

## Index

### a

absorption coefficient 135  
 acceptor 433, 439, 442  
 accumulation 345  
 accumulation contact 351  
 action spectra 209  
 activation energy 315, 444  
 active-matrix OLED (AMOLED) display 511  
 aggregate emission 155, 168 f  
 alkoxy-substituted poly-phenylenevinylene (PhPPV) 186 ff  
 Alq<sub>3</sub> 95 ff, 121, 261, 265 f, 477  
 – blue luminescence 103 ff  
 – crystalline phases 97 ff  
 – doped with Rubrene 285  
 – energy diagram at interfaces 87  
 – high-temperature phase 104  
 –  $\delta$ -phase 100  
 – symmetry groups 112  
 – trap distribution 279 ff, 282, 294 f  
 Alq<sub>3</sub> film, polarization 85  
 annealing 441

### b

band bending 58, 69  
 – C<sub>60</sub>/metal interface 78  
 – definition 72  
 – in Alq<sub>3</sub> film 84  
 – in nonequilibrium 75  
 – in thermal equilibrium 74  
 – TPD/metal interface 81  
 band transport 7  
 barrier for hole injection 470  
 bathochromic shift 504  
 BCP 478  
 bimolecular process 119  
 bimolecular recombination 442 ff, 445  
 binding energy 142, 483  
 bipolaron 276, 347, 459

blocking energy barrier 491  
 blue light emitting polymer 153 f  
 built-in field 447  
 built-in potential 69  
 bulk-heterojunction solar cells 433 f, 439 ff, 442

### c

C<sub>60</sub>, bulk Fermi level 80  
 – energy diagrams on metals 81  
 capacitance, depletion-layer 355  
 – insulator 345  
 – MIS 355  
 carbonyl 161, 164  
 $\beta$ -carotene 137 ff  
 carotenoids 139 ff  
 carrier density distributions 492 ff  
 channel length 345, 371  
 charge carrier density 9, 310 ff  
 charge carrier generation 448  
 charge carrier injection 9  
 charge carrier mobility 307 ff, 444  
 charge carrier transport 6  
 charge photogeneration 142 ff  
 charge transfer center 192  
 charge transfer state 186  
 – singlet exciton 184  
 charge transport 305 ff, 319, 321, 445  
 – density dependence of 320  
 charge trapping 266  
 charge-carrier balance 515  
 charged encounter complex 260, 264  
 chelate complex 95, 125  
 chemical interaction 58  
 color tuning 494  
 combinatorial device fabrication 512  
 combinatorial method 486  
 conjugated polymers (CP) 1, 131 ff  
 conjugation-length 236, 242 ff, 251

- contact workfunction 330, 332
- continuity equation 350
- correlated dipoles 504
- Coulomb effects 480
- CBP 263, 265
- CuPc 477
- cut-off frequency 356, 372
- cyclovoltametric method 485
  
- d**
- DCM 203 ff, 478
- defects 442 ff
- delayed fluorescence 118, 126
- delayed luminescence 126
- delayed phosphorescence 265 f
- Density of occupied states s. DOOS
- Density of states (DOS) 319, 347
  - Gaussian DOS 319, 322, 328
- dephasing 137 ff
- depletion length 352
- device efficiency 442, 517
- device simulation 442, 517
  - ATLAS 351
  - MOLED 476, 479
  - ISETCAD 351
- device structures 9
- dielectric constants 484
- differential scanning calorimetry (DSC) 100
- differential transmission 135 ff
- diffusion 320
- dipolar layer 227
- dipole 41, 43, 56, 58
- disorder, correlated disorder 488
  - dipolar 488
  - energetic 487
  - short-range correlations 488
  - spatial 487
- DMO-PPV, trap distribution 298 ff
- donor 433, 439, 442
- donor/acceptor interface, dipolar layer 230
  - exciton dissociation 226 ff
- DOOS 278
  - $\alpha$ -NPD doped with 1-NaphDATA 283
  - of Alq<sub>3</sub> 295
  - of DMO-PPV 299
  - of small molecules 281
- dopant assisted charge photogeneration 215 ff, 220 ff
- doped conjugated polymers 195 ff
- doping 9, 348, 362, 436 ff
- double-cable polymers 230
- double-excitation 145 ff
  - s. a. spectroscopy, pump-push-probe
  
- drift-diffusion-model 350
- dye doping 494 ff
- dynamic CV curves 362
  
- e**
- effective carrier mass 223, 228 ff
- effective density of states 347
- efficiency 494
- Einstein relation 351
- Einstein relation – generalized 324
  - density dependence of 324, 326, 330, 337
- electric field density distribution 494
- electrical potential 350
- electrical transport properties 446
- electroabsorption 278
- electrode, insulating layer 487
  - monolayers 486
  - surface dipole 486
- electrode-sensitized photoinjection 209
- electroluminescence 236 ff, 252, 486
  - delayed 118
  - efficiency 235, 237
  - efficiency, maximum possible 238, 245
  - spin statistics 238 ff
- electron affinity 346
- electron hole confinement 498
- electron scavenger 204
- $\pi$ -electron system 2
- electron trapping 495
- electronic relaxation 139 ff
- electron-phonon interaction 235 ff
- electro-phosphorescence 118
- electrostatic bonding 405
- emission layer 495
- emission pattern 523
- energetic disorder 483
- energetic position 118
- energy gap 346
- energy level alignment at organic/electrode interfaces 69
- energy level shift 502
- equations of motion 480
- equilibrium 322 f, 331
- equivalent circuit 356
- escape energy 274
- exchange interactions 264
- excimer emission 155, 168 f
- exciton 131, 183, 235, 237 ff, 245 ff
  - bimolecular exciton annihilation 189
  - binding energy 6, 185, 239
  - breaking rate 189
  - density-of-states 198 ff
  - diffusion 265 f

- diffusion length 11
- dissociation 185, 189, 193 ff, 224, 226
- dissociation at a charge transfer center 221
- dissociation potential 205
- dissociation probability 221
- energy relaxation 198 ff, 221
- excitonic DOS distribution 205
- field induced exciton quenching 214
- field-assisted dissociation 191
- formation 245
- formation cross-section 239
- formation rate 239
- fusion 119
- off-chain exciton dissociation 221
- optical absorption 241, 247 ff
- quenching 198, 259, 261, 266 f
- quenching, at charge transfer centers 204 ff
- singlet 235, 237 ff, 242, 245 ff
- singlet exciton 249 ff
- spin-statistics 245
- triplet 235, 237 ff, 245 ff, 250 ff
- ultrafast on-chain dissociation 215
- exponential density of states 305
- external quantum efficiency 433
- extraction 449
- extrinsic charge photogeneration 209

**f**

- facial isomer 125
- Fermi distribution 347
- Fermi energy 347
- Fermi level 323
- Fermi level alignment 69, 73 f
- field-effect doping 9
- field-effect mobility 310 ff
- field-effect transistor (FET) 305 ff, 334, 393
- field-induced exciton dissociation 185 ff
- field-induced PL quenching 187
- fill factor 442, 447
- flat band voltage 354
- fluorescence 5, 118
- fluorescence quenching 185 ff
  - spectral dependence 188
  - time resolved 188, 502
- Förster energy transfer 260
- Förster radius 198, 205
- Förster type 502
- Fourier-transform infrared spectroscopy (FT-IR) 112, 240 ff
- Franck-Condon region 136 ff
- Franck-Condon state 184, 187 ff, 191, 215, 218

- Frank-van-der-Merwe growth 18
- Frenkel exciton 184
- FT-IR 112, 240 ff

**g**

- gain 135
- gate insulator 345, 383
- Gaussian density of states 8, 305, 348
- Gaussian distribution 387
- geminate pair 184 ff, 191 ff, 195 ff, 209, 212 ff, 220, 226 ff, 230, 276 f
  - interfacial 228 ff
- geminate recombination 192
- general recombination picture 505
- geometric isomers 114
- g-factor, g-value 436
- glass transition temperature 476
- ground state depletion 435

**h**

- height difference correlation function 19
- hexabenzocoronene (HBC) 224 ff
- high-k dielectrics OFETs 408, 424
- hole accumulation 487
- hole mobility 306 ff
- hole trapping 495
- hole-conducting polymer 451 ff
- HOMO 441
- hopping frequency 482
- hopping rate 325
- hopping transport 7
- hot exciton 184
- hot exciton dissociation 191, 218 ff
- hydroxyquinoline 95, 112, 125
- hydroxyquinoline ligands 108
- hyperthermal growth 34
- hypsochromic shift 504
- hysteresis 377

**i**

- image charge screening 54
- image force 332
- image force potential, three-dimensional effects 479 ff
- impedance 356
- impurity 275
- indium-tin oxide (ITO) 58, 451
- infrared (IR) spectroscopy 112, 240 ff
  - s. a. IR
- injection 480
  - density of states 481
  - disorder 482
  - Fermi-Dirac function 481

- Fowler-Nordheim 483
- Langevin recombination 484
- metal electrode 481
- Richardson-Schottky 483
- thermionic 483
- tunneling distance 483
- tunneling integral 481
- WKB approximation 481
- intensity oscillations 32
- interaction potential 20
- interchain charge transfer 436 ff
- interchain interaction 235
- interdiffusion 17
- interface 17, 41, 50
- interface charges 354, 362, 365
- interface dipole 70
- interface morphology 229
- interference effects 521
- intermolecular interactions 117
- internal conversion 136 ff
- internal electric field 445, 489
- internal quantum efficiency 433, 445
- intersystem crossing (ISC) 115, 126
- intrinsic charge carrier density 444
- intrinsic photogeneration 210 ff
- inverse subthreshold slope 354, 365, 368, 372
- inversion 379
- ionisation energy 460
- IPCE 441, 447
- IR (infrared) spectroscopy 112, 240 ff
- Ir(ppy)<sub>3</sub> 263, 265
- islanding 37
- isomer, facial 96 ff
  - meridional 96 ff
  - transformation 111
- isomerism 96, 125
- ITO 58, 451

**k**

- Kelvin probe (KP) method 72, 76 f, 461
- keto defect 153 f

**l**

- layer-by-layer growth 32
- leakage current 492 ff
- lifetime 445, 494
  - of OLED devices 465
  - triplet states 121
- light emitting diode 305 ff, 330
- light induced electron spin resonance (LESR) 434, 448
- liquid crystal display (LCD) 475

- localisation 479
- localizations effects 494
- luminescence 4
- luminescent efficiency 258
- LUMO 439 ff

**m**

- macroscopic transport 504
- magnetic resonance 245
  - electroluminescence detected 251 ff
  - optically detected 244 ff
  - photoinduced absorption detected 245 ff, 250 ff
  - photoluminescence detected 244 ff, 248 ff, 434 ff, 448
- matrix geometry 478
- mean drift length 445 ff
- MEH-PPV 263, 365
- MeLPPP 143 ff, 209 ff, 218, 245
  - charge generation efficiency 213
  - field-induced fluorescence quenching 210
  - photocurrent 207
  - transient photocurrent 211, 212
  - transient photogeneration 210
- meridional isomer 125
- migration 143, 145 ff
- mini-exciton 118
- miscut 28
- mobility 7, 324, 346 f, 357, 393, 404, 419, 445
  - anisotropy 363, 368, 423
  - asymmetric detailed balance 482
  - density dependence 326, 330, 337
  - electric field dependence 327, 330
  - extraction 335, 339
  - gate-voltage-dependence 420
  - lateral 363
  - perpendicular 362, 365
  - polaron mobility 482
  - Poole-Frenkel mobility 483
  - symmetric detailed balance 482
  - temperature dependence 400, 405, 421, 422
- mobility-lifetime product 446
- molecular crystals 1
- molecular exciton 184
- molecular orientation 46
- molecular packing 109, 125
- molecular structure,  $\delta$ -Alq<sub>3</sub> 106
- molecular symmetry 111
- MOLED, OLED device simulation 476, 479
- monomolecular recombination 442 ff
- monotropic transition 101
- Monte Carlo 487

morphology 103, 117, 433  
 MOS capacitor 360  
 Mott-Schottky (MS) model 69, 74

**n**

1-NaphDATA, TSC 279 ff  
 noncollinear optical parametric amplifier (NOPA) 132 ff  
 $\alpha$ -NPD 477  
 – I-V characteristics 289  
 – TOF 290  
 – TSC 279 ff, 296

**o**

OC<sub>1</sub>C<sub>10</sub>-PPV 306 ff, 433 ff, 439 ff  
 ODMR 245  
 ohmic contact 382  
 OLED 126, 235 ff, 451 ff  
 oligomer 236, 240, 242  
 – oligomer-length 242 ff  
 – oligophenyl 242  
 – oligophenylene-vinylene (OPV) 242  
 – oligothienylene-vinylene (OTV) 242  
 – oligothiophene (OT) 242  
 Onsager's theory 143, 184, 214 ff, 218, 228, 230  
 – Brown's adaptation 220  
 – of geminate recombination 209  
 open-circuit voltage 439, 447  
 O<sub>2</sub>-plasma 491  
 optical absorbance 456  
 optical outcoupling 519  
 optical properties 4  
 optical transition 235 ff  
 optically stimulated current (OSC) 276  
 $\pi$ -orbital 3  
 $\sigma$ -orbital 3  
 organic field-effect transistor (OFET) 10  
 organic insulator 359  
 organic light emitting diode (OLED) 10, 235 ff, 245, 251 ff, 451 ff, 511  
 – delayed fluorescence 122  
 – delayed phosphorescence 122  
 organic photovoltaic cell (OPVC) 10  
 organic solar cells 447  
 orientational degrees of freedom 20

**p**

P3HT 434, 439 ff  
 P3OT 360, 378  
 PANI 468  
 parallel resistance 442  
 parity 140

parylene 410, 414  
 PCBM 433 ff, 439 ff  
 PDA 139  
 PDMS 406, 423  
 PEDOT:PSS 58, 61, 448, 451 ff  
 perylene diimide (PDI) 224 ff  
 PFO 245  
 phase transition 101, 125 f  
 phenyl-substituted PPV (PPPV) 186 ff  
 phosphorescence 5, 126  
 – Alq<sub>3</sub> 118 ff  
 photo cell 339  
 – quantum efficiency of 339  
 photoconductivity 208 ff  
 photocurrent 444, 447, 449  
 photocurrent action spectrum 209  
 photoemission 51, 54  
 photoemission spectroscopy 42, 43  
 photoexcitation 114 ff, 115, 448  
 photogeneration 9, 184, 433  
 photo-induced absorption 136, 158, 173, 240 ff, 278, 448, 494  
 – s. a. PIA  
 photoinduced charge transfer 11, 435  
 photoinduced electron transfer 433  
 photoluminescence 125, 245, 248 ff  
 – Alq<sub>3</sub> 102 ff  
 photoluminescence decay time 197  
 photoluminescence quenching 194 ff, 201 ff, 206  
 photomodulation 240 ff  
 photo-oxidative degradation 154, 165 f  
 photophysics 6  
 photovoltaic devices 449  
 PhPPV 196 ff, 215 ff, 218 ff, 223 ff  
 – charge carrier photogeneration quantum yield 216 ff  
 – photoluminescence intensity 208  
 PhPPV:PDI, charge photogeneration quantum yield 225  
 phthalocyanine 42, 50  
 PIA 136, 158, 173, 240 ff, 278, 448, 494  
 pi-conjugated oligomer 236  
 pi-conjugated polymer, degenerate ground state system 242  
 – non-degenerate ground state system 242  
 PL s. photoluminescence  
 plastic solar cells 433  
 PLDMR 245 ff, 448  
 – photoluminescence detected magnetic resonance 434 ff  
 PLED 153, 451 ff  
 Poisson equation 321, 350

- polarization 495
  - polarization energies 7
  - polaron 140, 145 ff, 235 ff, 245, 248 ff, 276, 347, 459
    - confinement parameter 242
    - interchain-interaction 245
    - energy level, localized 235 ff
    - mobility 235
    - optical absorption 235 ff, 240 ff, 244
    - recombination 235, 245, 251
    - recombination, spin-dependent 245, 247, 251
    - Su-Schrieffer-Heeger model 235, 242
  - poly(3,4-ethylenedioxythiophene):poly(styrene-sulphonic acid) (PEDOT:PSS) 451 ff
  - polyacetylene 140 ff
  - poly(3-alkylthiophene) (P3AT) 358
  - polyaniline 468
  - polycrystalline phases 125
  - polyenes 139 ff
  - polyfluorene (PFO) 148, 153 f, 245, 251, 451, 455, 463
    - $\beta$ -phase 154, 157 f
  - poly(fluorene-co-fluorenone) 166
  - polymer, conjugated 131 ff
  - polymer donor/acceptor blends 226
    - photoconductivity 224 ff
  - polymer light emitting diode (PLED) 153, 451 ff
  - polymer solar cell 449
  - polymer/acceptor blend 185
  - polymer/acceptor interface 227
  - polymorphism 17, 100
  - poly-para-phenylene (MeLPPP) 186 ff
    - ladder-type 245, 251
  - poly-phenylene-ethynylene (PPE) 244
  - poly-phenylene-vinylene (PPV) 207 ff, 244, 249 ff, 252, 305 ff, 358
    - MeH-PPV 244
  - poly(phenylphenylene vinylene) (PPPV), fluorescence quenching 202 ff
  - poly-spirofluorenes 451, 455, 463
  - polythiophene 452 ff
    - polythiophene, regio-random 244
    - polythiophene, regio-regular 244
  - poly(4-vinylphenol) (P4VP) 359
  - Poole-Frenkel mechanism 143, 499
  - potential energy surfaces 136
  - powder diffraction 106
  - powder spectrum 436
  - power conversion efficiency 442, 447
  - PPV 138, 209, 244, 451, 455, 463
  - PtOEP 265 f
  - $\pi$ - $\pi^*$ -transitions 2
  - pulse radiolysis 259
  - pump-probe spectroscopy 189 ff
- q**
- quantum efficiency 224
    - PL 103
  - quantum yield 436
  - quasi-Fermi potential 350
  - quenching parameter 193 ff
- r**
- Raman spectroscopy 458 ff
  - real-time X-ray diffraction 31
  - recombination 447, 449
    - bimolecular 248, 250 ff
    - direct radiative 350
    - Langevin 350
    - non-geminate 248
    - Shockley-Read-Hall 350
  - recombination centre 273
  - recombination rate distribution 502
  - recombination zone 497
  - recrystallization 103
  - $\mu$ - $\sigma$  relation 349
  - relaxation, electronic 139 ff
    - vibrational 137 ff
  - Rietveld refinement 108
  - roughness 17
  - rubrene 398, 403, 406, 419, 423
    - doped in Alq<sub>3</sub> 285
- s**
- scaling 345, 383
  - scaling exponent 444
  - scaling theory 19
  - Schottky barrier 480
  - Schottky-type contact 351, 382
  - screening effect 501
  - self-assembled monolayers (SAMs) 30
  - self-trapping 276
  - semiconducting conjugated polymer 451 ff
    - series resistance 442
  - Shockley model 345, 353
  - short-channel effect 357, 383
  - short-channel transistor 370
  - short-circuit current 443 ff, 447
  - simulation model 379, 476
  - single-crystal 393
    - characterization 399
    - contact 404, 412, 417
    - growth 396

- OFET characteristics 412
  - OFET fabrication 395, 405
  - singlet exciton 186
  - singlet fission 139, 141
  - singlet state 5, 114
  - singlet-polaron quenching 249
  - singlet-singlet annihilation 230
  - solar cell 439 ff, 449
  - soliton 140 ff
  - solvation 503
  - solvatochromic effect 503
  - solvent polarity 503
  - space charge effect 480
  - space charge layer 69, 74
  - space-charge limited current (SCLC) 11, 329 f, 402, 440
  - spectroscopy, coherent vibrational 136 ff
    - field-assisted pump-probe 144 ff
    - photocurrent cross-correlation 146
    - pump-probe 132 ff, 147
    - pump-push-probe 146 ff
    - ultrafast 131 ff
  - spin mixing process 260 f
  - spin state 436
  - spin statistics 260 ff
  - states, charge-transfer 143
    - dark 140 ff
    - emissive 140 ff
    - excited 140 ff, 145
    - ground 139 ff
    - singlet 140 ff
    - triplet 140 ff
  - Stranski-Krastanov growth 19
  - structural defect 275
  - structural properties, Alq<sub>3</sub> 95 ff
  - sublimation 97
  - sub-threshold current 373
  - sub-threshold slope 416
  - surface and interface energies 18
  - surface electric field 352
  - surface potential 352
  - Su-Schrieffer-Heeger (SSH) model 142 ff, 235
  - Suzuki-type coupling 153
- t**
- tandem excitation 230
  - tetracene 399, 403, 419, 424
  - thermal degradation 154, 161 f
  - thermal expansion 31
  - thermal properties, Alq<sub>3</sub> 95 ff
  - thermalization 135 ff
  - thermally stimulated current s. TSC
  - thermally stimulated luminescence s. TSL
  - thin-film transistor 345, 363
  - threshold voltage 353, 355, 383, 415
  - time-of-flight (TOF) 400 f, 487
    - on  $\alpha$ -NPD 290
  - TNF 215 ff, 218 ff
  - TPD 264 f
    - energy diagram of –metal 83
  - train sublimation 97, 105
  - transconductance 345, 356
  - transfer characteristics 309
  - transient optical absorption 188 ff
  - transient PL 115, 118
  - transit time 357
  - transmission, differential 135 ff
  - transport 433, 449
    - carrier density 482
  - transport energy 274
  - transport gap 55
  - transport properties 433
  - transport states 274
  - transport-limited 447
  - trap 273 ff, 373, 388, 449
    - acceptor-like 374
    - bulk 374
    - detection techniques 276 ff
    - distribution 381
    - donor-like 376
    - effect on electrical and optical properties 288 ff
    - in Alq<sub>3</sub> 295
    - in polymeric semiconductors 297 ff
    - in small molecule semiconductors 279 ff
    - interface 374
    - origin of 275 ff
    - structural defects 293 ff
  - trapping energy 499
  - trinitrofluorene (TNF) 196 ff, 207
  - triphenylamine 154
  - triplet, lifetime 118
    - temperature dependence 122
  - triplet energy 121, 126
  - triplet exciton 126, 435 ff
  - triplet state 5
    - excited electronic 95 ff
    - population 114
  - tris(8-hydroxyquinoline)aluminum s. Alq<sub>3</sub>
  - TSC 277
    - fractional 278
    - on Alq<sub>3</sub> 279 ff, 282, 285, 294
    - on DMO-PPV 298
    - on 1-NaphDATA 279 ff

- on  $\alpha$ -NPD 279 ff
- TSL 277
- fractional 278
- on Alq<sub>3</sub> 285
- T-T annihilation 119
- turn-on voltage 439

**u**

- ultraviolet photoemission spectroscopy (UPS) 453, 460
- underechting 371
- UPS 453, 460

**v**

- vacuum level alignment 69
- vacuum level shift 70
- variable range hopping 348
- vibrational analysis 111 ff
- vibrational degrees of freedom 20
- vibrational modes 121
- vibrational properties, Alq<sub>3</sub> 125
- vibrational relaxation 137 ff

- vibronic progression 120
- Vollmer-Weber growth 19

**w**

- Wannier exciton 185 ff
- wavepacket 136 ff
- weak charge-lattice coupling 483
- work function 43, 56, 351, 354, 381, 445, 460 ff

**x**

- X-ray absorption spectroscopy (XAS) 42, 45
- X-ray photoelectron spectroscopy (XPS) 453, 460
- X-ray powder diffraction 98

**y**

- Yamamoto-type coupling 153

**z**

- zero-field splitting parameters 115, 118
- zero-point oscillations 221 ff, 228