

Index

a

absorption coefficient 184, 185
 acoustic phonons 71, 74–77, 96
 activation energy 168, 171
 adiabatic approximation 31, 72, 166
 adsorption 82, 91, 99, 135, 137, 138, 141, 143,
 146–148, 156, 175, 204
 adsorption energy 135
 adsorption sites 137, 147
 angle-resolved photoemission spectroscopy
 (ARPES) 12, 20, 21, 37, 78–90, 105, 148,
 149, 186, 190
 anharmonicity 71
 ARPES, *see* angle-resolved photoemission
 spectroscopy

b

benzene 148, 149
 Bethe–Salpeter equation (BSE) 185, 194
 Bloch theory 6
 Bravais lattice 6, 77
 Brillouin zone 4–6, 19, 30, 34, 35, 38, 59, 62,
 76, 83, 90, 120, 122, 126, 148, 149, 182, 185,
 197
 BSE, *see* Bethe–Salpeter equation

c

CBM, *see* conduction-band minimum
 CDW, *see* charge density wave
 charge density wave (CDW) 19–21, 97
 chemisorption 135–137, 142, 143, 145, 147,
 156, 159, 160, 163, 166, 170, 178
 conduction-band minimum (CBM) 38, 96,
 97, 101

d

dangling bonds 120, 121
 DECP, *see* displacive excitation of coherent
 phonons

density functional theory (DFT) 8, 18, 21, 23,
 53, 57–59, 78, 85, 116, 136, 138, 142, 146,
 156, 161–163, 166, 176, 183, 193
 dephasing 28, 29, 41–43, 132, 135, 170, 171,
 206, 219, 220
 depolarization 142, 218
 DFT, *see* density functional theory
 dielectric function 2, 50, 181–185,
 191–194, 196–198, 200, 201, 205–218,
 220, 230
 dipole moment 135, 142, 215, 218, 230
 dispersion relation 27, 64, 101, 135, 211–214,
 217, 223, 229, 230
 displacive excitation of coherent phonons
 (DECP) 68, 69
 DMFT, *see* dynamical mean field theory
 Drude model 1, 2, 13, 207, 211, 212,
 217, 228
 – extended (EDM) 197, 199–201, 208
 dynamical mean field theory (DMFT) 12,
 15–18, 22, 23, 88

e

EDM, *see* Drude model
 EELS, *see* electron energy loss spectroscopy
 electron energy loss spectroscopy (EELS) 84,
 85, 101, 220
 electron–electron interaction 1, 2, 27, 30, 88,
 91, 184
 electron–hole pairs 13, 38, 39, 42, 44,
 46, 66, 67, 91, 102, 103, 192, 206,
 218, 227
 electronic correlations 12, 14, 21
 electronic excitations 1, 8, 13, 16, 20, 42, 82,
 189
 energy transfer 96
 excitons 28, 29, 38, 39, 42–46, 89, 97–101,
 105, 182, 185, 227–230
 extrinsic surface states 69, 115

f

- FEG, *see* free electron gas
 Fermi energy 4, 10, 34, 36, 52, 79, 116, 123, 127, 129, 137, 159, 195
 fluorescence 227
 four-wave mixing 73, 213
 free electron gas (FEG) 2, 4, 5, 30, 49, 50, 93, 198, 202
 full width at half maximum (FWHM) 59, 95, 104, 105, 127, 128, 163
 FWHM, *see* full width at half maximum

h

- Heisenberg model 53, 54, 56, 59–61, 64
 HET, *see* heterogeneous electron transfer
 heterogeneous electron transfer (HET) 155–178
 highest occupied molecular orbital (HOMO) 137, 138, 141, 143, 149, 163
 HOMO, *see* highest occupied molecular orbital
 Hubbard model 11, 12, 14–18

i

- ice 175, 176
 image states 48, 92, 151, 189
 impulsive stimulated Raman scattering (ISRS) 68, 69, 76
 independent electron approximation 4, 7, 8, 10
 inhomogeneous broadening 28
 interband absorption 93, 185, 192, 195, 196, 203, 211, 214, 217, 220
 interband transition 4–6, 182, 183, 185, 192, 195, 196, 204
 intrinsic surface states 115, 117, 125
 ISBS, *see* impulsive stimulated Brillouin scattering
 ISRS, *see* impulsive stimulated Raman scattering

j

- jellium model 161, 164

l

- Laplace equation 215
 LDA, *see* local density approximation
 LEED, *see* low-energy electron diffraction
 linewidth 28, 29, 36, 37, 71, 120, 127, 128, 132–134, 143, 218, 229, 230
 LO phonon–plasmon coupled modes (LOPC) 72, 73
 local density approximation (LDA) 8, 18, 21–23, 59, 136, 185, 193
 LOPC, *see* LO phonon–plasmon coupled modes

- low-energy electron diffraction (LEED) 98, 148, 186, 187, 190, 192
 lowest unoccupied molecular orbital (LUMO) 137, 138, 141, 163, 227
 LUMO, *see* lowest unoccupied molecular orbital

m

- magnetic linear dichroism (MLD) 104, 105
 Marcus theory 155, 156, 164, 166, 167, 170, 178
 mean free path 13, 77, 81, 186, 218
 metal films 213–215, 220, 223, 227
 metal–insulator transitions 12, 13, 15–17, 21
 MLD, *see* magnetic linear dichroism

n

- near-field scanning optical microscopy (NSOM) 220–222, 226
 nonadiabatic effects 166
 NSOM, *see* near-field scanning optical microscopy

o

- optical excitation 6, 38, 68, 206, 207, 215
 optical microscopy 220, 225, 226
 optical phonons 23, 33, 47, 65–73, 97

p

- PDOS, *see* projected density of states
 PEEM, *see* photoemission electron microscopy
 penetration depth 66, 74, 75, 96, 210
 PES, *see* potential energy surface
 photoemission electron microscopy (PEEM) 214, 217
 photoluminescence 29, 44–46, 97
 photoluminescence spectroscopy 29
 physisorption 135–137, 142, 143, 145, 147
 plasma frequency 2, 3, 72, 181, 183, 187, 198, 199, 201, 208, 211
 polaritons 52, 73, 74, 206, 207, 210, 220, 221, 224, 227, 229, 230
 polarizability 135, 175, 198, 215, 216, 218–220, 227
 potential energy surface (PES) 165–167, 170, 172, 176
 projected density of states (PDOS) 137, 160, 163

q

- QD, *see* quantum dot
 quantum dot (QD) 155, 158, 169, 227

- quantum well (QW) 38–41, 43, 45, 97, 116, 124, 125, 150, 151
 QW, *see* quantum well
- r**
- Raman scattering 68
 random phase approximation (RPA) 182, 184
 RCT, *see* resonant charge transfer
 reciprocal lattice 4, 184, 221
 reconstruction 98, 100, 115, 121, 204
 reflection coefficient 117, 119
 resonant charge transfer (RCT) 155–165, 168, 178
 retardation 212, 217, 218
 RPA, *see* random phase approximation
- s**
- SBE, *see* semiconductor Bloch equations
 scanning electron microscope 221, 226
 scattering time 192, 199–203
 Schottky–Mott limit (SM) 138, 139, 142, 146, 223
 second harmonic generation (SHG) 70, 73
 selection rules 69, 70, 128, 182
 semiconductor Bloch equations (SBE) 41, 45, 46
 SHG, *see* second harmonic generation
 Shockley surface states 119, 130
 silicon 94, 96–99
 SM limit, *see* Schottky–Mott limit
 spin dynamics 53, 57
 structure factor 71
 surface charge 49, 141, 210
 surface phonons 30, 33, 34, 48, 70
 surface plasmon polariton 207, 210, 221, 224, 229, 230
 surface plasmons 51, 52, 206, 207, 210, 211, 213–216, 218–221, 224, 227–230
 surface potential 117, 141, 162
 surface reconstruction 100
 surface region 115, 122, 140, 162
 surface resonances 33, 34, 83, 116, 119, 120
 surface states 30, 48, 52, 69, 74, 81–85, 88, 90, 94, 115–151, 158, 159, 181, 188, 189, 204, 205
- t**
- Tamm surface states 119, 120, 127
 time-resolved electron diffraction (TRED) 77
 time-resolved photoemission (TRPE) 64, 71, 74, 89, 206
 time-resolved X-ray diffraction (TRXRD) 71, 77
 TRED, *see* time-resolved electron diffraction
 TRPE, *see* time-resolved photoemission
 TRXRD, *see* time-resolved X-ray diffraction
- v**
- vacuum ultraviolet light (VUV) 90
 valence band maximum (VBM) 70, 90, 121, 190
 van der Waals interaction 135, 136
 VBM, *see* valence band maximum
 VUV, *see* vacuum ultraviolet light
- w**
- waveguide 224
 work function 90, 95, 116, 126, 129, 135, 136, 138, 140, 142, 143, 186
- x**
- X-ray diffraction 23, 69, 71

