

## Index

### **a**

A–B linkages in a random copolymer of A-co-B (ABABAB) 154  
 ABm-type monomers, polymerization 407  
 abundance sensitivity 5, 6, 10–12  
 acetone 127  
 acoustic nebulization (AN) 187  
 acrylate polymerization  
 – macromonomer formation mechanism 361  
 –  $\beta$ -scission in 360  
 acrylonitrile/butadiene 390  
*N*-acryloylmorpholine (NAM)  
 – polymerization 390  
 – RAFT-mediated polymerization 389  
 activated monomer (AM) mechanism 406  
 active chain end (ACE) mechanism 406, 420  
 aerosol interface, principle of 215  
 Ag cationization  
 – method of 156–162  
 alkoxyamine BlocBuilder<sup>®</sup> 377  
 alkylcarbonyloxy radicals  
 – decarboxylation 322  
 – disadvantage 322  
 alkyl peroxyacetates 327, 328  
 alkyl peroxyvalates 323–327  
 allyl butyl ether (ABE) 287  
 alpha-cyanocinnamic acid (CCA) 189  
*tert*-amyl peroxyacetate (TAPA) 327  
*tert*-amyl peroxyvalate (TAPP) 324  
 AP-MALDI applications 217  
 AP-MALDI/ion trap interfaces 216  
 AP-MALDI source  
 – schematic view of 218  
 architectural elucidation 33  
 atmospheric pressure (AP) 85  
 – sources 214

atmospheric pressure chemical ionization (APCI) 45, 49, 69, 283  
 – advantages 49  
 – limitations 49  
 atmospheric pressure glow discharge ionization (APGDI) 194  
 atmospheric pressure photoionization (APPI) 49  
 atmospheric solids analysis probe (ASAP) 69, 93  
 atomic force microscopy (AFM) 128  
 atomic ion beams 176  
 atom transfer radical polymerization (ATRP) 226, 284, 373, 378  
 – anionic polymerization to 382  
 – catalysts 381  
 – efficiency 381  
 – generated polymers  
 – structure 378  
 – initiators  
 – catalytic activity 381  
 ATRP-prepared PBAs  
 – MALDI-TOF-MS spectra 379  
 attenuated total reflectance FTIR (ATR-FTIR) 444  
 Au-cationized PS oligomeric distribution 166  
 automated data processing 468  
 2,2'-azobisisobutyronitrile (AIBN) 349, 381

### **b**

Bayesian probability theory 268  
 $\alpha$ -benzyl,  $\omega$ -hydroxy polyethylene oxide  
 – MALDI-TOF mass spectrum and SEC trace 408  
 benzyl radicals 326  
 biopolyesters poly(3-hydroxybutyrate)-co-poly(3-hydroxyvalerate) 306  
 bis  $\gamma$ -lactone

- anionic copolymerization mechanism 417
  - 2,2-(bis(2-oxazoline)-linked poly- $\epsilon$ -caprolactone (PCL-O) 455
  - bisphenol A-polycarbonate (BPA-PC) 441
  - bis-3,5,5-trimethylhexanoyl peroxide (BTMHP) 350
  - bombarded region
  - gel point 180
  - bottle-grade PET (btg-PET)
  - thermo-mechanical/thermo-oxidative degradation mechanisms 441
  - bovine serum albumin (BSA) 182
  - bromine-terminated poly(*t*-BA) 385
  - B<sub>2</sub>S<sub>2</sub>Se oligomers
  - single ion current (SIC) trace 456
  - n*-butyl acrylate (BA)
  - block copolymers 375
  - RP 358
  - tert*-butyl acrylate (*t*-BA)
  - ATRP 379
  - butyl alcohol (BuOH) 420
  - tert*-butyl mercaptan 351
  - chain transfer mechanism 351
  - n*-butyl methacrylate (BMA) 341, 343
  - polymerization 395
  - N-tert*-butyl-*N*-(1-diethylphosphono-2,2-dimethylpropyl nitroxide) 376
  - tert*-butyl peroxyacetate (TBPA) 328
  - initiation by 335
  - tert*-butyl peroxyvalerate (TBPP) 326
  - p-tert*-butylphenol/KHCO<sub>3</sub> system 423
  - (*R,S*)- $\beta$ -butyrolactone
  - transesterification 428
  - $\beta$ -butyrolactone
  - anionic ring-opening polymerization 411
  - ROP 410
- c**
- capillary electrophoresis (CE) 214
  - $\epsilon$ -caprolactone (CL) 426, 454
  - $\epsilon$ -caprolactone/Sn(Oct)/(butyl alcohol or water)
  - MALDI-TOF mass spectra 420, 421
  - carbon-centered radicals 322
  - $\alpha$ -carboxyl-terminated oligomers 354
  - catalytic chain transfer (CCT) 373
  - effective monomers 395
  - mechanism 395
  - polymerization 393, 395, 397
  - catalytic chain-transfer agent (CCTA) 356
  - catalytic-chain-transfer polymerization (CCTP) mechanism 320
  - catalytic cycle 394
  - catalytic cycle 393
  - in catalytic chain transfer (CCT) polymerizations 394
  - cationization methods 164
  - C<sub>60</sub>-capped polystyrenes 385
  - chain growth polymerization process 423
  - chain-length-dependent propagation (CLDP) phenomenon 339, 340
  - chain-length distribution (CLD) 324, 347
  - determination of 336
  - chain-transfer reactions 321
  - chain transfer to polymer (CTP) 335
  - facilitator 359
  - tertiary radical from 360
  - characteristic collision voltage (CCV) 405
  - CHCA matrix 128
  - chemical ionization 36, 37
  - limitation 37
  - cobalt cyclopentadienyl dicarbonyl 52
  - collisionally activated dissociation (CAD) 59
  - collision energy 28
  - collision-induced decay experiments 387
  - collision-induced dissociation (CID) 26, 59
  - experiments 381
  - fragmentation 85
  - condensation polymers
  - degradation pathways 439
  - controlled/living radical polymerization
  - simplified mechanisms 374
  - co-oligomers
  - MALDI-TOF-mass spectra 417
  - copolymer characterization 281
  - biological/(bio)medical application 304–307
  - MS spectrum 343
  - reviews 282, 283
  - scope 282
  - separation prior MS
  - ion mobility spectrometry-mass spectrometry (IMS-MS) 299–301
  - LC-MS 297–299
  - quantitative MS 303
  - tandem MS (MS/MS) 301–303
  - soft ionization techniques 283
  - APCI 294–297
  - ESI-MS 292–294
  - MALDI, application of 283–292
  - software development 307–309
  - copolymers
  - fingerprints 345
  - formation processes 382
  - mass spectra of 248
  - MS analysis 343
  - copolymer structures 282
  - copper(I) thiocyanate (CuSCN) 381

- cryptands  $\beta$ -butyrolactone 410  
 CuBr/2,2'-bipyridine (bpy) as a catalyst 378  
 Cu-catalyzed azide/alkyne reactions 385  
 4-cyanopentanoic acid-4-dithiobenzoate (CPADB) 294  
 cyclic carbonates  
 – ring-opening polymerization mechanisms 408–423  
 cyclic esters  
 – ring-opening polymerization mechanisms 408–423  
 – ring-opening polymerization 415  
 – ROP 415  
 cyclic ethers/esters  
 – ring-opening polymerization mechanisms 406–408  
 – ring-opening polymerization (ROP) mechanisms 405  
 cyclic oligolactones 418  
 cyclic oligomers 418  
 – formation 439  
 cyclic polymers 377  
 cyclic polystyrene (PS) oligomer 75
- d**  
 dead polymer molecules 353  
 decomposing initiators 331  
 degradation mechanisms, determination of 33  
 degradation process  
 – role 437  
 degree of polymerization 320, 394  
 design of experiment (DoE) 240  
 desorption atmospheric pressure photoionization (DAPPI) 93  
 desorption chemical ionization (DCI) 45  
 desorption electrospray ionization (DESI) 48, 69, 192, 193  
 – mass spectrometry 149  
 – source 48  
 desorption ionization on silicon (DIOS) 52, 385  
 desorption sonic spray ionization 93  
 diacyl peroxides 328–331  
 $\alpha,\beta$ -dialkyl-substituted- $\beta$ -lactones  
 – ROP 413  
 $\alpha,\alpha$ -dialkylsubstitutet- $\beta$ -lactones  
 – ROP 410  
 di-benzoyl peroxide (DBP) 329  
 di-*iso*-butyryl peroxide (DIBP) 329  
 dicaprylcapryl adipate (DCA) 173  
*N,N*-diethylacrylamide (DEAM) 377  
 – SEC/ESI-MS spectrum 377  
 diethylene glycol (DEG) 441  
 di-2-ethylhexyl peroxydicarbonate (EH-PDC) 331  
 di-ethyl peroxydicarbonate (E-PDC) 331  
 differential scanning calorimetry (DSC) 287, 438  
 2,5-dihydroxyacetophenone (2,5-DHAP) 96  
 2,5-dihydroxybenzoic acid 94  
 dihydroxybenzoic acid (DHB) 121, 122, 128  
 – matrix/polymer system 190  
 – optical images of 187  
 dihydroxy telechelic PMMA 395  
 diisooctylsebacate (DOS) 173  
 2,2-dimethoxy-2-phenylacetophenone (DMPA) 332  
 – photodissociation 332, 333  
 dimethyl itaconate (DMI) 332  
 dimethylphenyl silane (DMPS) 164  
 di-2-naphthoyl peroxide 330  
 di-*n*-dodecanoyl peroxide (DDDDP) 328  
 di-*n*-tetradecyl peroxydicarbonate (TD-PDC) 331  
 D ion traps 17–19  
 – basic components 19  
 3D ion trap system 17  
 – abundance sensitivities 18  
 – components 19  
 – linear dynamic ranges 18  
 – mass selective instability 18  
 – performance characteristics 18  
 1,5-dioxepan-2-one (DXO)  
 – ROP copolymerization 418  
 direct analysis in real time (DART) 93, 194  
 direct introduction probe chemical ionization (DAPCI) 93  
 direct-pyrolysis mass spectrometry (DPMS) 438  
 disproportionation  
 – rate coefficient 348  
 – termination by 348  
 dithioester  
 – UV-induced radical  $\beta$ -cleavage 392  
 double focusing sector mass analyzer 14  
 DP-APCI measurements 297  
 drug-loaded poly(ethylene glycol) macromonomers  
 – ROMP 425  
 dynamic mechanical analysis (DMA) 455
- e**  
 $\epsilon$ -caprolactone (CL) 296  
 electrohydrodynamic ionization (EHI) 45  
 electron capture dissociation (ECD) 61  
 – applications 61  
 – feature of 61, 62

- electronic noise 241
  - electron ionization (EI) 34, 35
    - limitations 35
  - electron transfer dissociation (ETD) 61
    - fragmentation 85
  - electrospray-assisted laser desorption/ionization (ELDI) 93
  - electrospray deposition (ESD) 219
    - principle of 186
  - electrospray ionization (ESI) 21, 33, 46, 47, 57, 87, 186, 281
    - advantages 46, 47
    - limitations 47, 48
    - mass spectra 210, 386
    - mass spectrum 384
    - sensitivity 329
    - techniques 320
  - electrospray ionization mass spectrometry (ESI-MS) 238, 331, 340, 390, 406, 424, 445, 452
    - chromatographic elution profiles of 268
    - chromatographic setup 266
    - instrument 332
    - MS analysis 429
    - MS experiments 406
    - technique 410
  - emulsion polymerization (EP) 364
    - mechanism 365
  - end-group analysis 33
  - energizing collisions with gaseous targets 59
  - enhanced spin capturing polymerization (ESCP) 373
  - entropic
    - compensation of 212
  - epoxide (glycidyl phenyl ether)
    - anionic copolymerization mechanism 417
  - ESI-MS<sup>n</sup>
    - fragmentation experiments
    - application 413
    - techniques 410
  - ESI-Q/ToF tandem mass spectrometer 71
  - ethylene oxide
    - zwitterionic ring-opening polymerization mechanism 407
  - ethylene oxide (EO)
    - anionic polymerization 406
    - polymerization 407
  - evaporation-grinding method (E-G method) 442
  - extensible markup language (XML) standard 238
    - mzData 238
    - mzML 238
    - mzXML 238
  - extractive electrospray ionization (EESI) 94
- f**
- fast atom bombardment (FAB) 42, 43
    - limitations 43
  - fast atom bombardment-MS (FAB-MS) 417, 441
  - field desorption mass spectrometry (FD-MS) 38–40
    - limitations 40
  - fingerprint approach 347
  - Flory-Fox equation 266
  - Fourier filtering 243
  - Fourier transformation (FT) 58
  - Fourier transform infrared (FT-IR) 288
  - Fourier transform-ion cyclotron resonance (FT-ICR) 287
    - mass analyzers 223, 391
    - mass spectrometers 61
  - Fourier transform ion cyclotron resonance mass analyzers 22–24
    - cyclotron frequencies 22
    - operating principles 23
    - performance characteristics 22
  - fragmentation
    - by ETD and CID 103, 104
  - fragmentation reactions 378
  - fragment ions in triple-stage MS experiments 58
  - free radical polymerization (FRP) 287
- g**
- gas chromatography/mass spectrometry (GC/MS) 438
  - gas cluster ion beams (GCIB) 177
  - gas-phase separation of linear, of poly( $\epsilon$ -caprolactone) 91
    - ESI-IMS-MS 2D plot of PCL 91, 92
    - folding transitions 91
  - gas-phase separation techniques 467
  - Gaussian peak shape 267
  - gel permeation chromatography (GPC) 162
  - Gibbs–Helmholtz equation 212
  - glutamate film 176
  - glycidol 407
  - glycidyl methacrylate (GMA) 343
  - glycodentritic copolymers
    - MALDI-TOF MS spectra of 304
  - glycolidyl, copolymer
    - chemical structure, changes 295
  - glycosulated PEG-dendritic copolymers
    - MALDI-TOF MS spectra of 305
  - gradient chromatography 226

- gravimetric mixtures 265  
G-SIMS process 174
- h**  
 $^1\text{H}/^{13}\text{C}$  NMR spectroscopy 417  
heat for ionization 97  
N-heterocyclic carbene catalysts (NHC) 406  
N-heterocyclic carbenes  
– alcohol adducts 416  
– application 413  
High-energy CAD 59, 60  
higher molecular weight (MW) analyses 97  
high-molecular-weight polymers 420  
high-performance liquid chromatography (HPLC) 211, 454  
– optimization 454  
high-resolution mass analyzers  
– Orbitrap 467  
– FT-ICR 61, 223, 287, 391  
high-resolution mass spectral analysis 428  
 $^1\text{H}$ -NMR spectroscopic data 382  
homopolymers 155  
hydroperoxy-capped macromolecules formation 391  
hydrophilic–lipophilic balance (HLB) value 142  
3-hydroxybutyrate oligomers formation 411  
(*R*)-3-hydroxybutyric acid (HB) 426  
(*R,S*)-3-hydroxybutyric acid  
– equimolar reaction 429  
(*R,S*)-3-hydroxybutyric acid reaction 429  
N-(2-hydroxypropyl) methacrylamide (HPMA)  
– polymerization 354  
– semitelechelic poly(HPMA) synthesis 354  
hyphenated coupling methods 228  
hyphenated techniques 209  
– coupling principles  
– LAC/LC-CC with MALDI-/ESI-MS 224–228  
– off-line coupling devices 218–220  
– online coupling devices 214–218  
– of SEC with MALDI-/ESI-MS 220–224  
– transfer devices 214  
– polymer separation techniques 210–214
- i**  
Ill-conditioned problem 268  
imaging mass spectrometry 149, 150  
include desorption electrospray ionization (DESI) 93  
induction-based fluidics (IBFs) 220  
inductively coupled plasma mass spectrometry (ICP-MS) 185  
infrared spectroscopy 33  
inlet ionization methods 91  
instruments for chemical analysis and imaging 94  
ion abundance 91, 94  
ion cyclotron resonance (ICR) trap 58  
ionic coordination catalysts 406  
ion intensity distributions 189  
ion–ion reactions 61  
– fragment ions arising from 61  
ionization bias effects 10  
ionization efficiency 162  
ion mobility mass spectrometry (IMS) 185, 281  
– applications 467  
– mass spectrometry (MS) 85  
– instrument, for polymers analysis 88  
ion traps (ITs) 58  
IR-MALDI 398  
IR multiphoton photodissociation (IRMPD) 61  
– applications 61  
isobaric components of nonionic surfactant 71, 72  
isolation and fragmentation processes 62  
isopropanol 127  
N-isopropylacrylamide (NIPAM)  
– 2,2,6,6-tetraethylpiperidin-4-on-N-oxyl-mediated polymerization 377  
IUPAC-recommended method 336
- k**  
kinetic energy 59
- l**  
lactide  
– ring-opening polymerization  
 $\beta$ -lactones  
– chemistry 409  
– ring-opening polymerization 417  
laser ablation (LA) 185  
laser ablation electrospray ionization (LAESI) 93  
laser desorption (LD) 43, 44  
– limitations 44  
laser desorption/ionization (LDI) 293  
laser desorption/ionization on silicon-mass spectrometry (DIOS-MS) 439  
laserspray ionization (LSI) 85, 96  
laserspray ionization/inlet (LSII) 85, 95, 96  
– practiced on high-performance instruments 94  
laserspray ionization/vacuum (LSIV) 85  
LC-MALDI coupling principles  
– scheme of 215

- LC-MS chromatograms 227
  - light scattering 33
  - linear dynamic range 5, 9, 10
  - linear ion traps 19, 20
    - performance characteristics 20
  - liquid adsorption chromatography (LAC) 209
  - liquid adsorption chromatography at critical conditions (LACCCs) 3
  - liquid adsorption chromatography under critical conditions (LACCCs) 376
  - liquid chromatographic/electrospray ionization mass spectrometric characterization 423
  - liquid chromatography at critical conditions (LC-CCs) 209
  - liquid chromatography, 2-D
    - schematic setup for 213
  - liquid chromatography mass spectrometry (LC-MS) 237, 284
  - liquid exclusion adsorption chromatography (LEAC) 228
  - liquid injection field desorption/ionization mass spectrometry (LIFDI-MS) 386
  - liquid metal ion gun (LMIG) 168
  - liquid-phase separation techniques 467
  - liquid secondary-ion mass spectrometry (L-SIMS) 42, 43, 375
    - limitations 43
  - living/controlled radical polymerization
    - CCT, protocols based on 393–397
    - degenerative chain transfer, protocols based on 388–393
    - novel protocols and minor protocols 397
    - persistent radical effect, protocols based on 373–388
    - reaction mechanisms and polymer structure elucidation 373–398
  - low-energy CAD 60
  - low-temperature plasma ionization (LTPI) 194
  - LSII-ETD, to identify myelin basic protein fragment 94
  - LSII-IMS-MS
    - 2D plot 98
    - of model polymer blend 97
  - LSII mass spectrum 95
    - of PEG-6690 94, 95
  - LSII-MS analysis of PEG-970 using a dithranol and NaCl matrix 88
  - LSIV-IMS-MS imaging in reflection geometry (RG) 107–109
  - LSIV in reflection geometry at intermediate pressure (IP) 100–102
    - LSIV-IMS-MS 2D plot of 102
    - LSIV-MS spectrum 102
  - LTQ-Velos mass spectrometer 96
    - LSII-MS analysis of polymers on 96
- m**
- macrocyclic polylactones 417
  - macromolecular design via interchange of xanthates (MADIX) 386, 387
  - macromolecules
    - synthesis of 467
  - macromonomer production machine 361
  - magnetic sector mass analyzer system 13
  - MALDI methods 379, 425
    - 2,5-DHB matrix 191
    - evaporation-grinding method for 442
    - experiment 387
    - imaging, desorption/ionization, process of 185
    - imaging, mass spectrometry 186
    - imaging, of peptides and proteins 185
    - interface, scheme of 216
    - mass segregation 189
    - for small molecule analysis 99
    - spectra 449
  - MALDI-MS
    - CLDs 338
    - quantification of polymers 52
    - spectra 343
    - spectrum 359
    - techniques 374
  - MALDI-Q/ToF tandem mass spectrometer 69
  - MALDI sample preparation, for polymers 119
    - absorption of laser light 121, 122
    - basic solvent-based sample preparation recipe 127
    - choice of matrix 125
    - choice of solvent 125–127
    - chromatography as sample preparation 138–140
      - rule of thumb for analysis of polymers 138, 139
    - deposition methods 127–130
      - Venturi effect 130
    - effective ionization 123–125
    - efficient desorption 122, 123
    - important aspects of sample preparation 143
    - intimate contact 121
    - matrix-to-analyte ratio 134–136
      - matrix-to-analyte plots for DDAVP and bovine insulin 135, 136
    - predicting MALDI sample preparation 142, 143

- problems in MALDI sample preparation 140–142
- roles of matrix 120, 121
- fulfill different functions to generate successful result 120, 121
- salt-to-analyte ratio 136–138
- Peak area plotted *versus* salt-toanalyte ratio for 137
- solvent-free sample preparation 130–132
- vortex method 132–134
- basic recipe for 132, 133
- mass spectra of different PEG standards 133
- SEM image of a vortex prepared sample 134
- MALDI techniques 374
- MALDI-TOF
  - analysis 395
  - mass spectra 418
  - data, time-series segmentation 248
  - mass spectrometer 297
  - mass spectroscopy (MS) 288, 378, 391, 407
  - analysis 292, 305, 391, 429
  - application 382
  - CO/styrene copolymerization 288
  - methods 406
  - microstructure of 288
  - MS spectra, of precursor ions 302
  - NMR spectroscopy 290
  - spectrometry analysis 406
  - technique 427
  - TEMPO-capped polystyrenes to 375
  - mass spectrum 419, 428
  - $m/z$  fragment 422
  - mass spectrum signals
  - isotope distributions 380
  - measurement 385
  - spectrum 244
- MALDI-ToF/ToF MS2 mass spectra
  - of  $[M + Ag]^+$  ions from 74
- Mark-Houwink parameters 266, 319
- Mark-Houwink parameters 319
- mass accuracy 5, 8, 9
- mass analyzer performance 5
- mass analyzer techniques 6
  - ability 320
  - FT-ICRs 431
  - Orbitraps 431
- mass analyzer technologies 5
- MassChrom2D 251
- mass range 5, 9
- mass resolving power 5, 6, 7
  - calculation 6
  - 3D ion trap-derived mass spectrum of the polymer 7
  - full width at half maximum height (FWHM) 7
  - IUPAC recommendations 6
  - peak width definition 6
- mass spectra
  - fingerprint region of 154
  - mass spectral peaks, definition of 241
- mass spectrometer 271
  - transmission 162
- mass spectrometric analysis 376
- mass spectrometric experiment
  - historical concept 1–3
- mass spectrometry (MS) 5, 57, 237, 319, 457, 467
  - advanced fragmenting techniques 251
  - for AP-MALDI, limited  $m/z$  range 94
  - application of 33, 386, 426, 467
  - applications to synthetic polymers 57
  - basic components 33, 34
  - containing trapping analyzers 58
  - electron multiplier detection 337
  - MALDI-TOF 284
  - mass accuracy 319
  - methods 437
  - molecular weight distribution (MWD) of polymer 57
  - procedure for quantitation 261, 262
  - purpose of 33
  - role 339
  - techniques, overview 458–460
  - use 321
- mass-to-charge ratio ( $m/z$ ) 57, 58
- matrix absorption 95
- matrix assisted inlet ionization (MAII) 85, 100, 101
  - MAII-MS spectrum 100
- matrix-assisted laser desorption electrospray ionization (MALDESI) 93
- matrix-assisted laser desorption ionization (MALDI) 12, 20, 33, 49–51, 57, 87, 210, 281
  - application of 283
  - imaging 184
  - mass spectrometry, history of 184, 185
  - of polymers 188–192
  - sample preparation 185–188
  - ion formation, conceptualization 51
  - limitations 51, 52
- matrix-assisted laser desorption ionization mass spectrometry (MALDI-MS) 119, 237, 446

- matrix-assisted laser desorption/ionization-  
quadrapol-time-of-flight tandem MS  
(MALDI-Q-TOF MS/MS) 301
- matrix-assisted laser desorption/ionization-  
time of flight (MALDI-TOF) 374
- mass spectrometry (MS) 320, 439
- matrix crystal sizes 87
- matrix-enhanced SIMS (MA-SIMS) 167
- matrix-free DIOS-MS 385
- matrix-free ionization method 385
- MaxEnt regularization 269
- maximum entropy (MaxEnt)  
regularization 268
- Mayo's mechanism 334
- meta-SIMS
- molecular weight distributions 166
- methanol 127
- methoxy PEO (mPEO) 226
- methyl acrylate (MA) 320, 379
- polymerization 394
- methylmethacrylate(MMA) 320
- BMA system 343
- methyl methacrylate(MMA)
- monomer 448
- methylmethacrylate(MMA)
- oligomers 324
  - ESI-MS spectrum 324, 326–328, 330
  - water-soluble 364
  - polymerization 347, 352
- 2-methyl-4'-(methylthio)-2-  
morpholinopropiophenone (MMMP) 332,  
349
- methyl poly(ethylene oxide) (mPEG) 296
- mass spectra 296
- 2-methyl-2-propanethiol (tBuS-H) 351
- $\alpha$ -methylstyrene (AMS) 355
- mid-chain radicals formation 390
- molar mass distribution (MMD) 319, 320
- measurement, schematic illustration  
of 254
  - types 337
- molecular dynamics (MD) simulations 175
- molecular mass determination 33
- molecular mass distribution (MMD) 210, 237
- accuracy of a polymer 253
  - model embodied
  - implications of 263
  - SEC yield, classical methods 253
  - two-dimensional quantity 254
- molecular weight distribution (MWD)
- band-broadening effects 267
- molecular weight distribution (MWD)  
determination 51
- MS-based method 350
- MS<sup>2</sup> in space 58
- MS/MS<sup>2</sup> experiments with ion mobility  
spectrometry (IMS) 71
- MS/MS of polymers 26
- mass analyzers and mass analyzer  
combinations used for 29
  - scan types 27
- MS<sup>n</sup> of polymers 26
- mass analyzers and mass analyzer  
combinations used for 29
- MS<sup>2</sup> (CAD) spectrum
- [M + 2H]<sup>+</sup> ions ions generated by ESI  
from 78
- MS<sup>2</sup> studies, structural information from 75
- binding energies, assessment of 77, 78
  - copolymer sequences 76, 77
  - end-group analysis 75
  - intrinsic stabilities, assessment of 77, 78
  - isomer/isobar differentiation 75
  - polymer architectures 75
- multiply charged ions 97
- multistage tandem mass spectrometry  
(MS<sup>n</sup>) 405
- multivariate curve resolution (MCR) 171
- mzXML file 239
- n**
- nanospray ESI source, analytical  
advantages 48
- National Physics Laboratory (NPL) 181
- organic multilayer reference material, depth  
profiling in 181
- Nd/YAG lasers 95
- negative chemical ionization (nCI) source 61
- negative ion ToF-SIMS images,  
– polymer/polymer interface 171
- neopentyl diol (NPG) 226
- neutral polymers 123
- new ionization method, capable of producing  
highly charged ESI-like ions 94
- NHC-catalyzed polymerizations 406
- <sup>63</sup>Ni-based source 45
- Ni grid 165
- NIST MALDI-based method 273
- NIST polystyrene molecular mass  
– MMD of 274
- nitroxide-mediated polymerization  
– intermolecular CTP occurrence 358
- nitroxide-mediated polymerization  
(NMP) 226, 358, 373
- PMAA–PMMA copolymer 294
- noisy polymer mass spectrometry data 244
- autocorrelation 244
- Norrish type II fragmentation 392



- nuclear magnetic resonance (NMR) 33, 365, 439  
 – experiments 363  
 – spectroscopy 281  
 nylon-6  
 – monomer 153  
 – photo-oxidation processes 450  
 nylon 66 (Ny66) 444
- o**
- 1-octanethiol (OctS-H) 362  
 OH-terminated PDMS  
 – calibration curve of 225  
 – chromatogram of 224  
 oligocarbonate diols synthesis 423  
 online spray method  
 – principles of 217  
 orbitrap mass analyzer 24, 25  
 – performance characteristics 25  
 organometallic ROMP catalysts 424  
 oscillating capillary nebulizer (OCN) 129, 187, 219  
 oxazoline-cyclophosphazene units  
 – melt mixing reactions 444  
 oxiranes, polymerization 406  
 oxygen-centered radicals 329
- p**
- [PBG]<sub>8</sub>Na<sup>+</sup>  
 – ion intensity distributions 190  
 penicillin G 410  
 (N,N,N',N',N-pentamethyldiethylenetriamine (PMDETA) 379  
 peptide biopolymers 26  
 performance, measures of 5  
 peroxyacetates 327  
 peroxydicarbonates 331  
 peroxyesters (POEs) 322, 323  
 – general structure 322  
 peroxy-pivalates 323  
 PGMA-PBMA trimer 300  
 – distributions of 300  
 2-phenylallyl alcohol (PhAA)  
 – use 397  
 photodissociation methods 60, 61  
 photoinduced conjugation reaction 393  
 photoinitiation 334  
 photopolymerization  
 – ESI-MS study 349  
 PLA grafted with acrylic acid (PLA-AA) 454  
 plasma desorption (PD) 44, 45  
 – limitations 45  
 plasma desorption ionization mass spectrometry (PDI-MS) 149  
 plasma desorption ionization techniques 194  
 plasma-polymerized polyethyleneglycol (pPEG)  
 – PCA, analysis of 172  
 – PCA for analysis of 172  
 PLP  
 – MS method 342  
 – MS studies 341  
 – size-exclusion chromatography (SEC) 336  
 pluronic (P104)  
 – 3D distribution of 182  
 – 3-D volumetric representations of 183  
 PMAA-PMMA, MALDI-TOF MS spectra of 293  
 PMMA  
 – ESI-MS spectra 396  
 – mass-weighted molecular mass distributions 272  
 – model, thermo-oxidative degradation products 448  
 – SEC retention time 269  
 – synthesized, commercial standards of 272  
 PMMA-*b*-PBAAcopolymer 383  
 PMMA(CPDB)  
 – polymerization of 272  
 PMMA 10 900 Da  
 – 3D plot for 223  
 Poisson distributions 347  
 poly ( $\epsilon$ -caprolactone)  
 – MALDI-TOF mass spectra 421  
 poly (3-hydroxybutanoic acid)  
 – ESI-mass spectrum 412  
 poly (butyl methacrylate)  
 – MS analysis of 335  
 poly (MMA)  
 – MALDI-MS spectrum 337  
 poly(acrylic acid) (PAA) 383  
 polyalkylcyanoacrylate (PBCA) nanoparticles  
 – formation of 222  
 poly(alkyl methacrylates) 151  
 polyamides (PAs) 225, 443  
 poly(BA)  
 – ESI-MS spectrum 362, 363  
 – MALDI-MS spectrum 359  
 poly(bisphenol-A-carbonate)  
 – thermal oxidative degradation processes 443  
 poly (ethylene oxide)-*b*-poly(styrene) copolymers 376  
 poly(butyl acrylate) (PBA) model 452  
 poly(butylene glycol) (PBG) 189  
 – single ion intensity distribution of 191  
 poly(butylene succinate) (PBSu)  
 – thermal-oxidation processes 447

- poly(butylene terephthalate) (PBT) 439
  - thermal oxidation 449
- PolyCalc
  - software tool 245
- polycaprolactone 430
- poly( $\epsilon$ -caprolactone) (PCL) 426
- polycarbonates (PCs)
  - molecular weights of 154
- poly(dimethylsiloxanen) (PDMS) 222
- polydisperse components
  - gravimetric mixture of 259
- polydispersity indices (PDI) 289
- polyester copolymer
  - MALDI-TOF MS, LC-CC, 2D-plot 299
- polyester oligomers 428
- polyesters
  - ESI-mass spectra 413
- polyether-based polyurethanes (PUs) 444
- poly(ethyl acrylate) (PEA) 379
- polyethylene (PE14)
  - side-view snapshots 175
- poly(ethylene glycol) (PEG) 88, 164, 282
  - positive ion DESI mass spectrum of 193
- poly(ethylene glycol)-*b*-poly(acrylic acid)-*b*-poly(*n*-butyl acrylate) 290
- poly(ethylene oxide) (PEO) 286, 406
  - MALDI-TOF mass spectrum 409
- poly(ethylene oxide)-*b*-poly(propylene oxide)
  - block copolymers of 299
- polyethylene (PE) surface 176
- poly(ethylene terephthalate) (PET) 439
  - samples 140
- poly(ethylhexyl acrylate) 383
- poly(3-ethyl-3-hydroxy-methyloxetane)-derived macroinitiators
  - MALDI-TOF-MS 383
- poly(ethyl methacrylate) (PEMA) 154
- poly(glycolic acid) (PGA) 167, 454
  - mass spectra of 174
- poly[(*R,S*)-3HB-*co*-CL] copolyesters 427
- poly( $\beta$ -hydroxyalkanoate)s (PHAs) 409
- poly(*o*-hydroxyamide) (PAOH) 442
- poly(3-hydroxybutyrate)
  - ESI-MS analysis 411
  - ESI-MS structural studies 410
  - macromolecules 410
- poly(3-hydroxybutyrate)-*co*-poly(3-hydroxyhexanoate) 306–307
- poly(hydroxy-ethyl methacrylate) (PHEMA) 151, 452
- poly(3-hydroxy-4-etoxybutyrate)
  - ESI-mass spectrum 414, 415
- poly(hydroxyethylmethacrylate) (PHEMA)
  - positive secondary ion fingerprint spectrum of 152
- poly(isobutylene) (PIB)
  - binder 173
  - containing plastic, PCA, analysis of 173
  - PCA, image analysis of 173
- polyisoprene (PIs) 177
- poly(*N*-isopropylacrylamide)
  - MALDI-TOF mass spectrum of 388
- poly(lactic acid) (PLA) 167
  - ESI mass spectrum 416
  - linear and cyclic structures of 225
  - matrix, quantitative depth profiling in 179
  - thermal degradation 445
  - thin film, representative depth profile of 177
- poly(lactide)-block-poly(2-hydroxyethyl methacrylate) polymers 382
- poly(L-lactide) (PLLA) 426
- poly(L-lactide) multiarm star polymers
  - molecular characterization 408
- polymerator software
  - screenshot of 252
- polymer chains 180
- polymer characterization 33
- polymer crystallinities 153
- polymer degradation 437–460
  - biodegradation 453–455
  - degradation processes 455, 456
  - photolysis and photooxidation 449–453
  - thermal and thermo-oxidative degradation 438–448
- polymer depth profiling 180, 182
  - limitations for 177
- polymer distributions 265
- polymer elution curves 212
- polymer formation mechanism 320
- polymerization process 249
- polymerization techniques 405–431, 468
  - cyclic esters and carbonates, ring-opening polymerization mechanisms 408–423
  - cyclic ethers, ring-opening polymerization mechanisms 406–408
  - radical structures in 349
  - ring-opening metathesis polymerization 423–425
  - step-growth polymerization mechanisms 425–430
- polymer mass spectrometry
  - automated data processing and quantification 237
  - automated spectral analysis and data reduction 241–248
  - chromatographic setup 266

- copolymer analysis 248–251
- file and data formats 237–239
- indistinguishable/overlapping mixture, schematic illustration of 258
- ionization conditions, optimization of 239–241
- MALDI-MS/ESI-MS
  - absolute MMD, determination of 262–266
  - monodisperse components, mixtures of 256, 257
  - oligomer, correction factor for 260, 261
  - polydisperse components, mixtures of 257–259
  - quantitation, procedure for 261, 262
  - quantitative 253–256
- MMD of homopolymers 266–270
  - comparison of two methods 273–274
  - components, mixtures of 270–273
- molar abundance of 274–276
- MS/MS, data interpretation 251, 252
- nonoverlapping mixture, schematic illustration of 259
- principal data processing, flow diagram of 271
- SEC, convolution process
  - graphical representation of 267
- SEC/ESI-MS
  - quantitative MMD measurement 266
- polymer molecular weights 153
  - determination of 152
- polymers
  - analysis 10
  - application for 430
  - chemical structures 86
  - chromatography of 211
  - depth profiling of 176
  - LC investigations of 211
  - quantitative depth profiling 178
  - RI detection 340
  - schematic representation of 211
  - sputter depth profiling 180
  - thermal degradation 438
- polymer science 26
- polymers in electrolyte fuel cells (PEFCs) 87
- polymer synthesis 468
- poly(methacrylic acid)-poly(methyl methacrylate) (PMAA-PMMA)
  - molar mass determination of random copolymers 292
- poly(methyl methacrylate) (PMMA) 222, 239, 376, 448
- poly(MMA)
  - ESI-MS spectrum 348
  - MALDI-MS spectrum 353
  - samples 338
- poly(NAM)-*block*-polystyrene copolymers 389
- poly(neopentyl isophthalate) (PNI) 450
- poly(paraphenylene sulfide) 52
- poly(para-phenylene terephthalamide) (PPD-T) 52
- poly(ethylene glycol) (PEG) 444
- poly(ethylene terephthalate) (PET) samples
  - matrix assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectra 440
- poly(*p*-phenylene sulfide)s (PPS) 442
- poly(propylene succinate) (PPSu)
  - thermal degradation mechanism 448
- poly(propionyl-ethyl methacrylate) (PEEMA) 151
- poly(propylene oxide) (PPO) 307
- poly(tetrafluoroethylene) (PTFE) 165
- poly[(*R*)-3-hydroxybutyrate] (PHB) 445
  - polymers synthesis 416
- poly[(*R,S*)-3-hydroxybutyrate-co-*L*-lactide] oligocopolyesters
  - ESI-MS/MS technique 429
- polystyrene (PS) 213, 286
  - ion intensity distribution of 190
  - MALDI-TOF mass spectrum of 189, 247
  - positive ion mass spectra of 195
  - ToF-SIMS spectrum of 165, 168
  - use of 448
  - variable separation techniques, coupling of 210
- polystyrene-*block*-polyisoprene system 343
  - copolymer fingerprints 346
  - MALDI-ToF-MS spectra 344
- polystyrene-*block*-poly(styrene-co-acrylonitrile) copolymers 376
- poly(styrene-coisobutylene)
  - positive secondary ion mass spectral images 170
- poly(styrene-co-isobutylene) triblock copolymer matrix 169
- polystyrene molecular weight
  - positive secondary ion spectra of 163
- polystyrene/poly(methylmethacrylate) (PS/PMMA) polymer blend film
  - nano-SIMS imaging of C and O components 169
- polytetrahydrofuran (PTHF) 448
- poly[(3,3,3-trifluoropropyl) methylsiloxane] (PTFPMS) 455
- poly(trimethylene carbonate) 418

- polyurethane-co-dimethylsiloxane (PU-PDMS) 167
  - polyvinylchloride (PVC) 195
    - pyrolysis 448
    - use of 448
  - poly(vinylidene difluoride) (PVdF)
    - topcoat 170
  - post-source decay (PSD) 62, 387
    - fragmentation analysis 455
  - P104 polymer
    - amphiphilic nature of 183
  - PPO–PEO–PPO triblock copolymer
    - stepwise data treatment of 308
  - principal components analysis (PCA) 159
  - propagation rate coefficients 319, 341
  - propylene oxide (PO) 406
    - polymerization 407
  - PS<sub>20</sub>-*b*-PEO<sub>70</sub>
    - MALDI-TOF MS spectrum of 286
  - P(*t*-BA) transformation
    - electrospray ionization mass spectra 392
  - pulsed laser-initiated radical copolymerization
    - copolymer fingerprint plots 250
  - pulsed-laser polymerization (PLP) method 319
  - pyrolysis (Py)-GC/MS 225
  - pyrolysis-GC/MS (py-GC/MS) 438
  - pyrolysis mass spectrometry (Py-MS) 37
    - limitations 37, 38
- q**
- QqQ instruments 28
  - quadrupole ion trap (QIT)
    - detector 390
    - mass analyzer 381
  - quadrupole ion trap (QIT) mass spectrometers 63–68
    - ESI-QIT MS<sup>3</sup> mass spectrum of b<sub>23</sub> fragment 66
    - ion–ion reactions 67
    - ion motion inside the trap 63
    - isolated precursor ions acceleration 65
    - mass-selective axial instability mode 64
    - Mathieu equation 63
    - precursor ion chosen 64
    - QIT MS<sup>2</sup> scan process for precursor ion 65, 67
    - QIT with external ESI and CI sources 68
    - shortcoming of CAD experiments in QITs 67
    - stability region 64
  - quadrupole ion traps 17
  - quadrupole mass filter system 15–17
    - basic components 15
    - Mathieu stability diagram 16
    - performance characteristics 16
  - quadrupole/time-of-flight (Q/ToF) mass spectrometers 69–72
    - MS<sup>2</sup> (CAD) mass spectrum of 70
  - quadrupole-TOF (Q-TOF) mass spectrometer 28
  - quantification at trace levels 33
  - quantum-chemical calculations 330
- r**
- racemic  $\alpha$ -methyl- $\beta$ -pentyl- $\beta$ -propiolactone
    - anionic ROP 412
  - radical polymerization (RP) process 319, 320, 347, 357, 373
  - radical polymerization reaction mechanisms
    - basic principles and general considerations 320, 321
    - chain transfer 351–364
      - transfer to small molecules 351–356
    - elucidation 319–365
    - emulsion polymerization (EP) 364, 365
    - initiation 321–335
    - initiator efficiency 335
    - propagation 335–347
      - chain-length dependence 340–347
      - rate coefficients 335–340
    - radical generation 321–335
      - photoinduced initiator decomposition 331–334
      - thermally induced initiator decomposition 321–331
    - termination 347–351
  - random coupling hypothesis 347
  - rate coefficient 376
  - reactive MALDI MS 52
  - refractive-index (RI) detection
    - use 319
  - reversible addition-fragmentation chain transfer (RAFT) 287, 334, 397
    - advantages 395
    - agent-derived end group containing chains 11
    - generated polymers, propensity 387
    - MADIX-generated polymers 389
    - mechanism 390
    - polymerizations 11, 223, 361, 373, 386, 387
      - analysis of 389
      - MALDI-TOF mass spectra 389
      - R-group approach 391
      - Z-group approach 391
      - star polymers formation (*See* R-group approach-RAFT polymerizations)
    - radiolysis 335
    - via ESI-MS 390

- RI detector 267
- ring-chain equilibration mechanism 439
- ring-opening metathesis polymerization (ROMP) 405, 423–425, 424
  - based block copolymerization 425
  - chain-growth reaction 425
- ring-opening polymerization (ROP) mechanisms 431
- of cyclic ethers/esters 405
- rotational–vibrational degrees of freedom of the ion 59
- ruthenium olefin metathesis catalysts 425
  
- S**
- Savitsky-Golay smoothing 243
- scanning electron microscopy (SEM) 128
- scanning microprobe matrix-assisted laser desorption/ionization imaging mass spectrometry (SMALDI-MS) 188
- Schulz–Flory theory 350
- secondary ion mass spectrometry (SIMS) imaging 40, 41, 128, 150
  - cluster ion beams, polymer depth profiling 174–182
  - optimized beam conditions, role 180–182
  - correlation of 153
  - data analysis methods 171–174
  - limitations 41, 42
  - PC molecular weight, quantitative analysis of 155
  - polymer blends/multicomponent systems 168–171
  - polymers, reference citations list 156–161
  - polymers, static 150
    - fingerprint region 151–162
    - high-mass region 152–168
  - polymer systems, 3-D analysis 182–184
  - specific polymers characterization 156–161
- sector mass analyzers 12–15
  - performance characteristics 14
- SG1-mediated polymerization 377
- signal autocorrelation 243
- silver tri-fluoroacetic acid (AgTFA) 195
- single ion current (SIC) trace 454
- single-pulse (SP) PLP experiments 332
- single charged copolymer
  - molar mass 345
- size exclusion chromatography (SEC) 3, 33, 90, 209, 238, 281, 319, 336, 390, 441
  - ESI-MS method 273
  - hyphenation 398
  - internal calibration 340
  - MALDITOF-MS
    - schematic view of 220
    - workhorse technique 220
- size exclusion chromatography and matrix-assisted laser desorption ionization MS (SEC/MALDI) 430
- size exclusion chromatography electrospray ionization mass spectrometry ((SEC)/ESI-MS) analysis 374
- size exclusion chromatography (SEC) fraction
  - matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) spectrum 442
- Sn(Oct)<sub>2</sub> initiator 419
- soft-ionization mass spectrometry
  - analysis of 382
  - use 374
- soft-ionization mass spectrometry (MS) techniques 373
- soft ionization technique
  - applications 449
  - MS techniques 385, 438
- soft ionization techniques 283
  - APCI 294–297
  - applications 457
  - ESI and MALDI 467
  - ESI-MS 292–294
  - histogram showing 283
  - MALDI, application of 283–292
- solid-phase microextraction (SPME) 438
- step-growth polymerization mechanisms 425–430
- Stochastic numerical optimization 240
- styrene-MMA statistical copolymer 345
- β-substituted-β-lactones 409
- surface analyses by imaging MS 104–109
- surface analysis technique. *See* desorption electrospray ionization (DESI)
- surface-assisted laser desorption/ionization (SALDI) 52
- surface-induced dissociation (SID) 60
- surface mass spectrometry methods
  - desorption electrospray ionization (DESI) 192–194
  - electrospray droplet impact for 194, 195
  - plasma desorption ionization techniques 194
- switching nitroxide-capped polystyrene 378
- symmetric diacyl peroxides
  - scheme for decomposition 329
- synthetic polymer
  - analyses of 63
- synthetic polymers
  - MALDI imaging for 188

- t**
- tandem mass spectrometry 444, 468
  - tandem ToF mass spectrometers 72
  - Taylor cone 46
  - Taylor expansion
    - zeroth derivative of 260
  - termination reaction 348–351
  - tertiary radicals (TRs) 361
    - formation 363
  - tetrahydrofuran (THF) 127, 391
  - 1,1,3,3-tetramethylbutyl peroxyacetate (TMBPA) 328
  - 1,1,3,3-tetramethylbutyl peroxyvalate (TMBPP) 325
  - 2,2,6,6-tetramethylpiperidine-*N*-oxyl (TEMPO)
    - capped polystyrene 51, 375
    - mediated living radical polymerization 375
  - 1,1,2,2-tetramethylpropyl peroxyacetate (TMPPA) 328
  - 1,1,2,2-tetramethylpropyl peroxyvalate (TMPPP) 325
  - thermal degradation experiments 448
  - thermal energy for sublimation/evaporation 97
  - thermodynamically controlled polycondensations (TCPs) theory 429
  - thermo fisher scientific LTQ-ETD mass spectrometers 91
    - from single laser shots 91
  - thermogravimetry (TGA) 438
  - thermo mass spectrometers 97
  - thermospray ionization (TSP) 45
  - thermospray (TSP) source 45
  - thin-layer chromatography (TLC) 439
  - thioetone-mediated polymerization (TKMP) process 397
  - timed ion selection (TIS) 72
  - time-of-flight (TOF) 338
    - mass analyzer 11, 22
    - major advance in 21
    - orthogonal acceleration, basic components of an 21
    - performance characteristics 22
    - mass analyzers 20–22
  - time-of-flight mass spectrometers (TOFMS) 119
  - time-of-flight secondary ion mass spectrometers (ToF-SIMS) 151, 439
    - secondary electron microscopy (SEM) imaging 168
  - time-series segmentation
    - schematic representation of 246
  - tin-containing macromolecules
    - identification 420
  - ToF/ToF instruments 72–75
  - p*-toluenesulfonyl initiator fragment 382
  - total solvent-free analysis (TSA) 85
  - traditional chain-transfer agent (TCTA) 351, 355
  - transfer rate coefficient 354
  - transmission geometry (TG) ion source 96
  - trapping rate coefficients 342
  - traveling wave (T-wave) 71
  - trifluoroacetate (TFA) salts 124
  - trimethylene carbonate (TMC)
    - homo/copolymerizations 421
  - 2,2,5-trimethyl-4-(isopropyl)-3-azahexane-3-oxyl (BIPNO) 375
  - 2,2,5-trimethyl-4-phenyl-3-azahexane-3-oxyl (TIPNO) 375
  - trimethylsilyl nucleophiles (NuE) 406
  - 1,1,1-tris(hydroxymethyl) propane (TMP) 407
  - trisilanolisobutyl-POSS (T-POSS) 441
  - two-dimensional (2D) gas-phase separation 89, 90
    - IMS dimension drift time vs. MS *m/z* yields 89
    - sigmoidal transition 90
    - drift times 90
  - two-dimensional liquid chromatography
    - schematic setup for 213
- u**
- Ultem® polyetherimide (PEI) 442
  - ultrafast LSII-MS imaging in transmission geometry (TG) 106, 107
  - ultra performance liquid chromatography (UPLC) 227
    - use of 298
  - ultraviolet (UV) lasers 94, 121
  - ultraviolet/visible spectroscopy 33
  - unimolecular rearrangement mechanisms 59
  - universal calibration. *See* Mark-Houwink parameters
  - UV-induced fragmentation 387
- v**
- vapor-deposited glutamate
    - using Ar<sup>+</sup> 176
  - vapor pressure osmometry (VPO) 33
  - Venturi effect 130
  - vinyl acetate (VAc) 383
  - $\omega$ -vinyl heterotelechelic oligomers 397
  - vinyllic monomers
    - polymerization 390
  - vinyl-terminated polymers 387

vinyl-terminated poly(methyl methacrylate)  
(PMMA)  
– cyclic degradation mechanism 453

**w**

Waters SynaptHDMS™ mass  
spectrometer 71  
wide angle X-ray diffraction (WAXS) 455

**x**

X-ray photoelectron spectroscopy (XPS) 154,  
441

**z**

Z-group-approach-RAFT polymerization  
391

