hydride-elimination
 β-pinene 252
 β-radiation 209
 Bicyclobutane 324
 Bifunctional initiator 271
 Binodal 31
 Bio-based 541, 543, 545
 Biodegradable 541
 Biological degradation/biologically degradable 541, 549
 Biopolymers 541
 Birefringent 115
 1,4-bis(chloropropyl)benzene 255
 Bisphenol A 188–189
 Block copolymers 15, 148, 236, 239, 246, 257, 266, 350, 369–372
 – by change of mechanism 372
 – by controlled radical polymerization 369
 Blowing agents 151, 159, 160, 458
 Blow molding 44, 9–451. See also Extrusion blowing
 Blown film extrusion 444
 Blown foams 458
 Bodenstein 212
 Boiling point 45
 Bottom-up strategy 570
 Branched macromolecules 8–10
 Branched segments 9
 Branching 106, 112, 123
 Branching coefficient 177
 Bridging precipitation 506
 Brittle 142, 143
 Brittleness 120, 147
 Brønsted acids 248–249, 328, 329
 BUNA 264
 Butadiene rubber (BR) 486
 Butane-1,4-dicarboxylic acid. See Adipic acid
 1,4-butanediol 187
 Butyl rubber (IIR) 391, 486

C

Cage effect 215
 Calamatic 517
 Calendering 451–452

- Calibration 80, 85
 Carbanion 338
 Carbenium ion 328–330
 Carbon black 424, 485
 Carbon fibers 399–400
 Carbon nanotubes (CNT) 569
 Carboxylate 338
 Carothers equation 170, 172, 174
 Catalyst cycle
 – chain growth 296, 297
 – chain transfer 297–299
 – initiation 296
 – termination 297–299
 Catalysts from late transition metals 306–307
 Catalytic curing of epoxides 204
 Catalytic polymerization 294
 Cationically charged 494
 Cationic polymerization 6, 246–247
 Cationic polymerization, chain growth 251–253
 Cationic ring-opening polymerization 327–336
 Ceiling temperature 281–284
 Ceiling temperature of α -methyl styrene 283
 Cellulose 544
 – esters 411–412
 – ethers 412–413
 Cement 501
 Centrifugal average 42
 Centrifugal force 53, 56
 Chain flexibility 106
 Chain growth 207
 – polymerization 165–167, 426
 – reactions 5
 Chain migratory mechanism 296
 Chain scission 419
 – α -decomposition 420
 – α -scission 420
 – β -decomposition 420
 – β -scission 420
 Change by complexation 361
 Change by mechanism 361
 Characteristic ratio 22, 26
 Chauvin, Y. 310
 Chemical vapor deposition (CVD) 571
 Chill-roll-extrusion 444
 China Clay 500
 Chiralnematic 518
 Chitin 547–548
 Chloroprene rubber (CR) 486
 Chrome-based catalyst 299
cis-trans isomerism 12
 Closed-cell foams 456
 Coatings 511–512
 Cobalt catalyst 318
 Cocatalyst 295
 Cohesion 474
 Coinitiator 250
 Cold curing of epoxides 204
 Collapse of the counter ion 272
 Collaps of counter ion 328
 Colloid stabilizers 499
 Colloid systems 497
 Color transfer inhibitors 504–505
 Combination 207
 Comonomers 14
 Comparison NMP, ATRP, RAFT 241–242
 Comparison of living and radical polymerization 234–236
 Compostable polymers 541
 Compounding 142, 440, 441
 Compression set 481
 Concrete 501
 Conductivity 3
 Conformation(s) 18, 25, 101, 107, 109–111, 121, 131, 132, 135
 Conformational isomerism 13–14
 Consecutive polymerization 552
 Continuous tower process 394
 Contour length 18, 21–24
 Controlled anionic polymerization 267
 Controlled cationic polymerization 255–259
 Controlled radical polymerization (CRP) 234
 Control of particle morphology 308–309
 Conversion 168, 170
 Coordination polymerization 294
 Copolymerization diagram 354–356
 Copolymerization of ethene with polar comonomers 316
 Copolymerization parameters r_1 , r_2 353
 Copolymerization rate 366–369
 Copolymers 14–16
 Copolymers of epoxides and carbon oxides 318
 Core-shell catalyst 308
 Covalent initiator 328
 Critical chain length 128, 131
 Critical micelle concentration (CMC) 431
 Cross linking 179–182
 – agent 485
 – of novolac 199
 – point 194
 – reactions 413–418
 – of resol 199
 Crude oil 538
 Cryoscopic constant 48
 Crystallization peak 98
 Crystals 516
 C_2 -symmetry 303
 Cyclic ether 246
 Cyclic olefin 322
 Cyclic siloxanes 335, 342
 Cyclization 154
 Cycloolefin copolymers (COC) 309
 Cyclopentene 309
 Cyclopolymerization of 1,6-heptadiyne 317
- ## D
- δ_1, δ_2 values 367
 Debye length 508
 Degenerative transfer (RAFT) 240–241
 Degradation 546
 Degradation of polymers 418–420
 Degree of crystallization 107
 Degree of freedom of rotation 322
 Degree of polymerization 4, 40, 166–170, 220, 427, 435
 – chain transfer
 – to monomer 223
 – rate of the transfer reaction 223, 224
 – kinetic chain length 220–221
 – molar mass distribution 226
 – temperature dependence of 222–223
 – termination by combination 221–222
 – termination by disproportionation 221
 – transfer to polymer 226
 Dendrimer(s) 9, 177
 Dendritic polymers 528
 Density variations 58
 DEPN 238
 Depolymerization 254, 275, 419
 Deprotonation 247
 Desalination 501
 Detergents 502
 1,3-diamino benzene 191, 193
 1,4-diamino benzene 191
 1,6-diamino hexane.
 See 1,6-hexamethylene diamine
 Diapers 510
 Dicarboxylic acid 168
 Die 442
 Dielectric thermal analysis (DETA) 102
 Diels–Alder adduct 211
 Differential scanning calorimetry (DSC) 97
 Diffraction 59

Diffusion coefficient 54, 56, 77, 130
 Dihydroxy carboxylic acid 168
 Diisocyanate 194–195
 Dilatometer 218
 Dilatometry 97
 Dimethyl dichlorosilane 195
 1,1-Diphenylethylene (DPE)
 242–243
 Dipole–dipole interactions 108, 124,
 144, 474
 Direct chain transfer 225
 Direct reuse 535–536
 Discotic mesomorphism 519
 Dispersion acids 428
 Dispersion aids 430
 Disproportionation 207
 Dissociation-combination
 mechanism 236–238
 Dissoziation constant of acid
 HA 183
 Dithranol 80
 Domains 517
 Dormant species 235, 236
 Double ring opening 326–327
 DPE method 242–243
 Drinking water 501
 Driving force behind ring-opening
 polymerization 342
 Dry box 247
 DSC 521
 Ductile 143
 Duroplastics 444
 Dynamic mechanical thermal analysis
 (DMTA) 98, 139
 Dynamic viscosity 127

E

Early transition metal 300
 Ebullioscopic constant 47
 Ecoflex® 546
 Ecovio® 547
 Einstein relation 54
 Elastomer additives 484–485
 Elastomers 444, 452, 453, 478
 Electrically neutral 494
 Electroluminescence 558
 Electroneutrality 247
 Electron transfer 266–267
 Electrophilic addition 251
 Electrospinning 470, 554
 Electrostatic stabilization 497
 Elemental analysis 354
 Elongation at break 480
 Elution volume 86
 E-module 111, 120, 156
 E-modulus 95, 99, 482

Emulsion polymerization
 – advantages 438
 – difference to emulsion
 polymerization 430–431
 – difference to suspension
 polymerization 430–431
 – kinetics 432–434
 – monomer depletion 434
 – particle formation 432–433
 – particle growth 434
 – theory of Smith and Ewart
 436–437
 Enantiotopic 304
 End group control 264
 End groups 44
 Energy dissipation 100
 Energy recovery 538–540
 Energy utilization 534
 Entanglements 94, 107, 121, 128, 129,
 131, 178, 191
 Enthalpy 322
 Entropy 322
 Epichlorohydrin 202
 Epoxy resin 202–204
 Equilibrium 171
 Equilibrium constant K 170–172, 276
 Esterification 182
 Ethene acrylic acid copolymers
 (EAA) 386
 Ethene-propene-diene elastomers
 (EPDM) 389
 Ethene-vinyl acetate copolymers
 (EVAc) 385
 Ethene-vinyl acetate elastomers
 (EVM) 486
 Ethene-vinyl acetate-vinyl alcohol-
 terpolymers (EVAL) 385
 Ethylene glycol 187
 Ethylene, propylene, and diene
 monomer (EPDM) 486
 Excess component 169
 Exfoliation 570
 Expanded polypropylene (EPP) 459
 Expanded polystyrene (EPS)
 459, 460
 Experimental determination
 of r_1 and r_2 359
 Experimental determination of the
 copolymerization
 parameters 361–364
 Exploders 512
 External catalyzed esterification 184
 External plasticization 393
 Extruders 441
 – twin-screw extruder 442
 Extrusion 442–444
 Extrusion blowing. *See* Blow molding

F

Fenton's reagent 433
 Fiber-reinforced plastics (FRP) 453–455
 Fiber-reinforced polymers 466
 Fibers 466–470
 Fiber spraying 455
 Fillers 148, 161, 485
 Film extrusion 444
 Filter elements 554
 Fineman–Ross equation 359, 363
 Fire resistance 159
 Fire retardants 160
 First-order phase transitions 95, 96, 98
 Flexible foams 457
 Flocculants 505–506
 Flocculation 498
 Flory–Huggins interaction
 parameter 30, 35
 Flory–Huggins parameter 50
 Flory–Huggins theory 37
 Fluorophilic surfactants 258
 Foam extrusion 458–459
 Foams 456
 Force field calculation 302
 Formaldehyde 199
 Form factor 72, 73
 Forming processes 440
 – bending 471
 – compressive forming 471
 – tensile-compressive forming 471
 – tensile forming 471
 Four center four electron
 transition 296
 Fracture 143
 Free ions 251, 252
 Free radicals 216–217
 Free volume 121, 125
 Freezing 45
 Friction factor 53, 54, 56
 Friedel–Crafts reaction 247
 Fuel cells 563–567
 Fuel consumption 540
 Functionalized transfer reagent 371
 Functional polymers 494, 543

G

γ -H-abstraction 420
 γ -radiation 209
 Gas chromatography 218
 Gas phase polymerization
 307, 309, 438
 Gas phase process 384
Gauche conformation 13
 Gaussian chain 18, 21, 23, 25

Gaussian chain model 22
 Gaussian distribution 19
 Gelatine 543
 Gel effect 427
 Gel point 180
 Gibbs–Duhem equation 66, 67
 Glass transition 95, 122
 Glass transition temperature
 95, 97, 100, 106, 110, 111, 114,
 120, 123–126, 131, 132, 143, 147,
 156, 470
 Graft copolymers 15–16, 350,
 372–378
 Grafting from 374
 Grafting onto 374
 Granulation 441
 – cold pelletizing 442
 – hot granulation 442
 – underwater granulation 442
 Graphene 569
 Graphene production 570–572
 Gravimetry 218
 Grignard reagent 265
 Group transfer polymerization
 265, 267–269
 Grubbs, R.H. 310
 Gutta percha 405

H

Hafnium 300
 Half-sandwich compound 300
 Hand lay-up 455
 Hard foams 457
 Heat capacity 97, 122
 Heat curing of epoxides 203
 Heat flow calorimetry 521
 Heterolytic splitting of photo
 initiators 331
 Heterogeneous catalysts 296, 311
 Heterogeneous Ziegler catalyst 305
 Hetero polyacids 329
 Hexagonal-columnar phases 520
 1,6-hexamethylene diamine 189
 High degree of polymerization 306
 High density polyethylene
 (HDPE) 108, 383
 Highest occupied molecular orbit
 (HOMO) 559
 High impact polystyrene (HIPS) 395
 High performance fibers 526
 High-pressure process 383
 High speed spinning of
 polypropylene 306
 High vacuum glass apparatus 247
¹H-NMR 44
¹H-NMR-spectroscopy 218, 354

Homogeneous catalysts 311–313
 Homogeneous polymerization
 catalyst 300–302
 Homogeneous single site effect 306
 Homolytic splitting of photo
 initiators 331
 Homopolymers 110
 Homotopic 302
 Homotopy 303
 Hooke's law 94, 99
 House-of-cards structure 500
 Hydride elimination 273–274
 Hydrodynamic radii(radius) 53, 55,
 56, 86
 Hydrogen bonds 108, 111, 124, 144,
 149, 191, 474
 Hydrogenolysis 298
 6-hydroxyhexanoic acid 175
 Hyper-branched polymers 177, 529

I

Ideal copolymerization 359–361
 Immobilized homogeneous
 metathesis catalyst 311
 Immobilized metathesis catalysts 313
 Impact modification 147
 Inability to melt 179
 Inclusion ratio of monomers 361
 Indispensibility 179
 Indium tin oxide (ITO) 559
 Influence of coinitiator 262–263
 Influence of solvent 262–263
 INIFER polymerization 255
 Initiator efficiency *f* 217
 Injection molding 148
 – fluid injection 447–448
 – multi-component injection 447
 – powder injection 448–449
 – reaction injection molding
 444–449, 463
 – thermoplastic foam injection
 molding 461–462
 Inorganic rubber 345
 In-plant recycling 535
 1,3-insertion 309
 Insolubility 179
 Instant release formulations 513
 Interfacial condensation 188
 Interfacial polymerization 172
 Intermolecular alkylation 335
 Intramolecular alkylation 335
 Intramolecular Friedel–Crafts
 reaction 253
 Intrinsic termination 335
 Intrinsic viscosity 83
 Iodonium salt 250

Ionomers 418
 Ion pair 252
 IR- 44
 IR spectroscopy 218, 354
 Isobutene 246
 Isocyanate 194–195
 Isomerism 10–14
 Isophthalic acid 188
 Isolelective metallocene 302, 303
 Isotactic 109, 110, 151, 156
 Isotactic polypropylene (it-PP)
 13, 302
 Isotropic 516

J

Joining processes 472–476
 ϕ value 369

K

Kalignost 276
 Kelen–Tüdös method 364
 Ketene acetal 325
 Kinetic chain length 290, 298
 Kinetics 409–410, 432–434
 – of anionic polymerization 274–277
 – of cationic polymerization
 259–263
 – stabilization 505
 – of step-growth
 polymerization 182–186
 Knudsen effect 464
 Kuhn chain 22
 Kuhn length 23, 25

L

Lactam 265
 Lactide 175
 Lactone 175
 Ladder polymers 153
 Latex particles 434
 Lattice model 28
 Layer pressing 454
 LC-polymers 529
 Leave-in catalysts 308, 384
 Leuchs anhydride 265, 339
 Lewis acidity 300
 Lewis acids 250–251, 328, 330
 Lignin 547
 Linear-low-density-polyethylene
 (PE-LLD) 110
 Linear macromolecules 8–10
 Linear polyethylene imine 497
 Linear segments 9

Liquid crystalline elastomers (LCE) 490–491, 527–528
 Liquid crystalline main chain polymers 524–526
 Liquid-crystalline polymers 469
 Liquid crystalline side chain polymers 526–527
 Liquid crystalline state 516
 Liquid crystal polymers 523–524
 Lithium alkyl 265
 Living cationic polymerization 255–259
 Living polymerization 246
 LLDPE 385
 Long-range order 516
 Loss factor 99, 100
 Loss modulus 99, 101
 Low-density polyethylene (LDPE/PE-LD) 110, 383
 Lower critical solution temperature (LCST) 36
 Lowest unoccupied molecular orbit (LUMO) 559
 Low-pressure process 384
 Lubricants 160
 Lyotropic liquide crystalline 192
 Lyotropic phase 516

M

Macro initiator 371
 Macromonomer method 377–378
 Main chain liquid crystal polymers (MCLP) 524
 MALDI-TOF-mass spectrometry 45
 Maltodextrin 544
 Mark–Houwink equation 84, 85
 Material recycling 536–537
 Material utilization 534
 Matrix 77
 Matrix materials 511
 Maximum stretchability temperature 471
 Mayo–Lewis equation 351–354, 359, 363
 McLaurin sequence 228
 Mean square end-to-end distance 21–24
 Mechanical adhesion 474
 Mechanism of the radical polymerization 207
 Melamine resin 201–202
M-elastomer 478
 Melt condensation 188
 Melting point 3
 Melting temperature 97, 106, 109–111, 114, 471

Membranes 563–567
 Merrifield synthesis 411
 Mesogenic 516
 Mesomorphism 516
 Metallacyclobutane 310
 Metallacyclobutane mechanism 311
 Metathese catalyst 322
 Metathesis 342–343
 – are dialkynes 315
 – reaction 313–316
 Methyl aluminoxane (MAO) 300
 2-methyl-2-oxazoline 251
 Micelles 431, 516
 Microorganisms 546
 Miscibility gap 33, 35
 Modulus of elasticity 481
 Molar enthalpy of polymerization 282
 Molar entropy of polymerization 282
 Molar free enthalpy of polymerization 282
 Molar mass 166–170
 – distribution 167–175
 – distribution from termination by combination 229
 – distribution from termination by disproportionation 227–229
 Molded part process 459–460
 Molecular non-uniformity 42
 Mole fraction 28
 Molybdenum amido catalyst 312
 Monochloro trialkyl silane 195
 Monodisperse 42
 Monomer consumption 351
 Monomers 4
 Morphology 94
 Mosaic adhesion 506
 MuCell®-process 462
 Multifunctional alcohols 181
 Multifunctional initiator 271

N

Nafion® 565
 Nanocomposites 552
 Nanofibers 554–556
 Nanofiller 569–573
 Naphthalene-2,7-dicarboxylic acid 188
 Narrow molar mass distribution 264, 306
 Natta, Giulio 299
 Natural rubber (NR) 405, 486
 Nematic phase 520
 Newtonian liquid 127
 Nickel effect 294, 295, 298
 Nitrocellulose 411
 Nitroxide radical 237

N-methyl pyrrolidone 197
 Nomenclature 7–8
 Non-stoichiometric factor *r* 169
 Non-uniformity of the molar mass distribution 290
 Non-uniformity *U* 233
 Norbornene 309, 342
 Norrish-I-type reaction 420
 Norrish-II-type reaction 420
 Novolac 199
N-oxide mediated polymerization (NMP) 238
 Nucleation 106, 116
 Nucleophilic initiators 265–266
 Nucleophilicity of the monomer 248
 Number average 47
 – degree of polymerization 173
 – molar mass 41, 44, 45, 48, 50, 52
 Number degree of polymerization 231
 Number of free functionalities 177
 Nylon-2, 341
 Nylon 6.6, 165

O

Observation angle 59
O-elastomer 478
 Oil production 568–570
 OLED 332
 Olefin-CO copolymers 317
 Olefin metathesis 310
 Oligomers 4
 ω -hydroxy carboxylic acid 175
 ω -hydroxyl-carboxylic acid 166
 Onium ions 328, 332
 Onium ions and ring opening 251
 Open-cell foams 456
 Optical constant 67, 74
 Oral pharmaceutical 511
 Order parameter *S* 518
 Organic light-emitting diodes (OLEDs) 558–563
 Organic peroxides 209
 Osmotic pressure 45
 Oxazoline 248
 Oxirane 246, 265, 322
 Oxonium ion 332

P

Packaging 540–541
 PAFC 565
 Paints 415–418
 Paper coatings 500–501
 Parallel (horizontal) polarization 61

- Partially aromatic polyamide 191
 PEFC 565
 PEK. *See* Polyether ketone (PEK)
 Pelletizing 442
 – cold pelletizing 442
 – hot granulation 442
 – underwater granulation 442
 Perchloric acid 248
 Permittivity 63
 Persistence length 23–25
 Phase separation 31, 34
 Phase shift 99
 Phase transitions 95
 Phenol 199
 Phenolate end groups 333
 Phenolic resin 199–200
 Phenyl carbonate 188–189
 Phillips catalyst 299
³¹P{¹H}-NMR 333
 Phosgene 188–189
 Phosphazene 248
 Phosphonium ion 332
 Photo initiator 209, 328, 330, 417
 Photoresists 414–415
 Plasticizers 160, 485, 501–502
³¹P-NMR 339
 Poisson distribution 284–292
 Polarizability 58, 60, 62
 Polarization microscopy 521–522
 Polarizing microscope 115
 Polyacetylene 314
 Polyacrylonitrile (PAN) 399–400
 Polyaddition 6
 Polyalkylene polysulfide 196
 Polyamide-6, 190
 Polyamide-6,6, 190
 Polyamides 6
 – from acrylamide 269–271
 – from lactam 269–271
 – from Leuchs anhydride 269–271
 Polyaramide fibre 191
 Polyarylene sulphide 197
 Polybenzimidazole (PBI) 566
 Polybutadiene 11–13, 404–405
 Polybutylene terephthalate (PBT) 187
 Polycarbonate (PC) 188–189
 Polychloroprene 405–406
 Polycondensation 6
 Polycyclooctene 314
 Polycyclopentene 314
 Polydiene 403–406
 Polydisperse 42
 Polydispersity index (PDI) 42, 175
 Polyelectrolytes 503, 508
 Polyester 6, 187–188
 Polyester carbonate (PEC) 189
 Polyether amide-12 elastomers 488
 Polyether ketone (PEK) 197, 198
 Polyethylene (PE) 294, 383
 – glycol 512
 – oxide 10, 322
 Polyethylene terephthalate (PET) 8, 187
 Polyglycerine 531
 Polyglycolide 322
 Polyimide 193, 194
 Polyinsertion 299
 Polyisobutylene (PIB) 390–391
 Polyisoprene 11, 12, 405
 Polyketone 326
 Polylactic acid 547
 Polylactide 322
 Polymer 4
 – analogous reactions 408–413
 – kinetics 409–410
 – architectures 8–16
 – dispersion agents 497–498
 Polymeric initiator 371–372, 374
 Polymerization
 – of α -olefines 294
 – in bulk 426, 429
 – of IBVE-rate of monomer conversion 262–263
 – of isobutyl vinyl ether 259
 – of lactam 252, 339
 – of 2-methyl-2-oxazoline 330
 – rate 435
 – in substance 426
 – without termination 271–273
 Polymer networks 9
 Polymer science 2
 Polymethyl methacrylate (PMMA) 398–399
 Polymorphic mesogens 519
 Polyoxymethylene (POM) 322, 400–401
 Polyphenylene oxide (PPO) 197, 198
 Polyphosphazene 322
 Polypropylene (PP) 12, 294, 387–389
 – atactic 389
 – isotactic 388
 – syndiotactic 388
 Polysaccharides 544–545
 Polysiloxane 195–196
 Polystyrene (PS) 7, 165, 394–398
 Polystyrene process 460
 Polysulfone 197, 198
 Polysulfone via electrophilic substitution 197, 198
 Polysulfone via nucleophilic substitution 197, 198
 Polytetrafluoro ethylene (PTFE) 402–403
 Polyurethane 6
 Polyurethane foams 462–463
 Polyvinyl alcohol 7, 10, 429
 Polyvinyl butyral 410
 Polyvinyl chloride (PVC) 391–394
 Polyvinyl pyrrolidone (PVP) 504
 Porosity 3
 Precatalyst, insertion 301
 Precipitation polymerization 172, 428
 Prepolymer 199
 Pressing 452–453
 Primary molding processes 440–453
 Processing of polymers 440
 Process intensification 556
 Prochiral molecule 301
 Progression theory 173
 Propellant 458
 Protective colloids 428, 499
 Proteins 543–544
 Protonation 252
 Pultusion 455
 Pyrolysis 537
 Pyromellitic acid 193
- ## Q
- Q-elastomer 478
 Q-e-scheme from Alfrey and Price 364–366
 Quasi-ideal 35
 Quasi-stationarity 212
- ## R
- Radical anion 338
 Radical polymerization 6
 Radical ring-opening polymerization 323–324
 Radical source 209–211
 Radius of gyration 72, 73, 75, 76
 Raleigh ratio 74
 Random walk 19
 Random walk model 18, 21
 Rate of polymerization 212, 435
 Rate of polymerization, temperature dependence of 219–220
 Rate of transfer to solvent 226
 Raw material recycling 537–538
 Rayleigh ratio 62
 Reaction foam casting 463
 Rearrangement of carbocations 251
 Rebound elasticity 480
 Recycling 534
 Recycling options 538
 Redox reaction 210
 Reduced viscosity 82
 Refractive index/indices 63, 64, 86, 97, 122, 149
 Regulator 226
 Reinforcing fillers 160

- Reinforcing material 400
R-elastomer 478
Relative viscosity 82
Relaxation time 130, 131
Renewable building blocks 545
Renewable resource 542
Reptation 129
Reshaping processes. *See* Forming processes
Resin transfer molding (RTM) 455
Resol 199
Retardation time 136
Retard formulations 513
Reuse 534
Reversible addition-fragmentation transfer (RAFT) 240–241
Rheology 126
Ring-opening of cyclic acetals 330
– of ethers 330
Ring opening of sulphide
– amine 330
– lactone 330
Ring opening polymerization (ROP) 6, 247, 322
Ring opening polymerization of phosphazene 343
Ring strain 322
ROMP 314–315
Rotational-Isomeric-State-Model 21
Rubber band 483
Rubber-elastic flow 121
Rubber elastic solids 484
Rubber-elastic state 121
Ruthenium catalyst 312
- S**
- SAN 351
SBR 351
SBS 351
Scale inhibitors 502–504
Scaling-up 557
Scattering 59
– center 60
– vector 74
Schlenk technique 247
Schlieren optics 53
Schotten–Baumann reaction 193
Schrock, R.R. 310
Schulz–Flory distribution 229
Second-order transitions 96
Second virial coefficient 75, 76
Sedimentation coefficient 54, 56
Selectivity 246, 264
Self-accelerating reaction 409
Self catalyzed esterification 184
Self-condensation 178
Self-dissociation 250
Self-retarding reaction 409
Semicrystalline 94
Separation of rings 328
Sequential addition of monomer 257
Shear modulus 94, 95, 101
Shear rate 127
Shear stress 127
Shear thinning 128
Shell higher olefin process (SHOP) 306
Shielding 509
Shore 480
Shore hardness 490
Shortfall component 169
Side chain liquid crystal polymers (SCLP) 524, 526
Silica 464, 485
Silicones (VMQ) 486
Silk 543
Siloxane 248
Silylated acetal of dimethyl ketene 267
Simultaneous polymerization 552
Single side catalyst 301
Size exclusion chromatography (SEC) 22
Sludge 505
Smart polymer 568
Smectic phase 519
 S_N1 -mechanism 327
 S_N2 -mechanism 327
Soil improvers 511
Soil release polymers 507
Solubilizers 512–513
Solution polymerization 428
Solvent effect on cationic Polymerization 259
Solvent process 384
Solvent separated ion pair 251, 252
Solvolysis 537
Spacers 525
Spandex® 487
Special salt effect 263
Specific surface adhesion 474
Specific viscosity 82, 83
Specific volume 122
Spherulites 114, 115
Spin coating 332, 559
Spinning 466, 526
– air gap spinning 469
– dry spinning 468
– electrospinning 470
– melt spinning 467–468
– stretching 470
– wet spinning 469–470
Spinning-disc reactor (SDR) 556–558
Spinodal 31
Spiro orthocarbonate 326
Stabilization 497
Stabilizers 160
Starch 544
State of polarization 59
Stationary state 352
Statistical copolymer 350
Statistical copolymerization 356
Statistical copolymerization of styrene with acrylonitrile 354
Statistical copolymers 14, 148
Staudinger, Hermann 2
Staudinger index 83, 85, 89
Stearic acid 512
Step-growth polymerization 165–167
Step-growth reactions 5
Stereochemistry 13, 302
Stereo control of polyinsertion 301
Stereoisomerism 11–13
– tacticity 11–13
Stereoisomers 13
Stereoregularity 299
Stereoselective metalloene 300
Stereoselectivity 308
Stereospecific polymerization 299
Steric stabilization 497
Steric stabilizing 498–500
Stirred tank reactor 557
Stoichiometry 166
Storage modulus 99–101
Stress relaxation 134
Structural elucidation of copolymers 379–380
– by compatibility 379
– by film transparency 379
– by gel permeation chromatography 379
– by ^1H and ^{13}C NMR spectroscopy 379
– by morphology 379
– by solubility 379
– by viscosity 379
Styrene-acrylonitrile copolymers (SAN) 395
Styrene-butadiene rubber (SBR) 486
Styrene dianion 266
Styrene radical anion 266
Substrates for catalysts 555
Sulfonium ion 332
Sulfonium salt 250
Super-absorbents 509–511
Super glue 265
Superplasticizers 501
Supports for Ziegler catalysts 307–308
Surface functionalization 507–508
Surfactants 430
Suspension polymerization 428–430

Suspension process 384
 Suzuki coupling 562
 Switch board model 113
 Syndiotactic 109, 151
 Syndiotactic polypropylene
 (st-PP) 13, 304–305

T

Tacticity 106, 112, 122, 124, 125, 388
 Technically important
 copolymers 378
 T-*elastomer* 478
 Telechelics 157, 196, 257, 258, 264,
 266, 369–370
 TEMPO 237
 Tenacity 120
 Tensile strengths 3, 148, 480
 Terephthalic acid dimethyl ester 187
 Terephthaloyl dichloride 189
 Terminal segments 9
 Termination
 – in cationic polymerization 254
 – chain transfer 297–299
 – with impurities 254
 – with phosphine 334
 – with water 254
 Tetrahydrofuran 246
 Texture 522
 Thermal brittleness 471
 Thermal conductivity 464
 Thermal insulation 540
 Thermal polymerization of
 styrene 210
 Thermodynamic parameters 343
 Thermograph 521
 Thermoplastic elastomers (TPE)
 147, 487–488
 Thermoplastics 144
 Thermoplastic vulcanizates (TPV) 487
 Thermotropic 516, 517
 θ -conditions 22, 36
 θ -solvent 26
 θ -state 35
 θ -temperature 26
 Thickeners 508–509, 545
 Thiirane 265
 Time-average intensity 59

Time of flight 79
 Time-temperature superposition
 principle 100
 Tires 404, 405, 424
 Tissue engineering 555
 Titanium tetrachloride 295
 Top-down strategy 570
 Toughness 143
Trans conformation 13
 Transesterification 188
 Transfer in cationic
 polymerization 254
 Transfer reaction 207
 Transition metal 294
 1,3,5-triaminotriazine 201
 Triisocyanates 181
 Trioxane 246
 TRIPNO 238
 Trommsdorff effect 427
 Tungsten 312

U

U-*elastomer* 478
 Ultimate elongation 480–481
 Undisturbed dimension 26
 Uniaxial stress 94
 Upper critical solution temperature
 (UCST) 36
 Urea resin 200–201
 UV- 44
 UV spectroscopy 218, 354
 UV-stabilizers 160, 423–424

V

Valence bond model (VBM) 21
 van der Waals forces 144
 van-der-Waals interactions 474
 Vapor deposition 559
 Vapor pressure 45
 Vertical polarization 61
 Vinyl cyclopropane 324
 Vinyl ether 257
 Virgin 537
 Virial coefficients 50, 67, 68
 Virial equation 49

Viscoelastic 134–136, 138, 143
 Viscoelasticity 121, 132
 Viscosity average molar mass 85, 86
 Volume fractions 28, 29, 83
 Vulcanization 157, 405, 413–414, 485
 Vulcanized 478

W

Wash liquor 503
 Wastewater treatment 505
 Wavelength 62
 Weight average molar mass 41, 68
 Weight degree of polymerization 231
 Weight fraction 173
 Welding processes
 – friction welding 474
 – hot-gas welding 473
 – hot plate welding 473
 – radiation welding 473
 – transmission welding 473, 474
 – vibration welding 474
 White biotechnology 542
 White genetic engineering 548
 Wire sheathing 444
 Wormlike-chain-model 24

X

X-ray diffraction 522–523
 X-ray spectroscopy 94

Y

Yield point 143
 Young's modulus 95, 99, 142, 143,
 147, 481

Z

Ziegler catalyst 294–296
 Ziegler, Karl 294
 Zimm equation 73, 74
 Zimm plot 75, 76
 Zirconium 300
 Zirconocene 305
 Zwitterionic monomers 494