

Subject Index

A

Aeronautical alloys, 289
 Aluminum alloys, 289
 Al-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
 crack tip 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_{ic} - 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

- Stress constraint, 120
- Stress fields, 318
- Stress triaxiality, 2, 64
- Surface-cracked plates, 120

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