

INDEX

A

- Alternate immersion test, 254
- Aluminum alloys
 - DTD 5020A, 340
 - DTD 5050B, 340
 - DTD 5090, 341
 - 2124 aluminum alloy, 255, 257
 - 2124-T851 aluminum alloy, 256, 257, 258, 260, 261, 262
 - 7075 aluminum alloy, 255, 258, 259, 263, 264
 - 7075-T6 aluminum alloy, 261, 265
- Ambient environment, 172
- Anodic dissolution, 47
 - Rates, 54, 55

B

- Beam deflection, 12, 14, 15
- Boiling water reactor materials performance, 149
- Box-Behnkin series, 214
- Brass, admiralty in
 - Nonammoniacal aqueous solutions, 266
 - Various solutions, 273
 - Anodic polarization behavior of, 273
 - Cracking mode of, 270
 - Current response of, 274
- Brass, admiralty
 - Photomicrographs of fractured specimens, 271
- Brass, unstressed admiralty, anodic polarization curves of, 269

Brass, 70Cu-30Zn

- Constant load tests on, 367
 - In solution of 1.5 *M* total ammonia and 0.04 *M* total copper, 241, 246, 247
 - Slow strain-rate tests, 368
- Brass, DEF 105
 - Effect of crosshead speed on slow strain-rate test results, 370
- Brass, silicon (alloys 1 to 5) and brass (DEF 105), 367, 369,
 - Constant load and slow strain-rate test results for, 370
 - Mechanical properties and copper contents of, 368
- Brittle fracture, 88
- Brittle mode, 64
- Buried pipelines, 223
- Bursting tube, slow strain-rate stress corrosion test, 408
 - Comparison with conventional tests, 415
 - Facility, schematic diagram, 410
 - Results of, 416

C

- Cathodic, current density, effects of, on hydroxide stress cracking of, 290
- Caustic stress corrosion cracking, 81, 95, 170
- Chemical environment, identification of, 223
- Chloride concentration, effect of, 308

- Cladding, corrosion resistant, 166
 Coal gasification candidate materials, 121
 Coatings, 227
 Quality, 223,
 Cobalt-base alloys, 279
 Constant beam deflection rate tests, 6, 20
 Constant flow stress, 347, 348
 Constant load cantilever beam tests, 12
 Constant load method, 362
 Constant load test, 13, 20, 296, 301, 302
 Constant strain-rate tests
 Calculated environmental effects in, 53
 Comparison of results with conventional testing techniques, 339
 Current densities in, 54
 In 4 *N* sodium nitrate (NaNO₃), 8
 Results on Type 304 stainless steel, 51
 Theoretical analysis, 48
 Copper-beryllium alloys, 238
 Corrosion fatigue, 19
 Crack growth rate, 47, 55
 Crack propagation, 11, 31, 64
 Crack tip, 18, 19, 28, 36, 38, 43, 209
 Region, 13, 16
 Strain rate, 15, 19, 242
 Unfilmed, 31
 Crack velocity, 9, 69, 232, 247
 Cracking kinetics, function of the dissolved oxygen content, 161
 Cracking response, 6, 12
 Creep
 Corrosion test, 425
 Rate of, 12, 20
 Response, 12
 Crevice chemistry effects, 146
 Crosshead speed, 239
 Cross-section metallography, 105
 C-shape specimens, tested in NaOH, 289
 Cyclic loading, 20
- D**
- Dislocation cross slip, 39
 Ductile, 212, 145
 Alloys, 23
 Failure, 17, 18
 Fracture, 6, 55, 247, 359
 Metal, 28
 Rupture, 88
 Steel, 63
 Ductility, 69, 73, 100, 119, 212, 214, 258
 Loss of, 64
 Ductility, specimen, measurement of, 69
 Dynamic strain, 105, 107, 109, 154
 Test, 9, 104, 153, 167
 Dynamic straining stress
 Corrosion test, 149
 Corrosion test facility, 151
 Tests (quality control tool), 167
- E**
- Effective strain rate, 7
 Elastic interactions, 23
 Electrochemical activity, 42
 Conditions for cracking, 12
 Reactions, 18
 Reactivation technique, 155
 Tension test, 206, 210, 214
 Electrochemical factors, 289
 Electrochemical potential, 248
 Electrode potential, 42
 Dependence of, 40
 Elongation to fracture, 247
 Engineering alloys, 27
 Environment, effect of, 224

Environmental deterioration rate,
change of with potential, 48
Environmental stress cracking, 279
Environmentally induced cracking
susceptibility, 321
Environmentally induced degradation,
320

F

Failure mode, effect of potential on,
90, 91
Fatigue precracked specimens, 7
Film formation for, 104
Austenitic stainless steels, 28
Brass, 27
Low strength ferritic steels, 29
Noble metal alloys, 30
Reaction films on alloys, 27
Titanium and titanium alloys, 29
Film, anodic rupture mechanism, 27
Film, chromium-containing passive,
28
Film, rupture, 43, 105
Repetitive, 35, 36, 38
Role of, 26, 38
Film, rupture, classic, 34
Films, corrosion, 26
Fractographic technique, 353
Fractography, 62, 68, 72
Fracture, alloy mode, 349
Fracture, mechanics approach, 55
Mode, 146
Surface, 101

G

Gas transmission pipeline, 223
Glycerine, 307, 308

H

Hastelloy Alloy C-276, 280
C-shape specimens tested in
NaOH, 289
Effects of cathodic current density
on the hydroxide stress
cracking, 290
Effects of cold work, 288
Effects of heat treatment on the
hydroxide stress cracking,
287
Effects of stress level and direc-
tion, 286
Hastelloy Alloy B, 280
Haynes Stellite Alloy No. 6B, 280
C-shape specimens tested in
NaOH, 289
Effects of cathodic current density
on the hydroxide stress
cracking, 290
Effects of cold work, 288
Effects of heat treatment on the
hydroxide stress cracking,
287
Effects of stress level and direc-
tion, 286
Heat treatment effects, detection of,
320
Helium and argon environments, as
"normalizing" environ-
ments, 118
High temperature
Anodic electrochemical studies,
185
Description of test facility, 389
High pressure slow strain-rate
testing, 133, 388
Schematic drawing of test vessel,
390
High temperature water, slow strain-
rate testing procedures in,
133
Hydrogen embrittlement, 26, 36

Hydrogen-induced cracking, 108

Hydrogen, on steel, cathodic charging of, 69

I

Inclusions, 66

Incoloy-800 alloy, 115, 171, 199

Caustic cracking, 184

Polarization curves, 191, 192, 193

Slow strain-rate testing, 183

Straining electrode experiments, 197

Incoloy Alloy 825, 280

Inconel 600, 39, 64, 73, 137

Inconel 671

Optical micrograph, 128

Scanning electron micrograph, 128

Inconel X750, 176

Inhibitors, 226

Effect of, 314

Inhibitors, corrosion, 226

Inhibitor-containing coatings, 227

Instron tension testing machine, 239

Intergranular corrosion, 66

Alloys, resistant to, 157

Intergranular crack, 17

Lengths, 17

Velocities, 19

Intergranular cracking, 21, 22, 55,

119, 141, 146, 147, 359

Intergranular fracture, 18, 121, 247

Intergranular propagation, 64

Intergranular stress corrosion cracks, 12, 13, 21, 39, 132,

214, 296

Propagation, 64

Resistance, 158

Susceptibility, 296

Ionic concentrations, 214

L

Liquid metal fast breeder reactor, steam generator, 170

Load cycling, 19

Load versus specimen elongation, 71

M

Magnesium-aluminum alloy, 13

In $\text{CrO}_4\text{-Cl}$ solution, 15, 17

Manganese-aluminum alloy in $\text{CrO}_4\text{-Cl}$, 18

Metallographic examination, 214

Technique, 353

Treatments, 174

Metallography, 62, 68, 69, 72

Optical, 64, 68

Metals in gaseous atmospheres, 113

Multispecimen test facility, 388

Design and construction of machine, 375

N

Nickel Alloy 600

Current density versus time curves, 327

Electrodes in H_2SO_4 , 85, 88

In NaOH solution, 324, 326, 329

Cracking zone for, 89

Effect of, 89

Influence of metallurgical condition and polarization on reduction of area of, 326

Nickel Alloy 671, stress-strain curves for, 124

Nickel Alloy 800, 85, 88, 119

In NaOH solution

Cracking zone for, 92

Effect of, 89

Scanning electron micrograph, 127

Stress-strain curves, 123

Titanium stabilized, 93
 Nickel alloys, 73
 Nickel-base alloy, 279, 320
 Ni-Co-Cr-Mo alloy, MP35N, multi-
 phase C-shape specimens
 tested in NaOH, 289
 Nitrate, alkaline radioactive wastes,
 polarization curves, 210
 Nitrate stress corrosion, 209, 214
 Nitronic 50 alloy, 155, 167
 Noble metal alloys, 30
 Nonpropagating cracks, 15, 16, 20,
 23
 Significance of, 15
 Nonpropagating surface phenom-
 ena, 63

O

Oxidizing condition, effect of, 228
 Oxyanions and chloride ion, effect
 of, 266

P

Passive oxide film rupture, 326
 Passive potential region, 55
 Pipeline coatings, 227
 Pipeline steel, 222
 In caustic solution
 Effect of strain rate, 233
 Effect of temperature and strain
 rate, 232
 In potassium dichromate, effect
 of, 226, 227
 In 1 N Na₂CO₃ + 1 N NaHCO₃,
 107
 Intergranular stress corrosion
 cracking range, 225
 Pitting corrosion, 66
 Plackett-Burman series
 Experiments, 212
 Results, 212, 213

Plastic crack tip, 55
 Plastic deformation, 28, 238
 Plastic displacement, 19
 Time dependent, 20
 Plastic strain, 16
 Plastic zone, 7, 15
 Polarization curves, 51, 177
 For 2¼Cr-1Mo alloy, 188, 189,
 190
 Polarization tests, 54
 Portable slow strain-rate stress cor-
 rosion test device, 399
 Description of apparatus, 400
 Schematic diagram, 400
 Potential, applied, effect of, 102
 Potential control tests, 86
 Potential, corrosion reactions, ef-
 fects of, 207
 Potentiostatically controlled tests,
 317
 Pourbaix diagrams, 54, 267
 Precracked specimen, 19
 Predicting threshold stresses, 14
 Prenotched cantilever-beam speci-
 men, 109
 Purex (221-F) specimen, 214

R

Radioactive waste, 209
 Composition of, 209
 Solutions, 204
 Supernates, ionic concentrations,
 210
 Synthetic, analyses of, 211
 Tanks, 209
 Reference electrode, 85
 Repassivation rate of aluminum
 alloys, 338

S

Sanicro 30, 84
 In NaOH, effect of potential, 93

- Secondary stress corrosion cracks, 66, 68
- Sensitization, 119, 138
- Sensitization resistant alloys, 124
- Shallow surface penetrations, 65, 66
Interpretation of, 65
- Shot peening, 144, 145
- Slow dynamic strain, 5, 12
- Solution heat treatment after welding, 164
- Sour-gas, simulated well environment, 394
- Static load test, 23, 88
- Static loading, 19, 20
- Steel
- AISI 304, 73, 307
 - In $MgCl_2$, fracture strain, 315
 - In $MgCl_2$, specimens, 405
 - Load as a function of elongation, 311
 - AISI 316, 307
 - Fracture strain as a function of temperature, 310
 - AISI 431, 307
 - Chromium (X20-Cr13), in NaCl solution, 342, 344
 - AISI 4130, 392
 - In H_2S-CO_2 , slow strain-rate test results, 395
 - In H_2S-CO_2 , time-to-failure and ductility, 396
 - A202 Grade B, in liquid ammonia, 106
 - A285-B
 - Effect of $NaNO_2$ and $NaOH$, 219
 - Fracture characteristics of, 216
 - Intergranular cracking of, 215
 - A517 Grade F
 - In air-contaminated ammonia, 109
 - In air-contaminated metallurgical-grade ammonia, 100
 - In liquid ammonia, 106
 - In water-inhibited air contaminated metallurgical-grade ammonia, 100
- Annealed
- $2\frac{1}{4}Cr-Mo$, 195
- Carbon, 63, 70, 73, 227
- ASTM A285-B, 208
 - Base metal, 94
 - In carbonate-bicarbonate solution, alloying additions effect, 231
 - In $1 N Na_2CO_3 + 1 N NaHCO_3$, 11, 65
- Carbon (285-B)
- Anodic potentiodynamic polarization of, 207, 212
 - Variation of strength, 214
- Carbon, annealed, 103
- Carbon-manganese, 9, 10, 14, 17
- In aqueous solution of sodium carbonate and bicarbonate, 12, 105
 - In CO_3-HCO_3 , 15, 17, 22
- Cast martensitic stainless in NaCl solution, influence of tempering temperature and polarization on reduction of area of, 325
- Chromium-molybdenum ($2\frac{1}{4}-1$), 271
- Caustic cracking in, 182
 - Slow strain-rate testing for, 179
- ERW Grade X46 line-pipe
- In air-contaminated metallurgical-grade ammonia, 101
 - In water-inhibited air-contaminated metallurgical-ammonia, 101
- Ferritic-austenitic alloy, 305
- Fracture strain as a function of $MgCl_2$ concentration, 309
- Fracture strain tested in glycerine for, 313
- Maximum load for, 312

- Load as a function of elongation, 310
 - Mild
 - Elongation-electrochemical tension test, 220
 - In 2 *N* (NH₄)₂CO₃, 102
 - Orion 26-1, 307
 - Orion 28-2, 307
 - Stainless
 - Alloy XM-19, 141, 142
 - Creusot-Loire ICL-473 (Type 304) alloy, 155
 - ICL-167 (Type 316), 157
 - ICL-473, 157
 - Kromar D70, 363, 365
 - Susceptibility of, 312
 - (X5CrNi 18 9), 338
 - Stainless, austenitic, 28, 73, 133, 138, 150, 238, 294, 305, 338
 - In MgCl₂ solutions, 308, 345
 - Stainless, martensitic, 305, 320, 323-325
 - In NaCl solution, reduction of area versus strain rate, 324
 - Stress-elongation curves for C-Mn, 8
 - Steel, Type 304 stainless, 48, 50, 59, 85, 88, 132, 153, 155, 157, 349
 - Chemical analysis of, 350
 - Constant strain-rate tests, 56, 57
 - Dynamic strain testing of, 163
 - Exposure to A262E, 144
 - Fracture surfaces of, 141, 146
 - In NaCl, 360
 - In NaOH, 92
 - Intergranular stress corrosion cracking, 165
 - Mechanical properties, 351
 - Polarization curves, 51, 52
 - Steel, Type 304, stainless, sensitized, 296
 - In 10 *N* H₂SO₄ + 0.1 *M* NaCl, 52
 - Steel, Type 308 stainless
 - Effect of heat treatment, 143
 - Exposure to A262E, 143
 - Steel, Type 310 stainless, 115, 119, 121, 124
 - In H₂O/H₂S, 120
 - Scanning electron micrograph, 125
 - Stress-strain curves, 121
 - Steel, Type 310S stainless, 115, 119, 124
 - Stress-strain curves, 122
 - Steel, Type 316 stainless, 153, 412
 - Steel, Type 347 stainless, 115, 119, 124
 - Stress-strain curves, 122
 - Steel, Type 446 stainless, 123
 - Stress-strain curves, 123
 - Steel, Uranus 50, 307
 - Stress-strain curves, 123
 - Steels, fracture strain for, 312
 - Maximum load for, 312
 - Steels, fracture strain for, 312
 - In 4 *N* NH₄NO₃, 9, 10
 - Steels, stainless, susceptibility of, 312
 - Straining electrode, 83
 - Annealed 2¼Cr-1Mo steel, 194
 - Straining electrode experiment, 37, 177, 186
 - Strauss test, modified, 138
 - Stress relaxation, 44
 - Stresses, macroelastic, 359
- T**
- Temperature, effect of, 231, 309
 - Tensile machine, 375
 - Capacity, 376
 - Major components, 378
 - Multispecimen, 377, 380
 - Power drive, 378
 - Schematic drawing, 379, 380
 - Single specimen, 377, 379

- Space, 377
 - Strain rate, 376
 - Tensile strength, 247
 - Tension specimen, diagram of, 208
 - Threshold strain rates, concept of, 16
 - Threshold stress, 13, 18
 - From creep data, 13
 - Time-to-failure studies, 70, 73
 - Time to fracture, 302
 - Titanium alloy, 241
 - In NaCl formamide, 338
 - Precracked in NaCl water, 338
 - Ti-5Al-2.5Sn in NaCl, 42
 - Ti-6Al-4V, 337, 340
 - In aqueous NaCl, 342
 - Titanium-base alloys, 241
 - Titanium-oxygen, 242, 243, 244
 - In aqueous NaCl solution, 242
 - In CH₃OH/HCl solution, 243, 244
 - Ti-13Cr-11V-3Al
 - In CH₃OH/HCl solution, 245
 - Transgranular cracking, 21, 22, 39, 64, 141, 359
 - Transgranular fracture, 18
- U**
- U-bend stress corrosion test, 347, 348
 - Ultimate tensile strength, 212
- W**
- Weld metal, 85, 94
 - Weldments, 158, 172
 - Type 304 stainless steel, 155
 - Type 308L, dynamic strain testing, 158
- Z**
- Zircaloy-2, 245