

Index

- absorption, optical 1, 119
 - constant 1
 - direct 7
 - extrinsic 9
 - Ge 8
 - imperfections 9
 - indirect 8
 - intrinsic 7
- accumulation layer 14
- $\text{Al}_x\text{Ga}_{1-x}\text{As}$ 185
- $\text{AlGaAs}/\text{GaAs}$
 - solar cell 247, 261
 - superlattices 284, 289, 295, 298
- $\text{AlInAs}/\text{GaInAs}$ superlattices 283, 289, 302, 303
- amorphous semiconductors 216ff
 - a-Si:H 233ff
 - background information 217
 - chalcogenides 219ff
 - a- As_2SeTe_2 231
 - a- As_2Te_3 231
- avalanche photodiodes 283
 - channeling structures 287
 - impact ionization in superlattices 287
 - multiquantum wells 284
 - staircase structures 284
- Beer's law 1
- capacitance, junction 13
 - constant capacitance voltage transient spectroscopy 188
 - decay for MIS junction 124
 - photocapacitance 136, 267
 - Schottky barrier 118
- capture coefficient 1
- capture cross section 2
 - Auger recombination 111
 - cascade capture with multiphonon emission 109
 - Coulomb repulsive imperfection 110
 - phonon emission 108
 - radiative recombination 105
 - sensitizing centers 88
 - summary for recombination at imperfections 113
- CdS 22, 72, 73, 82, 86, 113, 125, 126, 135, 175, 196ff, 250, 262ff
- $\text{CdS}:\text{Cu}$ 96, 99
- CdSSe 89, 98, 161, 175
- CdS/ZnCdTe junction 259
- CdSe 74, 94
- CdTe 193, 250
- CdTe solar cells 260
- chalcogenides, amorphous 219
- conductivity, dark 114
- constant capacitance voltage transient spectroscopy 188
- contacts, electrical 3, 10
 - blocking 11
 - injecting 15
 - ohmic 14
 - tunneling 13
- CuInSe_2 solar cells 260, 261
- current density 5
 - blocking contact 12
 - diffusion 5
 - drift 5
- $\text{Cu}_x\text{S}/\text{CdS}$ heterojunctions 262ff
 - enhancement/quenching model 265
 - junction capacitance 263
 - optical quenching 264

316 *Index*

- $\text{Cu}_x\text{S}/\text{CdS}$ heterojunctions (*cont.*)
 overview of effects 262
 persistence of enhancement 265
 photocapacitance 267
 spectral response 263
 thermally restorable optical degradation 270
- decay measurements 149*ff*
 continuous exponential trap distribution 160
 continuous uniform trap distribution 157
 discrete set of traps 156
 exponential decay 150
 rate window 151, 180, 183
 single level 151*ff*
 strong retrapping 150, 153*ff*
 thermally stimulated 151
- deep level transient spectroscopy 182*ff*
 demarcation level 42
 analysis of two-center effects 83*ff*
- Dember field 53
 depletion layer 12
- electron-beam induced current 123
 excitation spectra 142
- Fermi level, steady state 41
 analysis of two-center effects 83*ff*
- GaAs 113, 128*ff*, 132, 293
 GaAs solar cells 260
 multijunction cells 261
 gain 21
 maximum gain 30
 GaInP₂ solar cells 261
 Ge:Mn 76
 grain boundaries 189*ff*
 direct measurements 193
 electric field during heat treatment 201
 heat treatment in hydrogen 197
 oxygen adsorption effects 199, 205, 211
 photocapacitance 195
 photoconductivity 207
 photo-Hall 192, 207
 photothermoelectric power 196
 small grain vs large grain effects 190
 thermoelectric power 196
- Hall effect
 dark 116
 photo-Hall effect 124*ff*
 thermally stimulated 172
- imperfections 9
 InGaAs/InAlAs superlattices 289
 injection from contacts 15
 double 17
 single 15
 In₂O₃ 261
 InP solar cells 260
 InP/InGaAs superlattices 296
- junctions
 buried junctions for photovoltaics 247
 decay of capacitance of MIS junction 124
 decay of open-circuit voltage 124
 heteroface junctions for photovoltaics 247
 heterojunctions for photovoltaics 246
 multijunction solar cells 261
 p-i-n junctions for photovoltaics 248
 Schottky barriers for photovoltaics 247
 spectral response of 123
 transport processes in heterojunctions 256*ff*
 diffusion 257
 interface recombination without tunneling 257
 recombination in depletion region 257
 thermally assisted tunneling through interface 258
 tunneling recombination through interface without thermal assistance 258
- Lifetime 2, 19
 minority carrier 120*ff*
 temperature dependence 128
- lifetime-mobility product 20
 luminescence 105*ff*, 141*ff*
 thermally stimulated 163
- mobility 5
 photoexcitation dependence 19
- models of photoconductivity
 general large-signal model 50, 94
 insulator model including thermal processes 50
 one-center model with traps 56
 Shockley-Read model 60*ff*
 simplest one-center model 45
 sublinear behavior without traps 52
 two-center effects 71*ff*
- optical transient current spectroscopy 180

Index

317

- PbS 204*ff*, 232
 photochemical changes 175*ff*
 photoconductivity 18*ff*, 119
 amorphous chalcogenides 219*ff*
 analytical two-center model 91*ff*
 avalanche photodiodes 283
 effective mass filtering in quantum wells 282
 in CdS films 196*ff*
 in PbS films 207*ff*
 in a-Si:H 235*ff*
 intrinsic semiconductor 28*ff*
 mathematical models 39*ff*
 negative 79, 87
 one-center models 45*ff*
 optical quenching 76, 85, 126
 photosensitivity 20
 quantum well infrared photodetectors (QWIP) 289
 saturation with electric field 120
 saturation with photoexcitation 79, 89
 sensitizing imperfections 82
 spectral response 21
 speed of response 26
 supralinear 73, 83
 thermal quenching 76, 83
 two-center effects 71*ff*
 examples 96*ff*
 two-center model, qualitative 81
 photoconducting systems
 avalanche photodiodes 283
 homogeneous material 31
 n-p-n junctions 35
 p-n junctions 33
 polycrystalline intergrain boundaries 36, 193
 quantum wells 282*ff*, 289
 photodeflection spectroscopy 119
 photoelectronic analysis
 steady-state 114*ff*
 electron-beam induced current 123
 field effect 232
 Hall effect, dark 116, 212
 luminescence 141
 optical absorption 119
 photocapacitance 136
 photocarrier grating 124
 photoconductivity 119
 photoconductivity saturation with electric field 120
 photo-Hall effects 124*ff*, 192
 photomagnetolectric effect 121
 photon-beam induced current 123
 photothermoelectric effects 134, 196
 Schottky barrier capacitance 118
 spectral response of junctions 123
 surface photovoltage 122
 temperature dependence of dark conductivity 114
 thermoelectric effect, dark 117, 196, 232
 transient 149*ff*
 constant capacitance voltage transient spectroscopy 188
 decay measurements 149*ff*
 decay of capacitance of MIS junction 124
 decay of open-circuit voltage 124
 deep level transient spectroscopy 182*ff*
 photoinduced transient spectroscopy 180
 rise curves 156
 thermally stimulated conductivity 167
 thermally stimulated Hall effect 172
 thermally stimulated luminescence 163
 photoexcitation rate 19
 photoinduced transient spectroscopy 180
 photomagnetolectric effect 121
 photon-beam induced current 123
 photosensitivity 20
 detectivity 20
 gain 21
 specific photosensitivity 20
 photovoltage, surface 122
 photovoltaic effects 244*ff*
 buried junctions 247
 collection functions 253*ff*
 heteroface junctions 247
 heterojunctions 246, 256*ff*
 materials 260*ff*
 more realistic model 252
 multijunction cells 261
 p-i-n junctions 248
 Schottky barriers 247
 simple model 250
 Poisson's equation 13
 Quantum wells 280*ff*
 avalanche photodiodes 283
 effective mass filtering photodetector 282
 electron in a one-dimensional 281
 infrared photodetector (QWIP) 289
 internal electric polarization 294

318 *Index*

- Quantum wells (*cont.*)
 quantum confined Stark effect 290*ff*
 tunable band-edge discontinuities 297
 doping interface dipoles 297
 ultrathin interlayers 300
 tunneling-related effects 301
 far infrared laser 303
 sequential resonant tunneling 301
 infrared photodetector 305
- recombination 2
 Auger 111
 cascade capture with multiphonon
 emission 109
 Coulomb-repulsive imperfection 110
 junction depletion region 257
 junction interface without tunneling 257
 one-center models 45*ff*
 pair-transitions 107
 phonon-emission, Coulomb attractive
 108
 processes 105*ff*
 radiative 105*ff*
 Shockley–Read model 60*ff*
 summary of recombination at
 imperfections 113
 two-center effects 71*ff*
 analytical model 91*ff*
 examples of 96*ff*
 imperfection sensitization 72
 negative photoconductivity 79, 87
 optical quenching 76, 85
 qualitative model 81
 saturation of photoconductivity 80, 89
 sensitizing imperfections 82
 supralinear photoconductivity 73
 thermal quenching 76
- scattering
 change in cross section by
 photoexcitation 124
 relaxation time 5
- Schottky barrier capacitance 118
- sensitizing imperfections 82*ff*
 capture cross sections 88
 hole ionization energies 84
- Shockley–Read recombination model 60*ff*
 comparison with computer model 67
 two Shockley–Read recombination
 centers 67
- Si solar cells 260
- Si: B 185
- a-Si: H 120, 233*ff*
- a-Si: H solar cells 260, 261
- Si: Zn 83, 101, 125
- SnO₂ 261
- space-charge-limited currents 5, 15, 30
- Stark effect in superlattices 290*ff*
 modulation of light beam 292
 self electrooptic devices (SEED) 294
 voltage-tunable photodetector 293
- superlattices 280*ff*
- thermally stimulated conductivity 167*ff*
- thermally stimulated Hall effect 172
- thermally stimulated luminescence 163
- thermoelectric effect, dark 117, 196, 232
- trapping 3, 26
 analysis with strong retrapping 153
 continuous exponential trap distribution
 160
 continuous uniform trap distribution
 157
 discrete set of traps 156
 effect on drift mobility 27
 effect on photosensitivity 28
 effect on speed of response 27
- workfunction 11
- ZnCdTe 259
- ZnO 259
- ZnO/CdTe junctions 259
- ZnO/InP junctions 259
- ZnS 79, 141
- ZnS: Cu 164
- ZnSSe 98
- ZnSe: Cu 98, 143*ff*
- ZnTe 250