

Index

- anelasticity, 243
- anisotropy, 25, 44, 128, 213
- anisotropic hardening, 86
- Arrhenius equation, 105, 253, 263, 343
- axes, transformation, 4, 12

- barreling, 47
- Bauschinger effect, 74, 305
- bcc metals, 85
 - ductile-brittle transition, 225
 - lattice rotation, 123
 - Schmid factor, 120
 - slip, 120
 - Snoek effect, 253
 - twinning, 169
 - wire textures, 128
- beach marks, 275
- bend tests, 54
- biaxial tension, 51
- boundary conditions, 16
- Bridgman, 60, 215
- Bridgman correction, 43
- brinell hardness, 56
- brittle fracture, 216
- buckling, 48
- bulge test (see also biaxial tension), 51
- bulk modulus, 21
- Burgers vector, 141

- cavitation, 265
- ceramics, 318–337
 - elasticity, 318
 - fatigue, 329
 - fracture toughness, 324
 - hardness, 319
 - high temperature behavior, 324
 - porosity, 319
 - slip systems, 319
 - testing, 322
 - toughening of, 326
- Charpy test, 218–221
- clamshell markings, 275

- Clausius-Clapyron equation, 179
- cleavage, 216
- closed cell foams, 381
- coaxing, 282
- compact tensile specimens, 263
- compliances, 25–27
- composites, 363–384
 - brick wall model, 376
 - compressive strength, 373
 - discontinuous fibers, 372
 - elastic behavior, 363
 - failures, 372
 - fiber reinforcement, 363
 - fiber volume, 368
 - lamellar, 378
 - orientation dependence, 369
 - particulate, 375
 - rule of mixtures, 364
 - typical properties, 374
- compression, 47
- creep, 259–274
 - alloys, 269
 - cavitation, 265
 - Coble, 261
 - deformation mechanisms, 259
 - diffusion-controlled, 260
 - dislocation-controlled, 262
 - extrapolation, 266
 - Larson-Miller, 267
 - mechanisms, 264
 - Nabarro-Herring, 261
 - rupture, 266
 - Sherby-Dorn, 267
 - steady state, 262, 265
 - temperature dependence, 263
- critical resolved shear stress, 113
- crystals
 - elastic moduli, 25
 - slip, 113
- cup and cone fracture, 210
- curly grain structure, 128
- cyclic stress–strain behavior, 292

- damping, 248
 - mechanisms, 251
 - viscoelasticity, 248, 345
- dead metal, 47
- deformation mechanisms, 264, 326, 357
- deformation zone geometry, 392
- diffusional processes, 97, 261, 264
- discontinuous deformation, 199, 207
- dislocations, 137–165
 - Burgers vector, 141
 - climb, 163, 262
 - cross slip, 158
 - edge, 139
 - energy, 142
 - forces on, 146
 - intersections, 159
 - partial, 147
 - pile-ups, 158, 185, 305
 - screw, 139
 - stress fields, 144
- dispersion strengthening, 188–192
- drawing
 - deep, 394
 - wire, 386
- ductility, 208–221
 - common parameters, 40, 91
 - ductile-brittle transition, 218–221
- dynamic strain aging, 200–204

- easy glide, 117, 159
- effective strain, 80, 85
- effective stress, 80, 85
- effect of texture on microstructure, 128
- elasticity, 20–35
 - anisotropic, 55
 - composites, 327
 - constants, 29
 - isotropic, 20
 - moduli, 20, 251, 319
 - orientation dependence, 27
 - polymers, 340–344
 - relaxed versus unrelaxed, 251
 - rubber, 344
 - superelasticity, 183
 - temperature dependence, 23
- elastic limit, 38
- elongations
 - superplastic, 95–99
 - uniform, 68
- fatigue, 275–301
 - ceramics, 329
 - crack propagation, 289
 - cyclic stress–strain curves, 292
 - design for, 297, 385
 - endurance limit, 278, 286
 - fatigue limit, 278, 286
 - mean stress, 279
 - metallurgical considerations, 286
 - nomenclature, 276
 - polymers, 295
 - S-N curves, 278
 - static, 334
 - strain to failure, 286
 - strength, 278
 - stress concentration, 282
 - surface effects, 284
 - temperature effects, 292
 - testing, 297
 - rate effects, 292
- fcc metals
 - lattice rotation, 121
 - Schmid factors, 119
 - slip systems
 - stress strain curves, 118
 - twinning, 169
- fibers, 363–375
 - discontinuous, 369
 - properties, 374
 - pull-out, 272
 - yielding in compression, 373
- flow rules, 78, 84
- flow stress
 - strain-rate dependence, 65
 - temperature dependence, 92, 100
- foams, 379–381
- force balance, 14
- force measurement, 45
- formability, 393
- forming limit diagrams, 398
- fracture, 208–221
 - brittle, 215–221
 - ceramics, 324
 - cleavage, 216
 - cup and cone, 210
 - ductile, 210–215
 - intergranular, 216
 - Irwin analysis, 229
 - mechanics, 225–243
 - metallurgical effect, 235
 - modes, 229
 - plastic zone, 231
 - polymer, 356
 - porosity effect, 323
 - strain-energy, 237
 - strength, 321
 - theoretical strength, 225
 - thin sheets, 233
- Frank-Read sources, 155, 189,
- Frank's rule, 144
- free surfaces, 16
- friction, 47, 51, 392

- glasses, 329–336
 - delayed fracture, 334
 - glassy metals, 334
 - residual stresses, 331
 - static fatigue, 334
 - strength, 332
 - tempering, 332
 - thermal stresses, 333
- glass transition, 340

Index

417

- Goodman diagrams, 279
- grain boundaries, 259
- grain size, 184
- Griffith model, 227

- Hall-Petch relation, 184
- hardness, 56–58
- hcp crystals
 - elasticity, 30
 - packing, 149
 - slip, 121
 - textures, 128
 - twinning, 171
- height-to-diameter ratio, 47
- hexagonal symmetry, 27, 31
- Hill, 84
- Hooke's law, 20
- hot shortness, 218
- hot working, 108
- hydraulic bulge test, 51
- hydrostatic stress, 21, 145, 215

- inclusions, 214
- ideal work, 385
- impact energy, 218
- inhomogeneity factor, 390
- interstitial solutes
- intrusions, 276
- ironing, 395
- Irwin's fracture analysis, 229–231
- isotropic hardening, 86

- J-integral, 238
- jogs, 160

- kinematic hardening, 86
- Knoop hardness, 57

- Larson-Miller parameter, 267
- Lattice rotation
 - compression, 123
 - tension, 121
 - twinning, 166
- Levy-Mises equations, 76
- limiting drawing ratio, 295
- Lüders bands, 39, 295

- Madelung constant, 318
- Marciniak, 71
- martensite
 - formation, 178
 - hardness, 187
 - tempering
 - zirconia, 328
- mechanical working, 385–405
 - bulk forming, 385
 - deep drawing, 394
 - deformation zone, 389
 - efficiency, 387
 - extrusion, 388
 - formability, 393
 - friction, 392
 - sheet forming, 394, 401
 - stamping, 403
- metal foams, 397
- Meyers hardness, 57
- Miller indices, 407
- Mohr's circles, 6, 13, 75, 79
- Moh's hardness, 58
- moment balance, 14

- natural strain, 9
- necking
 - localized, 397
 - Bridgman correction, 43
- normality principle, 79
- notation system, 3
- notch fatigue factor, 282
- notch sensitivity, 282

- offset yield strength, 38
- orientation
 - preferred, 4, 27
 - stereographic representation, 412
- open cell foams, 381
- Orowan theory, 229
- orthotropic symmetry, 26, 31
- Ostwald ripening, 190

- Palmgren-Miner rule, 281
- Paris law, 289
- pencil glide, 120, 133
- percent elongation, 40
- percent reduction of area, 40
- persistent slip bands, 276
- pile-ups, 158, 185, 305
- plane-strain compression, 50
- plane-strain tension, 51
- plasticity theory, 74–91
- Poison's ratio, 20
- polymers, 339–362
 - crazing, 354
 - crystallinity, 340
 - damping, 345
 - deformation maps, 357
 - fracture, 356
 - molecular orientation, 339
 - pressure effects, 350
 - S-N curves, 296
 - shape memory, 357
 - yielding, 347
- porosity (in ceramics), 329
- Portevin-LeChatelier effect, 203
- power-law hardening, 66
- precipitation hardening, 188
- preferred orientations, 41, 127
- pressure
 - effect on yielding, 74
 - effect on fracture, 215
- principal stress, 6

- R-value, 44, 125, 127, 395

- residual stress, 302–317
 - fatigue, 286
 - glass, 332
 - measurement, 311
 - mechanical working, 308, 392
 - relief, 313
 - welding, 307
- Rockwell hardness, 56
- rolling, 398
- rubber, 344
- rupture (see also fracture), 266

- saturation hardening, 66
- Schmid, 132
- Schmid factors, 114
- Sendizimir, 401
- shape memory, 178, 357
- shear modulus, 3
- sheet anisotropy, 44, 84, 125, 395
- Sherby-Dorn, 267
- size effects
 - fatigue, 286
 - fracture, 322
- slip, 120–126
 - bcc, 119
 - ceramics, 319
 - cross slip, 158
 - directions, 113
 - fcc, 118
 - hcp, 121
 - lattice rotation, 121
 - planes, 113, 319
 - strains produced by, 116
 - vectors, 141
- Snoek effect, 253
- solid solution strengthening, 187
- spinning, 400
- St Venant's principle
- stacking faults, 149, 159
- stamping, 396
- stereographic projection
- stick-slip phenomena, 199
- strain aging, 191
- strain hardening, 186
 - effect on yield locus, 86
 - exponent, 67
- strain localization, 205
- strain-rate sensitivity, 92
- strains, 9, 11
 - effective, 80
 - engineering, 9, 41
 - logarithmic, 9
 - measurement, 45
 - nominal, 9
 - normal, 11
 - principal, 13
 - small, 11
 - transformation, 12
 - true, 9
- strain ratio, 44, 125, 127, 395

- strain path, 400
- strength, 1, 39
 - theoretical, 139
 - tensile, 46
 - yield, 36
- stress, 2
 - concentration factor, 227, 282
 - intensity factor, 229
 - invariants, 6
 - normal, 2
 - principal, 6
 - shear, 2
 - sign convention, 3
 - subscripts, 3
 - true, 41, 48
- stress–strain curves, 37, 351
 - approximations to, 65
 - temperature dependence, 103
- striations, 275
- super alloys, 269
- super elasticity, 179
- super plasticity, 95

- Taylor, G. I., 126, 133, 137
- tension tests, 37, 68
 - compact tension, 236
 - ductile fracture, 210
 - specimens, 36
- tetragonal symmetry, 31
- texture formation, 124
- texture strengthening, 127
- thermoelastic effect, 251
- thermal expansion, 24, 31
- torsion, 53
- toughness, 229–240
 - J-integral, 238
 - sheet thickness, 233
 - temperature effect, 234
- Tresca, 75, 87
- twinning, 168–176

- ultimate tensile strength, 40

- vacancies, 162
- Vickers hardness, 157
- viscoelasticity, 244–258
 - damping, 248, 345
 - dashpot model, 245
 - Maxwell model, 245
 - natural decay, 249
 - Snoek effect, 253
 - thermo-elastic effect, 251
 - Voight-Maxwell model, 246
- void coalescence, 209
- Voight model, 246
- von Mises, 76

- Weibull analysis, 321
- welding stresses, 307
- Westergaard equations, 229
- work per volume, 70

Index**419**

- x-rays, 311
- yield criteria, 74–88, 350
 - Coloumb-Mohr, 353
 - high exponent criterion, 83
 - Hill criterion, 84
 - nonquadratic, 85
 - polymers, 351
 - Tresca, 75
 - von Mises, 76
- yield points, 39, 146, 191
- yield strengths, 38, 74
 - crystal structure effect, 184
 - theoretical, 137
- Young's modulus, 20, 250
 - ceramics, 319
 - composites, 364, 374
 - foams, 379
 - polymers, 339
- Zener-Hollomon parameter, 263
- zirconia, 328