

Index

a

- acetylcaprolactam 353
- aluminum trihydroxide (ATH) grades 303–306
- amide-amide interchange 159
- anthracene 76, 77
- Arrhenius equations 47
- Arrhenius laws 143
- attenuated-total-reflection (ATR-IR) technique 111

b

- Bagley corrections 119, 121
- Banbury mixer 39
- Bayer process 301
- Beer-Lambert law 111
- Bernoullian distribution 153
- burning test 323
- Buss Kneader technology 331

c

- cable trials
 - bedding compounds 322
 - burning test 323–328
 - final cable construction 322
 - fire performance, according to EN 50399 322–323
 - standard crosshead 322
- capillary rheometry 121, 122
- caprolactone (CL) 191
- ε -caprolactone, polymerization of 55–59
- Carreau model 91
- Carreau-Yasuda law 50, 57

cationic starches 60

- chemometric(s) 112, 115
- chemometric model 116
- compatibilizer concentration distribution (CCD) 210
- conveying elements 16
- copolymer 247
- cyclopentanone 155

d

- degree of exchange (DE) 155
- degree of interchange 140
- degree of polymerization (DP) 158, 160, 190, 194
- degree of randomness (DR) 140, 141, 155
- degree of substitution (DS) 59–61
- Devaux model 141, 149
- devolatilization/degassing 25–26
- DGEBA-MDEA 198, 199
- diameter of the dispersed phase
 - domain distribution (DDD) 210
- di-butyl-tin-laurate (DBTL) 309
- diglycidyl ether of bisphenol A (DGEBA) 197, 200
- Dirac function 72
- distributive mixing
 - elements 17
 - kinematic modeling of 88–89
- D_o/D_i ratio 24
- downstream feeding 24
- DSC 137, 140, 145, 148, 154, 156
- dynamic vulcanization 40

e

- epoxy-amine
 - phase 198
 - stabilization 202
- epoxy-comonomer 196
- ester-carbonate exchange 144
- ester-ester exchange 139
- esterification, EVOH 113
- ethylene carbonate (ETC) 144
- ethylene-propylene-diene
 - tripolymers/polypropylene (EPDM/PP) 333, 334
- ethylene vinyl acetate (EVA) 181
 - chemical modification of 113
 - copolymer 46
 - mechanical properties and fire resistance 201
- polymer chains 190
- transesterification 52
- ethylene-vinyl-alcohol (EVOH) 113

f

- finite element method 42
- Fire Performance of Electrical Cables (FiPEC) test 317
- flame retardant wire and cable
 - compound
 - aging performance 315–317
 - cable trials 322
 - compounding line 306–308
 - crosslinkable HFFR products
 - one-step compounding process 309–313
 - two-step compounding process 308–309
 - crosslinking density 314–315
 - heat release rate (HRR) 317
 - mechanical properties 315
 - non-polar compounds 318–321
 - oxygen depletion calorimetry 317
 - time to ignition (TTI) 317
- flame retardant wire and cable
 - compounds
 - aluminium trihydroxide (ATH) 331
 - crystallisation process 302
 - endothermic decomposition 303

Martinal® grades 304

mode of action 302–303

ethyl vinyl acetate copolymers 300

jacketing applications 299

magnesium hydroxide (MDH) 331

polar formulation 301

Polyethylene blends 300

silane addition 301

silane crosslinking

PEX-b 299

reactive extrusion 301

silane grafting principle 302

fluorescence spectroscopy 104

fluorescent detector 74

flush mounted sensors 106

Fourier transform infrared (FTIR)

spectroscopy 137, 140, 182

methods 160

g

- gel-permeation chromatography (GPC) 121
- glycidyl methacrylate (GMA) 114
- graft polymers 271
- grafted polyolefins
 - coupling agents 375
 - polypropylene glass fiber compounds 380
 - wood plastic composites 385
- grafted TPE's, overmolding
 - applications 400–403
- industrial synthesis
 - free radical grafting 377
 - melt grafting technology 377–378
 - solid state grafting 377–380
 - solution grafting 377
- maleic acid anhydride 375
- polymer blending
 - Polyamide reactive blending 392–400
 - Polyesters reactive blending 399
- grafting ratio 188

h

Haake batch mixer 76

heat distortion temperature (HDT) 28

heat release rate (HRR) 185, 186

HPLC pump 181
 hybrid system 385
 hydrolytic polymerisation 347–348

i

immiscible polymer blends
 Janus nanoparticles (JNPs)
in situ mechanism 290
 PLLA/PVDF blends 291
 PMMA/PS and SAN/PPE blends
 289
 polymer-polymer interfaces
 289–293
 morphology development
 compatibilizer effects 253–254
 melt flow stage 251–253
 solid–liquid transition stage
 249–251
 reactive comb compatibilizers 272
 in-line RTD
 measuring system 73–74
 of preformance 76–77
 in-line slit rheometry 117
 inorganic particles, *in situ* sol–gel
 synthesis of 180
 in-process rheometry 116–125
in-situ polymerization and *in-situ*
 compatibilization process 179
 vs. classical polymer blending 255,
 257
 nano-structured polymer blends
 PP/PA6 nanoblends 257–264
 PPO/PA6 nanoblends 264
 PA6/core-shell blends 264–267
 polymer nanoblends 255–257
 interpenetrating network (IPN) 28
 ionic exchange capacity 187
 ionomers 152
 isophorone diamine (IPD) 197
 isothermal thermogravimetric (TGA)
 141

j

Janus nanoparticles (JNPs)
in situ mechanism 290
 PLLA/PVDF blends 290

PMMA/PS and SAN/PPE blends
 289
 polymer-polymer interfaces 289

k

Kenics mixer 95
 kinetic equations 44, 45, 56, 65
 Kjeldahl method 60
 kneading blocks 16–18, 20, 25, 102
 mixing elements 88
 types 82
 kneading discs (KD) 47, 61
 description of 90
 distributive mixing performance
 93–97
 efficiency 93–97
 flow channel 90
 numerical simulation 89–92
 staggering angle 79
 zone 79–81

l

length-to-diameter ratio 75
 light transmission 73
 linear polymerization 117
 liquid crystalline polymer (LCP) 106
 2-lobed kneading discs 20
 3-lobed kneading discs 20
 low density polyethylene (LDPE) 114
 Lubonyl method 299
 Ludovic® 44, 45, 57, 61–63, 182

m

machine torque capacity 29
 MALDI-TOF MS 151, 163–165, 167
 maleic anhydride (MA) 31–32, 113,
 194
 mass polymerization 3
 mass spectrometry (MS) 137, 140
 measured off-line (MFR) 110
 mechanical energy transfer 25
 melt elasticity 117
 melt flow index 34
 melt flow rate (MFR) 102
 test 120
 melt grafting technology 377, 378
 melt homogenizing effect 22

- mercaptopropyltriethoxysilane (MPTES) 187
- methylene diphenyl diisocyanate (MDI) 30
- microscale 188, 189, 204
- mixing bushings 25
- mixing mechanisms 25
- molar mass (MM) 135, 137, 139, 143, 150, 157
- molar mass distribution (MMD) 138, 160
- molar ratio 187
- molecular weight (MW) 51, 103, 105, 117, 121
- molecular weight distribution (MWD) 103, 117, 121
- molten polymers 180, 183
- monomer(s) 190
- ϵ -caprolactam 190
 - conversion C(t) 56
 - in situ* polymerization 188
- monomer/polymer ratio 112
- Monte Carlo method 160
- n**
- nano-structured polymer blends
- PP/PA6 nanoblends 257
 - PPO/PA6 nanoblends 264
- nanocomposites 179–188
- nanometer scale 104
- nanoscale 189, 204
- nanostructuration 188–196
- near infrared (NIR) spectroscopy 73, 109, 114
- NMR 137, 140, 163
- normal stress difference 104
- o**
- on-line capillary rheometry 110, 120
- optical fibers 109
- optical spectroscopy 104
- output/screw speed ratio (Q/N) 111
- oxygen depletion calorimetry 317
- p**
- PA6/core-shell blends 264
- PA6 gas chromatography analysis 355
- PA6 oligomers 151
- partial Couette flow rheometer 106, 110
- partial differential equations 50
- partial least squares (PLS) 115
- PET/MXD6 blends 152
- PET/PEN, interchange reactions of 140
- PET/poly(butylene terephthalate) (PBT) 143
- piezo axial vibrator 122
- plasticizers 196
- plastics processing
- processing chain of 3
 - supply chain of 4
- PMMA/PS and SAN/PPE blends 289
- polar monomers 194
- polarimetry 105
- polarized optical microscopy (POM) 105
- poly(ethylene terephthalate) (PET) 32–33, 138, 140
- thermal-degradation mechanism 153
- poly(phenylene oxidize) (PPO) 196
- poly(vinylidene fluoride)/acrylic rubber (PVDF/ACM) blends 335
- polyamide 6 (PA6) 185
- anionic polymerisation 348–352
 - hydrolytic polymerisation 347–348
 - residual monomers 347
- twin screw extruders
- acetylcaprolactam 353
 - cellulose fibers 353
 - hexamethylene diisocyanate and CPL 352
- material properties 353
- modified reaction system 353
- reaction system and experimental setup 354–356
- residual monomer content, degassing zones 354–364
- screw configuration and process conditions 353
- polyamide 12 (PA12) 203
- polyamide copolymer 186

- polyamide/polyamide (PA/PA) 138,
 159–166
 poly- ϵ -caprolactone (PCL) 190
 polycarbonate (PC)
 oligomers 143
 recycling 191
 polycarbonate/polyamide (PC/PA)
 138, 155–159
 polycarbonate/polyester (PC/PEs)
 143–148
 polydimethoxysiloxane (PDMOS) 186,
 187
 polyetheramide triblock copolymer
 190
 polyetherimide (PEI) 196
 polyester/polyamide (PE/PA) 138,
 148–155
 polyester/polycarbonate (PEs/PC) 138
 polyester/polyester (PE/PE) 138–143
 polyester reactive blending 399
 polyethersulfone (PES) 196
 polyethoxysilane (PAOS) 181
 polyethylene (PE) 188
 glycol 190
 polyethylene terephthalate (PET) 8,
 113
 polyimides (PI) 196
 polylactic acid (PLA) 102
 poly-lactic acid (PLLA) 111
 polymer blending processes
 CCD 210
 compatibilizer-tracer, concept of
 210
 mixers, types of 221
 screw speed, effects of 220
 DDD 210
 emulsification 210
 reaction kinetics and reactive
 functional groups 222–223
 reactive compatibilizer-tracers, *see*
 reactive compatibilizer-tracers
 residence time distributions (RTD)
 210
 twin screw extruders 209
 polymer chain 136
 polymer, low thermal conductivity 107
 polymer matrix 101
 polyolefins 180, 194, 195
 polyoxymethylene (POM), thermal
 degradation of 112
 polypropylene (PP) 33–34
 antibacterial properties of 183–184
 controlled degradation of 41, 44,
 50–55
 glass fiber compounds
 applications 380
 exemplary screw design 382
 maleic acid anhydride grafted
 polyolefins 383
 PET 385
 PP/GF compound 385
 sized glass fiber 383
 stiffness and heat deflection
 temperature (HDT) values 380
 thermoplastic polymers 383
 peroxide degradation of 52–54
 rheological modifications 40
 polystyrene (PS) 76, 197
 polystyrene-poly(methylmethacrylate)
 (PMMA) 203
 polytetramethylene ether glycol
 (PTMEG) 190
 polyvinylidene fluoride (PVDF) 203
 power law 91
 power transmission 14, 15
 PS-g-PA6-MAMA-1 219
 PS-g-PA6-MAMA-2 219
- r**
- Rabinowitsch corrections 121
 Raman band intensity 114
 Raman spectroscopy 114
 reactive blending 135, 144, 145, 247
 reactive comb compatibilizers
 carboxyl-terminated PMMA 273
 compatibilization 272
 molecular structures 272
 PLLA/ABS blends
 carboxyl groups reactions 283
 cocontinuous phase 282–289
 internal pressure and free volume
 enlargement 288
 morphologies 282
 TEM images 283, 288

- reactive comb compatibilizers (*contd.*)
 - tensile stress-strain curves, of neat components 284
 - thermal properties, of neat components and compatibilized blends 286
 - PLLA/PVDF blends 274–282
- reactive compatibilization 247
- reactive compatibilizer-tracers
 - blend composition effects 235–238
 - emulsification curve build-up, experimental procedure 216–219
 - geometry of screw elements, effects of 238–241
 - in-line fluorescent light detection device 214–216
 - morphology development 224–229
 - non-reactive compatibilizers *vs.* reactive compatibilizers 223–224
 - PS-g-PA6-MAMA compatibilizer-tracer 213
 - reactive compatibilizer-tracer
 - injection location 233–235
 - twin screw extruder 229–233
- reactive extrusion
 - ϵ -caprolactone, polymerization of 55–59
 - coupling 45
 - defined 39–40
 - dynamic vulcanization 40
 - EVA copolymer, esterification of 46–50
 - in-line measurements 106
 - in-process rheometry 116–125
 - industrial applications 40–41
 - kinetic equations 44
 - on-line measurements 107
 - optimization 61–65
 - PA/PA 159–166
 - PC/PA 155–159
 - PC/PEs 143–148
 - PEs/PEs 138–143
 - PE/PA 148–155
 - PET 8
 - polymer matrix 188
- polymerisationin 9
- polypropylene, controlled
 - degradation of 50–55
 - principle of 41–46, 189
 - process modelling 41
 - process parameters 355
 - reactive blending 40
 - requirements, in-process monitoring of 103–111
 - rheokinetic model 44
 - scale-up 61–65
 - starch cationization 59–61
 - twin screw flow module 42–44
 - types of 6
- reactive linear polymers,
 - compatibilization 272
- reagents degradation 46
- reflectance mode 107, 112
- residence revolution distribution (RRD)
 - 81
 - local 86–87
 - partial 82–86
- residence time distribution (RTD) 71, 81, 104
- deconvolution procedure 79
- distributive mixing, kinematic modeling of 88–89
- experimental validation 92–93
- exutrder configurations 75–76
- feed rate, effect of 77–79
- in-line measuring system 73
- in-line preformance 76
- kneading disc zone 79
- local 86–87
- modeling of 88
- numerical simulation 89–92
- partial 82–86
- pressure measurements 110
- screw configurations 75–76
- screw speed, effect of 77–79
- staggering angle 80
- of theory 72–73
- variance 72
- residence volume distribution (RVD)
 - 81
 - local 86–87
 - partial 82–86

- reverse pitch screws 16
rheokinetic model 44, 46
rheometer 104, 107, 120
rotational rheometry 103
Runge–Kutta procedure 50
- S**
- screw elements 16–22
screw mixing element (SME) 22
screw speed 14, 48, 103, 104, 112
 effect of 102
 feed rate 182
SiDOPO 185
signal to noise ratio 112
single-screw extruders 101
size exclusion chromatography (SEC)
 113
small amplitude oscillatory shear
 (SAOS) 110, 117
small angle light scattering (SALS)
 105, 109
small-angle X-ray scattering (SAXS)
 137, 140
softsensor 110
sol–gel method 66
sol–gel chemistry 180, 181
solid state grafting technology 378,
 379
specific mechanical energy (SME) 28
spectroscopy techniques 104
staggering angle 79–81, 86, 97
starch cationization 59–61
starve-fed single screw extruders 102
strain hardening effects 117
strain-gauge 109
stress tensor 91
stretch ratio 88, 89, 94, 95, 97
styrene of, radical polymerization 40
styrene–maleic anhydride 111, 112
surface to volume ratio 24
- t**
- tapered kneading blocks (TKB) 21
Taylor diffusion 107
thermal energy transfer 24–25
thermoplastic
 elastomer 190
 nanostructuration 188–196
 polymer/epoxy-amine miscible
 blends 197–201
 polymerization and crosslinking 179
thermoplastic elastomer (TPE)
 definition 27, 331
 intrinsic copolymer 331
 reactive blending 331
 thermal reversibility 332
 TPVs, *see* thermoplastic vulcanizates
 (TPVs)
thermoplastic phase, *in situ*
 polymerization 179
thermoplastic polymers
 flame retardant properties 184–186
 in situ nanocomposites synthesis
 181–183
 monomers crosslinking via radical
 polymerization 202–203
 PP/TiO₂, antibacterial properties of
 183–184
 stabilization 202
thermoplastic polyurethane (TPU) 9,
 27, 29
thermoplastic vulcanizates (TPVs)
 deformation mechanism of 332
 dynamic vulcanization procedure
 331
 EVA/EVM blends 338–342
 morphological development of
 333–334
 PP/EPDM 334
 PVDF/ACM blends 334–338
thermoset 200, 202
 minor phase 179
 polymerization of 196–203
three-lobed kneading blocks 19
time to ignition (TTI) 185
TiO₂, antibacterial properties of
 183–184
titanium-alcoxy bond 55
toluene diisocyanate (TDI) 31
transmission electronic microscopy
 (TEM) 191, 198, 202
trimethylol propane trimetharylat
 (TRIM) 203
twin screw extruders 353

- twin screw extruders (*contd.*)
- acetylcaprolactam 353
 - ϵ -caprolactam, polymerization of 112
 - cellulose fibers 353
 - chemical reactor 179
 - material properties 353
 - modified reaction system 353
 - residual monomer content,
 - degassing zones
 - contents of activator 358
 - degassing efficiency 357
 - gel permeation chromatography (GPC) 363
 - influence of amount and entrainer types 365–367
 - mass temperature 359, 360
 - polymer influence 367–368
 - side reactions 361
 - thermal degradation 362
 - screw configuration and process conditions 353
 - character dimensions of 15
 - chemical reactions 26–27
 - development for 14
 - devolatilization/degassing 25–26
 - discharge 26
 - downstream feeding 24
 - feeding 23
 - MAH 31
 - mechanical energy transfer 25
 - melting mechanisms 24
 - mixing mechanisms 25
 - octanoic acid 113
 - PMMA 42
 - PP/TiO₂ nanocomposite 181
 - problems and challenges 45–46
- styrene/maleimide 113
- thermal energy transfer 24–25
- TPE processing 27–29
- TPU polymerization 29–31
- unit operations 22–26
- upstream feeding 23–24
- twin screw flow module 42–44
- typical unit operations 22
- u**
- ultraviolet–visible (UV–VIS) 104
- upstream feeding 23–24
- v**
- viscometers 122
- w**
- wide-angle X-ray spectroscopy (WAXS) 166
- wood plastic composites
- bending strength and Charpy impact strength 387
 - coupling agents 388
 - coupling mechanism, maleic acid anhydride grafted polypropylene 388
 - maleic acid anhydride and silanes 388
 - plastic material, processing temperature 385
 - polypropylene 385
- z**
- zero length die 119
- zero shear viscosity 50, 91, 117
- Ziegler–Natta catalysis 50
- ZSK barrels 16