Index

acene backbone 457, 477–8
acene compounds 487, 489
acene precursors 463, 465, 467, 469–71
acene skeleton 457–8, 505, 507, 510
acene synthesis 457, 459, 461, 489, 491, 493, 495–7, 499, 501, 503, 505, 507, 509–10
acenes 487–8, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510
  higher 456, 464, 472–3, 475, 477, 479
  synthesis 489, 491, 493, 495, 497, 499, 501, 503, 505, 507, 509
acetonitrile 301–2, 306
activation energy 5, 457–8
aluminum 13, 330, 332
amino acids 188, 194–6
anthracene moiety 317, 339, 354, 459, 461
arene-1,2-diamines 232, 237, 240, 253, 261, 275
aromatic compounds 347–8
  five-membered heterocyclic 346–7
  six-membered heterocyclic 333
aromatic cores 46, 50, 59
aromatic molecules 188, 190–1
aromatic rings 113, 124–5, 194, 235, 252, 258, 288
aromatization 260, 268, 270, 457, 459, 506
atom-transfer radical polymerization (ATRP) 439–40
ATRP, *see* atom-transfer radical polymerization
azobenzenes 141–3, 147–51, 167, 172
  bridged 151

benzene rings 97–8, 100, 102–5, 109–10, 113, 121, 123–4, 130–1, 235, 257
benzidine oxidation 425
benzimidazoles 330, 339, 347–9
benzothiazoles 347–8, 351–2
bidirectional elongation 499, 501–3
bis-adducts 236–7, 239–41, 243–4, 246, 248
bis-quinoxalines 236–7, 239–40, 247
brake-on states 153, 156–7, 162–3, 167, 170
butylphenyl 345, 352–4

calixarene 287–9, 307, 320
  lower-rim 1,2,3-triazoles 299, 301, 303, 305, 307
calixarene-based cavitands 304
calixarene chemistry 287–8, 312
calixarene chemists 320
carbazole 79, 399–412, 414–16, 418, 420, 422, 424, 426, 428, 430–2, 434, 436–40, 442
  anodic oxidation of 406–7
  dendritic 410

electrografting of 406
electrochemical polymerization 404–5, 407
electropolymerization 399, 404–8, 410, 416, 418, 422, 424, 436–40
carbazole dendrimers 408
carbazole molecules 411
carbazole-substituted triarylborane 409
carbazole units 408, 410
carbon, electrophilic 272
carbon fibers 406–7
charge recombination 2–6, 22, 119, 155, 334
charge separation 2–6, 22, 80, 315, 374
charge transfer interaction 100–1, 103, 105, 107, 109, 111, 113, 187
charge transport 2, 7, 10, 98, 107, 129, 389, 403
chelation ligands, synthesis 289, 318
chemical cross-linking 400, 415
chemical gels 186–7
chemical sensors 41, 187, 299
chemical wastes 138–9
chemosensors 76, 299–300, 302, 304, 310
chlorinated polyacenoquinone esters 268, 272–3
cis-trans photoisomerization 141, 143, 145, 147, 149, 151
co-electrografting 406
colloidal template electropolymerization 438
conformations
boat 102–3, 116, 124–5, 250
chair 102–3, 110, 113
conjugated polymers 69, 399–400, 414
conjugated systems 507
crystal packing 48, 50, 54–5, 69, 475
crystal structures 12–13, 34, 74, 113–15, 251, 268, 275, 316, 468
cyclic voltammetry 408, 410, 412, 467, 490
cycloadducts 232–3, 459, 476
cyclopentadienones 232
cyclophanes 97, 106, 110–11, 113, 120–1, 127–8, 130–1, 236, 239, 320

decalin gel 208–10
dendritic molecules 428, 431
dicarbazole 408–9
electropolymerization 408
dicarboxylic anhydride 243–4, 253
dichloroetheno-bridge 234, 236, 240, 246, 261
Diels–Alder adducts 232–4, 237, 248, 254, 259, 261–3
Diels–Alder reactions 232–3, 237, 244, 275, 499
dienophiles 232, 235–7, 259, 275
differential scanning calorimetry (DSC) 48–9, 213
dip-pen nanolithography (DPN) 39–40
diphenylamine 419–20
electrochemical polymerization 419–20
electropolymerization 420
disorder formalism 401, 403
donor-acceptor interactions 48–9
double-layer devices 342, 349, 352
DPN, *see* dip-pen nanolithography
DSC, *see* differential scanning calorimetry

DSSCs, *see* dye-sensitized solar cells
dye-sensitized solar cells (DSSCs) 3–4, 6

EBL, *see* electron-beam lithography
electricity-gated internal rotation 137–8, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166
electrochemical cross-linking 410, 414, 432
electrochemical deposition 399–400, 402–36, 438, 440, 442
electrochemical nanolithography 437
electrochemical oxidation 404, 408, 412, 415–17, 419, 425, 427, 429–31, 434, 436–8, 441
electrochemical polymerization 404–5, 407–8, 416, 419–22, 428–9, 431
electrochromism 404, 426
electrodeposition 433
electrografting 406
electron-beam lithography (EBL) 39–40
electron injection 333–4, 336, 340, 351, 356–8, 360, 369
electron transfer 1–4, 6–8, 10, 12–16, 18–20, 22–3, 165, 389
  theory of 7, 9, 16
electron transfer coupling 6, 13
electron transfer dynamics 11
electron transfer reactions 5, 16–17, 95
electron transport 337, 344, 352, 366, 369
electron transporter 230, 267
electron-transporting hole-blocking (ETHB) 332
electron-withdrawing substituents 150, 260, 272, 474
electronic coupling 4, 6, 8, 10–13, 15, 17–19, 21, 23, 169, 456
electronic coupling magnitude 11–12
electronic devices, organic 1, 403
electropolymerization 399–400, 403–8, 410, 416, 418–20, 422–6, 428–9, 433, 435, 437–41
  PVK 410, 437
  triphenylamine 399, 404–5, 418–22, 424–6, 429, 433, 435
  triphenylamine polymers 435
electrospinning 35, 37–8
emissive materials 329, 331, 342, 352, 354, 365
esters 188–9, 206, 261, 263–5, 291, 369
  polyacenequinone 262, 265–6
ethanol 78, 118, 150–1, 206, 296
ETHB, *see* electron-transporting hole-blocking
ethylene 147, 151, 259

FCD, *see* fragment charge difference
Fermi level 412, 425
field-effect transistors 49, 455–6, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 502–3
five–membered heterocycles 347, 349, 351, 353, 355
flower-shaped supramolecular assemblies 62–3
fluorescence 118, 144–5, 148, 197, 215, 300–1, 304, 306, 308, 311, 313, 366

fluorescence intensity 197, 301, 304, 310–13, 317
fluorescent chemosensors 289, 304, 309, 314, 317
fluorescent sensors 289, 300, 302, 304–5, 314
fluorinated compounds 356–7
fluorogenic sensors 299, 301, 303, 305, 307, 320
fluorophores 289, 303–4, 307, 309, 311–12, 314, 320
FMO, *see* frontier molecular orbital
fragment charge difference (FCD) 20, 22
frontier molecular orbital (FMO) 12, 19
fullerenes 62
functionalized carbazole macromonomer 415–16

gelation 45, 185, 187, 189–90, 192–4, 196–9, 204, 206, 213, 215, 219–20
gelators 187, 207–8, 211–12, 214–15
  low-molecular-weight 187–8, 218
gels
  anisole 210–11
  molecular 186
  polymer 186
  stable 188–9, 192, 194
glass transition temperatures 334, 344–5, 357
Grob-type fragmentation 260–2, 265, 268–9, 275

9H-carbazol-9-ylpyrene 416
heteroaromatic compounds, five-membered 347
hexacene 462–3, 467–8, 473–4, 479
hexane 44, 57–9, 143–4, 146–8, 191, 204, 219
hexathiapentacene 67
highest occupied molecular orbital (HOMO) 14, 16, 127–8, 367, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 400
hole mobility 49–50, 67, 70–1, 328, 334, 337, 400–2, 410, 431
hole transfer 14, 96
hole-transporting materials 3, 71, 328
HOMO, *see* highest occupied molecular orbital
homogeneous films 431, 433–4
hydrogen bonding 159, 189, 192–4, 200, 215, 272
hydrogen bonding interactions 188–9, 191, 194, 204–6, 213
hydrophobic interactions 51, 215
hydroxy ketones 291–6

ICT, *see* intramolecular charge transfer
imidazoles 304, 347–9, 363, 424, 426
imidization 243, 253–4
inter-molecular interactions 54, 219
intermolecular hydrogen bond 194, 196, 207, 216
intermolecular hydrogen bonding interactions 194, 196, 205–6
intermolecular interactions 45, 54, 199, 219, 390
internal charge transfer 402
intramolecular arene-arene interaction 250

intramolecular charge transfer (ICT) 150, 274
isomerization 141–2, 144–5, 148, 150–2, 165–6, 170–1
isomers 50, 101–3, 116–18, 124, 141–4, 147–9, 151, 164–5, 170–1, 334, 461
isoxazoles 289, 292–3, 295, 297, 299, 316
isoxazolines 289–93, 295

Koopmans' theorem 16, 19–20

lactam-bridged precursors 477–8
Lewis acid 407
light-gated molecular brakes 160–1, 163, 165, 167
light-gated molecular switches 141, 143
liquid organic semiconductors (LOSs) 403
lithography 39–40, 436–7, 439, 441
long-chain dicarboxamides 185–6, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214
lowest unoccupied molecular orbital (LUMO) 16, 121, 127–8, 356–7, 359, 361, 367, 369–70, 372, 374, 376, 378, 380, 382, 386
LUMO
  see lowest unoccupied molecular orbital
  low-lying 330–1, 337, 354, 359–60, 369
LUMO energies 344–5, 351, 354, 357, 362

Marcus theory 4–5, 8, 10–11
metal-ligand charge transfer (MLCT) 299
microbelts 58, 75–6
microtwists 60, 74–5
microwires 48–9, 59, 74–5, 78
MLCT, *see* metal-ligand charge transfer
molecular brake 140, 152, 154–8, 165, 170–3
  chemicals-powered 140
  electricity-gated 168–9, 171–2
  light-gated 160–3
molecular braking system 165–6, 169
molecular devices 2, 95, 97, 157
molecular machines 137
  artificial 137–8, 172–3
molecular motors 161
molecular orbitals 8, 12, 19, 46
molecular rotors 138, 140, 173
molecular shuttle 157
molecular switches 138–9, 141, 168
  design of light-gated 141, 143
  stilbene-derived 143, 145
molecular systems 19, 362–3, 367–8
  chemicals-gated 138
molecular wires 95–7, 131
monomers 52, 54, 65, 115, 304, 310, 312, 404, 416, 420, 423, 437, 465
Monte Carlo simulation 9–10
multi-functionalized polyazaacenes 259, 261, 263, 265, 267, 269, 271, 273

nanomaterials 34–5, 44, 46, 66, 77–8, 80
  inorganic 34, 66

nanopatterning 436–7, 439, 441
nanosheets 51–2, 61, 68, 70
nanostructures 35, 39, 61, 67, 72
  flower-shaped 75–6
  one-dimensional 215
  predefined 35–6
nanowires 34, 36, 38–41, 45, 52–4, 65, 67, 69–71, 79
  supramolecular polymeric 54, 65
naphthalene 246, 248, 457, 464
nitrile oxides 290, 296
norbornadienone type precursors 457, 459, 461

OFETs, *see* organic field-effect transistors
OLEDs, *see* organic light-emitting diodes
oligoacenes 49, 496–7
oligothiophenes 364–5, 402
organic compounds 329–30, 332
organic crystals 49, 54, 64
organic field-effect transistors (OFETs) 1, 35, 41, 66–9, 71, 80, 115, 402, 455, 469–70, 474
organic light-emitting diodes (OLEDs) 1–2, 34–5, 71, 327–30, 332–4, 336, 338, 340–2, 348, 358, 364, 366, 368–70, 388–90, 479
organic materials 1–4, 6–8, 10–14, 16, 18, 20, 22–3, 33–5, 39, 41, 54, 80, 327–9, 389–90
  small molecule-based 329
organic molecules 8, 36, 40–1, 64, 67, 75
organic nanomaterials 43, 51, 54, 56, 69, 73
organic nanostructures 61, 67, 71, 75, 79
organic nanowires 39, 64, 69–71, 73
organic semiconductors 34, 39, 50, 230, 403
organic solvents 41, 188, 196, 199, 215, 441
organic transistors 70
organogelators 185, 188–91, 194–6, 206, 220
organogelators based on amides 196–7, 199, 201, 203, 205, 207, 209, 211, 213, 215, 217, 219
organogels 185–6, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214
organometallics 146
orthocyclophanes 229, 235–45, 247–52
oxadiazoles 330, 345, 348, 352–4, 391
oxazoles 330, 347–9

PCT, *see* photoinduced charge transfer
pentacene 48–9, 456, 458, 461–70, 472–3, 479, 488, 498–9, 501
pentacene films 456–7, 470
pentacene precursors 457–8, 462, 464
pentacene synthesis 498, 500
pentacenoquinone ester 272–3, 275
perfluorinated compounds 330, 356–7
PET, *see* photoinduced electron transfer
PFCzPO 414
phenols 288, 311–12
phenylcarbazole 418
phenylenediamine 169, 240–1, 254
phenylquinoxalines 342
photochemical reactions 141, 143, 165, 467

photocyclization 142–4
photoinduced charge transfer (PCT) 96, 289, 299
photoinduced electron transfer (PET) 165–6, 289, 299
photoisomerization 142, 146–7, 149–50, 165
photolithography 39, 436
phototransistors 42
physical vapor transport (PVT) 35, 40–1, 43, 50, 66–7, 468, 471
PLEDs, *see* polymer light-emitting diodes
polyacenoquinone esters 265, 268, 272, 274
polyazaacenes 229–30, 261
polycarbazole 406–9, 415
  conjugated 406, 409
  electrochemical polymerization 408
polycarbazole Cd/Se/TiO_2 thin films 415
polycyclic molecules, quinoxaline-based 231–2, 235
polymer brushes 413, 440
polymer light-emitting diodes (PLEDs) 344, 404, 413
polymerization 208, 406–7, 416, 420, 428–30
polystyrene 415–16, 438–9
pulse radiolysis 99, 119–20, 130
PVK brushes 413
PVK film 413, 437
PVT, *see* physical vapor transport
pyrazines 229, 330, 333, 340
pyridines 303, 330, 333–4, 336, 424, 426

quinolines 330, 333, 336
quinoxaline 73, 229–31, 244, 247–8, 253–4, 256–7, 261–2, 264, 268–70, 272, 330, 333, 336, 342, 344
quinoxaline derivatives 230
quinoxaline rings 236–7, 248, 250, 257
quinoxaline sidewalls 236–7, 244, 250, 253
quinoxaline walls 250–2, 258

ring-opening reactions 289, 293, 295, 299, 309–10, 320, 478

SAED, *see* selected area electron diffraction
selected area electron diffraction (SAED) 42, 67
six-membered heterocycles 330, 332–3, 335, 337, 339, 341, 343, 345
sol-gel polycondensation 208, 210–11
solution-processed acenes 455–6, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480
stilbenes 142–9, 165
  photoisomerization of 145
superhydrophobic materials 35, 76
supramolecular chemistry 45, 79, 186, 289, 345
supramolecular structures 45, 253
symmetry-broken solutions 17–18

TEM, *see* transmission electron microscopy
TEMPO 407–8
terephthaldinitrile oxide 296–8
tetracene 456, 462–3, 466–7, 470–1, 479, 498, 502, 506
  precursor of 461, 467

tetracene sulfoxide 491–3
TICT, *see* twisted intramolecular charge-transfer
toluene 151, 188, 194, 196–7, 199–200, 203, 214–15, 217–18, 249, 299
9-tosyl-9H-carbazole 406–7
transmission electron microscopy (TEM) 42, 52, 65
triarylamine 352, 399–436, 438, 440–2
triarylamine-based materials 400–1
triazoles 300, 302–4, 307, 316–17, 330, 348, 354
trimethylene bridges 104, 106–7, 124–5
triphenylamine 402, 405, 416–22, 424, 426, 431, 434, 436, 441
triphenylamine derivatives 399–401, 404, 416–18, 420, 426–8, 433, 441
twistacenes 477–9
twisted intramolecular charge-transfer (TICT) 146

van der Waals interactions 46, 51, 53, 59, 62, 192, 196, 218, 220

X-ray diffraction (XRD) 42, 49, 52, 62
xerogels 196, 201, 203, 206, 217
XRD, *see* X-ray diffraction

Y-shape triarylamine 430
Y-shape triphenylamine homologues 429