Subject Index

A
Aeronautical alloys, 289
Aluminum alloys, 289
AI-Li 8090-T8 alloy, 289
a/w effects, 239
ASTM standards
  E-399, 196
  E-813, 195, 196, 239, 437, 474, 483, 486, 492
  E-1152, 195, 196, 197, 239, 437
  E-1152-87, 198, 384
B
Bend specimens, 306
Brittle fracture toughness, 306
C
Center-cracked tension specimens, 492
Circumferential flaws—pressure vessels, 318
Charpy specimen testing, 139, 200 (table)
Cleavage, 79, 306, 473
Cleavage fracture initiation, 264, 318, 384
Cleavage fracture strength, 41, 79
Compact tension, 418
Constraint
  brittle fracture toughness, 306
  cleavage initiation, 318
  ductile fracture behavior, 41, 473
  effect on cleavage fracture toughness, 264
  effect on ductile crack growth, 383
  effect on specimen dimensions, 79
  elastic-plastic stress, 120
  high-strength steel, 239
  material susceptibility, 418
  out-of-plane loading, 318
  pressure-vessel steels, 104
  role in ductile tearing, 64
  side-grooved compact tension specimens, 429
  testing and analysis of laboratory specimens, 264
  thickness loss, 289
Controlled crack growth, 176
Crack arrest, 361
Crack depth, high-strength steel, 239
Crack growth resistance, 418
Crack resistance curves, 41
Crack stress fields, 318
Crack tip conditions, 492
Crack tip constraint, 2, 21, 64, 120, 473
Crack tip deformation, 21
Crack tip extension, 21
Crack tip fields, 2
Crack tip opening displacement
  compact tension specimens, 429
  controlled crack growth, 176
  plastic ductile tearing, 158
  reactor pressure vessel steel, 104
Cracking—type IV, 341
Creep resistant steels, 341
Creep rupture, 341
CTOD testing (See Crack tip opening displacement)
D
Delamination, 289
Deformation plasticity failure assessment diagram (DPFAD), 384
Ductile brittle transition region, 264
Ductile crack extension
  geometry dependence, 21
Ductile fracture behavior
  controlled crack growth, 176, 239
  effect of stress, 41
  role of crack tip constraint, 64, 383
Ductile tearing, 64, 158, 264, 473
Dynamic fracture, 361
E
Elastic fracture mechanics, 120
Elastic-plastic behavior of structural steels, 195, 239
Elastic-plastic cleavage fracture toughness testing, 264
Elastic-plastic crack-tip fields, 120
Elastic-plastic fracture
crack-front fields, 120
constraint, 2
reactor pressure vessel steel, 104
toughness, 21
Energy dissipation rate, 158, 159–161
EPRI elastic-plastic handbook, 384

F

Ferritic steel, 306, 341
Finite element analysis, 341, 473
Finite element method, 2
Fossil power plants—welded joints, 341
Fracture, 2, 139, 264, 492
Fracture mechanics
constraint and toughness, 21
controlled crack growth, 176
estimating fracture toughness, 361
Fracture surface toughness, 289
Fracture toughness, 2, 21
charpy specimen testing, 139
controlled crack growth, 176
effect of constraint, 79
effect of stress, 41
estimating, 361
measurement, 239
reactor pressure-vessel steels, 104, 195
specimen size dependence, 473
testing, 79, 104, 139, 264
Fracture toughness (lower bound), 139

G

Geometrical effects, 418
Geometry dependence
of ductile crack extension, 21
of J-curves, 64, 492
Gurson’s model, 64

H

HAZ properties, 341
Heat affected zone (HAZ)—welded joints, 341
Heavy Section Steel Technology Program, 104
High strength steel, 239
High temperature behavior of welds in fossil power plants, 341
HSST (See Heavy Section Steel Technology Program)
HY 100 steel, 176

I

Impact testing, 139
Irwin B-correction, 104

J

J dominance, 120
J-integral
compact tension specimens, 418, 429
ductile tearing, 64, 473
reactor pressure vessel steel, 104, 195
specimen size dependence, 473
J-resistance curve, 64, 383
J-K-R curves, 289
J-curve, 64, 158, 195, 239, 383
J-Q theory, 2
J-T stress, 492

L

Large-scale yielding, 2
Load displacement predictions, 384
Lower bound initiation toughness of reactor grade steel, 139

M

Macro-fracture toughness, 158
Micromechanical models, 64
Micromechanics, 79
Micromechanisms, 473
Mild steel, 492
Multiaxiality, 42

N

Necking of specimens, 429
Normalized R-curves, 176
Nuclear pressure vessels, 361

O

Out-of-plane loading, 318

P

Plasticity, 21
Pop-in behavior, 289
Pressure vessel crack tip constraint, 318
Pressure vessel steel, 104, 195
Pressurized thermal shock—nuclear pressure vessel behavior, 361
Q

q factor, 41
Q stress, 79
Quotient of multiaxiality, 41

R

R curves, 158, 429
Reactor grade steel, 139
Reactor pressure vessel steel
  chemical compositions, 199 (table)
  fracture toughness, 104, 195
  uniaxial strength data, 199 (table)
Recrystallization, 289

S

Safety assessment
  pressure-vessel steels, 104
  structural fracture, 79
Sandel fracture theory, 41
Shallow-crack fracture toughness, 104
Side grooves, 306, 473 (table)
Simulation model—compact tension, 418
Size effects
  brittle fracture toughness, 306
  cleavage and ductile tearing, 473
  compact tension specimens, 429
  ductile crack growth, 384, 473
  effect of constraint, 79, 473
  reactor pressure vessel steels, 195
Small-scale yielding, 2
Small specimen testing, 139
Stable crack extension, 41, 158
Statistical modelling, 264
Steel (reactor grade), 139
Strength data, pressure vessel steels, 199
  (table)
Stress, 21, 41, 341, 492

T

T stress, 21, 79, 120, 492
Tearing resistance, 64, 158, 195
Tearing toughness, 158
Temperature gradient, 361
Test results—correction function, 264
Testing procedures
  elastic-plastic cleavage toughness, 264
  fracture toughness, 79
  laboratory specimens, 264
  reactor grade steel, 139
Thickness constraint, 289, 418
Thickness effects, 306
Thickness reduction, 361
Three-dimensional finite element analysis, 120
Three-point bend specimens, 492
Titanium—ductile tearing, 158
Toughness, 21, 158, 361
Toughness locus measurement, 2
Transition region, 264
Triaxiality, 2, 64, 473
Two-parameter characterization, 120

V

Validity range—specimen size, 429

W

Welded joints—fossil power plants, 341
Weldments, 341
Wide-plate testing, 361