

## A

Absorption, reactive  
 process intensification, 2:881  
 Accident Ordinance (StörfallV), 2:975  
 Accident Release Information Program (ARIP), 2:978  
 Acetylene  
 fuel, 2:728  
 Acute exposure threshold level, 2:937  
 Adiabatic reactor  
 for nonhomogeneous, gas–liquid systems, 1:185  
 for nonhomogeneous, solid–solid systems, 1:185, 187  
 heat exchange in, 1:220  
 homogeneous, isothermal, 1:182  
 nonisothermal, 1:183  
 temperature profile in, 1:220  
 Adipic acid  
 synthesis, 2:805  
 Adsorption-distillation process  
 process intensification, 2:891  
 Adsorption, reactive  
 process intensification, 2:884  
 Agitator  
 hollow blade radial flow, 1:633  
 Airlift loop reactor, 1:239  
 downcomer, 1:241  
 Airlift reactor  
 in biochemical engineering, 1:101  
 Algae  
 definition, 1:483  
 Aluminum  
 production in Hall–Héroult cells, 1:477  
 Ammonia  
 two-stage converter, 1:323  
 Annulus reactor, 1:646  
 AOD (Argon-Oxygen-Decarburization) converter, 1:454  
 Arc furnace, 466, 1:455  
 Archimedes number  
 for fluidized beds, 1:385  
 Aris' shape-generalized Thiele modulus, 1:80  
 Arresters  
 for dusts, 2:1008  
 flame, 2:1005  
 for gases, 2:1002  
 Arrhenius number  
 modified, 1:75  
 Aspergillus sojiae  
 solid-state fermentation of, 1:405  
 ATEX Directive, 2:1007  
 ATHEANA, 2:1034  
 Attrition  
 in fluidized beds, 1:387  
 of catalyst, 1:387  
 Autoignition temperature, 2:918  
 Axial dispersion  
 in metallurgical processes, 1:155  
 Axial dispersion model  
 application in hydrometallurgy, 1:156

## B

Baker equation, 2:1084  
 Baker–Strehlow–Tang method, 2:1077  
 Basic process control system, 2:987  
 BASIL process, 2:820  
 Batch chromatographic reactor (BCR), 1:250  
 Batch cultivation, 1:109  
 Batch process  
 laboratory studies, 1:163  
 Batch reactor  
 mathematical treatment of, 1:26  
 Bath smelting furnace, 1:451

Baum equation, 2:1084  
 Bayesian reliability data evaluation, 2:1027  
 Beek and Singer model, 1:207  
 Bent coiled tube reactor, 2:866  
 Benzene  
 dimer reaction, 2:808  
 Bessemer converter, 1:453  
 Biocatalytic membrane reactor, 1:432  
 Biochemical engineering, 1:83  
 Biodiesel, 2:729  
 Biogas, 2:729  
 Biomass  
 fuel, 2:729  
 Bioreactors  
 in biochemical engineering, 1:144  
 Biotechnology  
 applications in fluidized-bed reactors, 1:404  
 chemical reaction engineering in, 1:21  
 Biot number, 1:41  
 Blackman kinetics, 1:485  
 Blast furnace  
 equilibrium control, 1:160  
 Bodenstein number, 1:204, 233  
 Boiler, 2:738  
 Boiling-liquid expanding-vapor explosion (BLEVE), 2:1072, 2:1079  
 Bottom-Blown Oxygen Process (BOP), 1:454  
 Boussinesq approximation, 1:209, 2:1051  
 Box–Wilson method, 1:218  
 Brode equation, 2:1084  
 Bubble anomaly, 1:279  
 Bubble behavior  
 gas-evolving electrodes, 1:278  
 Bubble-cap plate  
 in fluidized-bed reactors, 1:379  
 Bubble column  
 gassing devices for, 1:144  
 microalgae growth in, 1:489  
 Bubble columns, 1:227  
 backmixing, 1:233  
 downcomer, 1:240  
 types, 1:229  
 Bubble coverage, 1:280  
 Bubble curtain, 1:283  
 Bubble detachment, 1:280  
 Bubble distribution, 1:282  
 Bubble flow  
 in fluidized beds, 1:380  
 Bubble geometry, 1:286  
 Bubble growth  
 in gas-evolving electrodes, 1:279  
 Bubble-growth model, 1:381  
 Bubble nucleation  
 in gas-evolving electrodes, 1:279  
 Bubble rise velocity, 1:232  
 Bubble size  
 bubble columns, 1:231  
 Bubbling bed  
 solid recycle system in, 1:386  
 Bubbling fluidized bed, 1:393  
 Buddy manager program, 2:1113  
 Burke–Plummer equation, 1:210  
 Burkhardt model, 2:1111  
 Burner  
 for combustors, 2:731  
 Bursting disk, 2:996  
 Butane  
 fuel, 2:728  
 Butanol  
 fuel, 2:727  
 Bypass  
 in flow models, 1:158

- C**
- Calorimetry  
 plant and process safety, 2:946
- Canadian Environmental Protection Act (CEPA), 2:980
- Capillary gap cell, 1:298
- Carbon  
 sequestration, 2:743
- Carbon dioxide  
 dream reaction, 2:808
- Carbon-in-leach (CIL) process  
 equilibrium control, 1:162  
 neural network models, 1:167  
 process rate limitations, 1:164
- Carbon-in-leach (CIL) reactor cascade  
 schematic, 1:168
- Carbon-in-pulp (CIP) process  
 equilibrium control, 1:162  
 process rate limitations, 1:164
- Carcinogens  
 classification, 2:936
- Carman–Kozeny equation, 1:210
- Catalysis  
 membranes, 1:429, 434
- Catalyst  
 activity profiles, 1:335  
 adiabatic operation, 1:317  
 anisotropic pellets, 1:52  
 bales, 2:862  
 ceramic or metal foams, 2:863  
 deactivation, 1:345  
 egg-shell, 2:858  
 fixed-bed reactor, 1:308  
 isotropic pellets, 1:52  
 laminar flow, 1:314  
 mass- and heat-transfer coefficients, 1:315  
 non-adiabatic operation, 1:318  
 pressure loss, 1:316  
 process intensification, 2:806  
 random packing, 2:862  
 regular arrangement of particles, 2:861  
 regular structure, 1:313  
 Shell-type, 1:359  
 soluble polymer-bound, 2:824  
 structured packings, 2:861  
 thermoregulated phase-transfer, 2:827  
 wall-coated tubes, 1:319  
 washcoated monolithic, 2:858
- Catalyst pellet  
 one-phase model, 1:201  
 two-phase model, 1:200
- Catalyst pellet temperature  
 blowout of, 1:77  
 hysteresis of, 1:77  
 runaway of, 1:77  
 stable operating point, 1:76  
 unstable operating point, 1:76
- Catalyst recycling, 2:830  
 temperature-dependent multicomponent solvent systems, 2:831
- Catalysts, heterogeneous  
 molecular design, 2:810
- Catalysts, homogeneous  
 molecular design, 2:809
- Catalytic reaction  
 degree of occupation, 1:18  
 heterogeneous complex reaction schemes for, 1:18  
 solids mixing in, 1:389
- Catalytic wall reactor  
 characteristic numbers, 2:854
- Catastrophic phase inversion, 1:635
- Caterpillar micromixer, 1:525
- Cavitation  
 acoustic, 2:836  
 hydrodynamic, 2:838
- CDCMENE process, 1:620
- CD Tech catalyst bales, 1:617
- Cell retention, 1:112
- Centrifugal pump  
 in biochemical engineering, 1:148
- Channel furnace, 1:456
- Channel induction furnace, 1:473
- Chemical Emergency Preparedness Program (CEPP), 2:978
- Chemical kinetics  
 standard models for metallurgical processes, 1:168
- Chemical reaction engineering, 1:9
- Chemineer CD6, 1:633
- Chemineer HE 3, 1:628
- Chemostat, 1:637
- Chemshear CS2, 1:636
- Chemshear CS4, 1:636
- Chilton–Colburn analogy, 1:74
- Chromatographic reactor, 1:249  
 analytical, 1:271  
 annular, 2:885  
 batch, 1:263  
 macroscopic design, 1:261  
 microscopic design, 1:262  
 preparative, 1:259  
 racemization processes, 1:270  
 simulated moving bed, 1:263
- Chromatographic separation  
 process control, 1:259
- Circulating fluidized bed, 1:382  
 elutriation diagram in, 1:385
- Circulating fluidized-bed reactor, 1:408  
 flow structureflow structure of, 1:409
- Cleaning  
 plant and process safety, 2:963
- Coal  
 fuel, 2:725
- Coalescence  
 in stirred tanks, 1:635
- Coanda micro mixer, 1:525
- Coke  
 fuel, 2:726
- Combustion  
 adiabatic flame temperature, 2:723  
 air/fuel ratio, 2:722  
 chemistry of gases, 2:722  
 chemistry of liquids, 2:723  
 chemistry of solids, 2:723  
 combustor types, 2:730  
 energy conversion, 2:730  
 flammability limit, 2:722  
 flashpoint, 2:723  
 heat transfer, 2:724  
 ignition, 2:722  
 laminar flame speed, 2:722  
 pollutant reduction, 2:724  
 process, 2:721  
 quenching, 2:724  
 safety aspects, 2:741  
 synthesis, 2:743
- Computational fluid dynamics (CFD), 1:409  
 airlift loop reactor, 1:244  
 bubble columns, 1:236  
 in microreactor simulation, 1:575  
 stirred tanks, 1:639
- Configurational-bias Monte Carlo method, 2:814
- Continuous cultivation, 1:111
- Continuous, ideally mixed, stirred-tank reactor  
 concentration ratio of different reaction order, 1:191  
 kinetics, 1:193  
 mathematical treatment of, 1:27
- Continuous, ideally mixed, stirred-tank reactor, 1:190
- Continuous rotating annular chromatograph (CRAC), 1:250
- Continuous stirred tank reactor (CSTR)  
 bypass, 1:158  
 cascade of, 1:197  
 isothermal heterogeneous system, 1:194  
 kinetics, 1:192  
 nonisothermal, mathematical treatment of, 1:194  
 residence-time distribution, 1:192  
 schematic, 1:155
- Control of Industrial Major Accident Hazards (CIMAHA) Regulation, 2:977
- Control of Major Accident Hazards (COMAHA) Regulation, 2:977
- Converter, 1:452
- COP micro evaporator, 1:550
- Copper smelter, 1:464
- Cracking, thermal  
 of naphtha, 1:400
- Crucible furnace, 1:456
- Crucible induction furnace, 1:470  
 compact vacuum, 1:470  
 line-frequency, 1:471  
 medium-frequency, 1:472  
 vacuum chamber, 1:471

- Crude oil  
fuel, 2:727
- Crystallization-chromatography process  
process intensification, 2:891
- Crystallization-distillation process  
process intensification, 2:890
- Crystallization, reactive  
process intensification, 2:882
- Crystallizer  
mixed suspension, mixed product removal, 1:637
- Current density  
in gas-evolving electrodes, 1:287
- Cyclohexanol  
synthesis, 2:803
- Cyclohexene hydration process, 2:805
- Cyclone  
in fluidized-bed technology, 1:395
- Cyclone mixer, 1:524
- D**
- Damköhler number, 1:30  
process intensification, 2:851
- Danckwerts penetration model, 1:34  
*see also Penetration theory*
- Darcy–Oberbeck–Boussinesq model, 1:209
- Darcy's law, 1:209  
modified, 1:209–210
- Davidson model  
for fluidized beds, 1:380
- Dead-end polymerization, 1:17
- Dead-end reactor, 1:637
- Dead volume  
in flow models, 1:158
- Dean number  
for microreactors, 1:578, 584
- Dean vortex, 1:488
- Deflagration-to-detonation transition, 2:928
- Degree of reactor utilization, 1:60–61
- Degussa BMA reactor, 1:333
- DEMiS reactor, 2:854
- Density functional theory  
process intensification, 2:811
- Derived minimal effect level, 2:938
- DESIGNER  
for design of reactive distillation processes,  
1:614
- Dextran  
production in a chromatographic reactor, 1:269
- 1,3-Dialkylimidazolium chloroaluminate, 2:819
- Dialysis cultivation, 1:115
- Diaphragm pump  
in biochemical engineering, 1:149
- Diels–Alder reaction  
of butadiene, 1:667
- Diesel fuel, 2:726
- Difasol process, 2:819
- Differential thermal analysis (DTA)  
plant and process safety, 2:943
- Dimensionless distribution coefficient, 1:36
- Dimensionless pellet temperature, 1:77
- Dimersol X process, 2:819
- Dirac delta function, 1:25
- Direct numerical simulations  
bubble columns, 1:239
- Discrete bubble model (Euler–Lagrange model)  
bubble columns, 1:238
- Dispersion  
axial in bubble columns, 1:233  
hydrodynamic, in microreactors, 1:598
- Dispersion model, 1:390
- Distillation  
catalytic, 1:610
- Distillation column  
energy efficiency, 2:698
- Distillation, reactive  
applications of, 2:879  
process intensification, 2:877
- Double-skeleton electrode, 1:291
- Down cell, 1:478
- Drift flux model  
airlift loop reactor, 1:241
- Dust explosion, 2:923, 1081
- Dusty-gas model, 1:33
- E**
- Effective diffusion coefficient, 1:46
- Effectiveness factor, 1:47
- Electric-arc furnace, 1:455, 467
- Electrochemical cell  
design, 1:298
- Electrochemical reactors, 1:277  
design, 1:296
- Electrodes  
cubic, 1:295  
horizontal, 1:283  
three-dimensional, 1:283  
three-dimensional, bed-current density, 1:294  
three-dimensional, geometric arrangement, 1:292  
three-dimensional, kinetics, 1:293  
three-dimensional, uses, 1:295  
vertical, 1:283
- Electrodes, horizontal  
in electrochemical reactors, 1:289
- Electrodes, microporous  
in electrochemical reactors, 1:290
- Electrode surface  
bubble behavior, 1:278
- Electrodes, vertical  
in electrochemical reactors, 1:288
- Electromagnetic casting (EMC), 1:469
- Electron-beam furnace, 476, 1:456
- Electron-beam melting (EBM), 1:455
- Electropolishing  
in biochemical engineering, 1:124
- Electroslag refining process (ESR), 1:464
- Electrothermal furnace, 1:455  
production of metals from raw materials  
by reduction, 1:456  
recovery of metals in, 1:457  
refining of specific metals, 1:456  
smelting and melting in, 1:458
- Electrothermal reactor, 1:454
- Eley–Rideal mechanism, 1:19
- Emergency Planning and Community Right-to-Know  
Act (EPCRA), 2:978
- Endothermic reaction, 1:13
- Endothermic reaction  
in metallurgical furnaces, 1:448
- Energy  
storage, 2:739
- Energy management, 2:685
- Enhancement factor, modified, 1:69
- Environmental Emergency Plan, 2:980
- Enzyme membrane reactor, 1:430
- Eötvös number, 1:239, 655
- Ergun equation, 1:655
- Ethanol  
fuel, 2:727
- ETHERMAX process, 1:619
- Ethylene  
preparation in a chromatographic reactor, 1:266
- Euler–Euler formulation, 1:606
- Euler–Euler model  
*see Two-fluid model*
- Euler–Lagrange model,  
*see Discrete bubble model*
- European emission trading system, 2:688
- Event tree analysis, 2:1017
- Exergy analysis  
in plant design, 2:691
- Exothermic reaction, 1:13  
runaway potential, 2:939  
safety evaluation, 2:941
- Explosion, 2:1075  
cases of, 2:1075  
classification into groups, 2:1007  
condensed substances, 2:926  
definition, 2:926  
gas, 2:742  
mechanism, 2:927  
models, 2:1075
- Explosion groups, 2:919
- Explosion limit, 2:907  
determination, 2:909  
temperature and pressure Influence, 2:911
- Explosion protection, 2:1002
- Explosive substances

- classification, 2:927
- testing, 2:928
- Extraction, reactive
  - process intensification, 2:881
- Extractive distillation
  - process intensification, 2:821, 890
- Extrusion, reactive
  - process intensification, 2:892
- Exxon fluid coking process, 1:399
- F**
- Failure
  - dependent, 2:1029
  - repair, 2:1025
- Failure mode and effects analysis (FMEA), 2:1015
- Failure probability, 2:989, 1024
- Failure rate
  - plant and process safety, 2:1023
- Falling-film reactor, 1:642
  - applications of, 1:645
- Fault tree analysis, 2:1020
  - numerical evaluation, 2:1037
  - reliability data, 2:1040
- Fed-batch cultivation, 1:110
- Federal Antipollution Law (Bundes-Immissionsschutzgesetz)
  - plant and process safety, 2:1142
- Feed-limited growth, 1:20
- Fick's first law, 1:32
- Film theory
  - instantaneous reaction, concentration profiles, 1:66
- Filtration
  - sterile, 1:93, 147
- Filtration, reactive
  - process intensification, 2:893
- Fireballs, 2:1071
- Fire point, 2:921
- Fischer-Tropsch synthesis, 1:398
- Fixed-bed reactor
  - in biochemical engineering, 1:115
- Fixed-bed reactor, autothermal, 2:869
  - combination of exo- and endothermic reactions, 2:873
  - equilibrium-limited reactions, 2:872
  - total oxidation, 2:871
  - types of, 2:870
  - weakly exothermic reactions, 2:870
- Fixed-bed reactor, catalytic
  - adiabatic, 1:306, 320
  - adiabatic, design concepts, 1:318
  - autothermal, 1:306
  - autothermal, with recuperative heat exchange, 1:338
  - catalyst packings, 1:363
  - catalyst types, 1:309
  - cooled, 1:330
  - decocking, 1:345
  - feed cycling, 1:356
  - gas-phase reactions, 1:305
  - heated, 1:331
  - heat-transfer media, 1:327
  - influence of coolant flow, 1:337
  - instabilities, 1:342
  - integrated heat exchange, 1:324
  - interstage heat transfer, 1:321
  - isothermal, 1:306
  - liquid-phase reaction, 1:358
  - liquid upflow, 1:363
  - multitubular, 1:306
  - multitubular, design concepts, 1:325
  - periodic flow reversal, 1:349
  - temperature profiles, 1:353
  - thermal and reaction front, 1:344
  - thermoplate, 1:328
- Flammability
  - gases and vapors, 2:906
  - of gases in the GHS, 2:914
- Flash fire, 2:1070
- Flash point, 2:921
  - test equipment, 2:922
- Flash smelting furnace, 1:452
- Flat-panel airlift reactor, 1:489
- Flat-plate reactor, 1:488
- Flex fuel vehicles, 2:730
- Flexi-coking process, 1:400
- Flooding
  - in stirred tanks, 1:633
- Flow
  - flow distribution in microreactors, 1:575
  - laminar, 1:626
  - in packed-bed reactors, 1:209
  - in thin-film reactors, 1:643
  - turbulent, 1:626
- Flow number
  - for stirred tanks, 1:627
- Flow regime
  - heterogeneous or churn-turbulent, 1:230
  - homogeneous, 1:230
  - slug flow, 1:230
- Flow separation, 1:553
- Fluid dynamics
  - bubble columns, 1:235
- Fluidized bed
  - circulating mass flow rate of solids in, 1:384
  - horizontal gas mixing in, 1:393
  - large-diameter, 1:391
  - plant-scale, 1:391
  - pressure gradient in, 1:384
  - residence time of solids in, 1:392
  - solids concentration in, 1:384
- Fluidized-bed combustor, 2:733
- Fluidized-bed drying, 1:392
- Fluidized-bed electrode, 1:295
- Fluidized-bed fermenter, 1:405
- Fluidized-bed furnace
  - high-pressure combustion in, 1:400
  - incineration of sewage sludge in, 1:402
- Fluidized-bed reactor, 1:371
  - bed forms for, 1:373
  - in biochemical engineering, 1:114
  - biogas production in, 1:404
  - biotechnology applications in, 1:404
  - bubbling, 1:407
  - catalytic reaction in, 1:389
  - elutriation in, 1:382
  - estimation of transport disengaging height, 1:382
  - fluid-mechanical principles, 1:374
  - gas distribution in, 1:380
  - gas mixing in, 1:392
  - gas–solid reaction systems, 1:375
  - Geldart diagram for, 1:376
  - heterogeneous catalytic gas-phase reaction in, 1:396
  - mathematical modeling, 1:406–407
  - multiscale CFD modeling of, 1:410
  - noncatalytic gas–solid reaction in, 1:389
  - polymerization of olefins in, 1:399
  - pressure profile in, 1:382
  - Scale-up, 1:411
  - synthesis of acrylonitrile in, 1:397
  - two-phase model, 1:408
  - Wirth state diagram for, 1:380
- Fluidized-bed roaster, 1:378
- Fluidized-bed systems, 1:410
- Forced-flow membrane reactor, 1:431
- Forchheimer model, 1:209
- Frank–Kamenetzki
  - approximation, 1:79
  - temperature profile, 2:939
- Frequency distribution, 1:23
- Froude number, 1:235
  - for fluidized beds, 1:383
  - for gas-evolving electrodes, 1:285
  - low fuel vapor, 2:1063
  - for stirred tanks, 1:626
- Fuel
  - characterization, 2:725
- Furnace, 2:731
- Fused-salt electrolysis cell, 1:477
  - sodium recovery in, 1:478
- G**
- Galileo number, 1:243
  - modified, 1:655
  - for trickle-bed reactors, 1:655
- Gas
  - chemically unstable, 2:917
  - combustion systems, 2:735
  - flammability, 2:914
  - oxidizing potential, 2:915

- Gas chromatographic reactor, **1:266**
- Gas distribution
- bubble columns, **1:229**
- Gas distributor
- for fluidized beds, **1:379**
  - horizontal gas jets, **1:380**
  - vertical gas jets, **1:380**
- Gas engine, **2:735**
- Gas evolution efficiency, **1:282**
- Gas-evolving electrodes, **1:277**
- backflow, **1:284**
  - charge-transfer overpotential, **1:287**
  - diffusion overpotential, **1:287**
  - mass transfer, **1:285**
- Gas-heated reformer, **1:333**
- Gas-lift systems
- in electrochemical reactors, **1:291**
- Gas-liquid systems
- in stirred tanks, **1:632**
- Gas-solid Fluidized-bed reactor
- mathematical modeling, **1:407**
- Gas-sparged reactor, **1:633**
- Gasification, **2:733**
- Gas–liquid hydrodynamic models, **1:236**
- Gasoline, **2:726**
- GASP, **2:1043**
- Gas sparger, dynamic, **1:229**
- ejector jet nozzle, **1:229**
  - momentum-transfer tube, **1:229**
  - two-phase jet nozzle alone, **1:229**
  - Venturi tube, **1:229**
- Gas sparger, static, **1:229**
- dip tube, **1:229**
  - perforated plates and ring, **1:229**
  - porous plates, **1:229**
- Gas tungsten arc welding (GTAW)
- in biotechnology, **1:117**
- Gas turbine, **2:735**
- Glass
- in biochemical engineering, **1:125**
- Globally harmonized system (GHS), **2:972**
- for the classification and labelling of chemicals, **2:906**
- Glucose
- isomerization of, in a chromatographic reactor, **1:268**
- Graphite furnace, **1:465**
- Greenhouse gas emission
- energy management, **2:688**
- H**
- Haldor Topsoe HTRC reformer, **1:333**
- Hardware fault tolerance, **2:989**
- Hashimoto chromatographic reactor, **1:254**
- Hatta number, **1:62–64**
- modified, **1:69**
- Hazard
- characteristics of exothermic processes, **2:942**
- Hazard and operability study (HAZOP)
- guide words, **2:1018**
  - plant and process safety, **2:1015**
- Hazard assessment, **2:958**
- Hazard classes, **2:907**
- Hazardous materials
- handling, **2:961**
- Hazardous substances
- carcinogenic properties, **2:934**
  - classification, **2:929**
  - exposure control, **2:935**
  - plant and process safety, **2:906**
  - regulations, **2:930**
  - short-term exposure limits, **2:937**
  - toxic effect, **2:931**
- Health and Safety at Work (HASAW) Act, **2:977**
- Heat and power (CHP) plant, **2:686**
- Heat exchanger
- counterflow, **1:540**
  - cross-flow, **1:539**
  - electrically powdered, **1:542**
  - energy efficiency, **2:698**
  - heat pipe, **1:544**
  - induction heating, **1:542**
  - microwave, **1:542**
  - optimum heat recovery, pinch technology, **2:712**
  - pinch technology, **2:713**
  - process intensification, **2:849**
  - without heat recovery, pinch technology, **2:711**
- Heat exchanger network (HEN), **2:710**
- Heat-exchanger reactor, **1:604**
- countercurrent, **1:604**
  - 2D finite-volume simulation, **1:605**
  - 3D finite-volume simulations, **1:605**
- Heat-integrated distillation column (HIDIC), **2:695**
- Heat-transfer coefficient, **1:74**
- Heating
- types of, in metallurgical furnaces, **1:456**
  - with laser, **1:456**
- Heat transfer
- airlift loop reactor, **1:244**
  - bubble columns, **1:235**
  - in gas-evolving electrodes, **1:287**
  - in microreactors, **1:581**
  - process-to-process, **2:708**
  - with reaction in series, **1:74**
  - with simultaneous reaction, **1:79**
  - in thin-film reactors, **1:643**
  - in trickle-bed reactors, **1:658**
- Heaviside step function, **1:25**
- HEN *see* Heat exchanger network
- Herringbone mixer, **1:526**
- H-Statements, **2:933**
- Higbie penetration model
- for simultaneous reactions, **1:54**
- High-temperature Winkler (HTW) process, **1:403**
- Hinterland ratio, **1:60**
- Holdup gas
- airlift loop reactor, **1:242**
  - bubble columns, **1:233**
- Holdup, liquid
- dynamic, **1:655**
  - external, **1:655**
  - internal, **1:655**
  - residual, **1:655**
- Honeycombs, **2:857**
- Human error
- plant and process safety, **2:1030**
- Hybrid membrane process, **2:891**
- Hydroformylation
- catalysts for, **2:809**
- Hydrogen
- fuel, **2:728**
  - release from gas-evolving electrodes, **1:281**
- Hydrogen peroxide propylene oxide (HPPO)
- process, **2:802**
- Hydrophilic polyalkene oxide (PAO), **2:827**
- Hyflon membrane, **1:436**
- I**
- Impeller
- for stirred tanks, **1:627**
  - marine-type, **1:191**
- Incident Ordinance (StörfallV)
- plant and process safety, **2:1144**
- Induction furnace, **469, 1:456**
- channel induction, **1:469**
  - crucible induction, **1:469**
  - special, **1:474**
- Inoculation, **1:109**
- Interelectrode gap
- flow in, **1:283**
  - Ohmic resistance of, **1:282**
- Interfacial area, specific
- bubble columns, **1:234**
- Internal combustion engine, **2:734**
- Ionic liquids
- process intensification, **2:818**
- Iron blast furnace, **1:450**
- Isasmelt process, **1:452**
- J**
- Jet fire, **2:1072**
- Joule effect
- in furnaces, **1:468**
- Joule–Thomson microcooler, **1:541**
- Joule's law
- application of, in electrothermal furnaces, **1:458**

- K**  
 KATAMAX, 2:862  
 KataMax technology, 1:617  
 KATAPAK-S, 2:862  
 KataPak technology, 1:617  
 Kellogg-Orthoflow system, 1:397  
 Kerosene, 2:726  
 Key performance indicator (KPI), 2:700  
 Kinetic model  
   for first-order reactions, 1:56  
 Kinetics  
   of continuous, ideally mixed stirred tank reactors, 1:193  
   of continuous stirred-tank reactors, 1:193  
   of gases in liquids with reactants from both, 1:65  
   in microreactors, 1:600  
 Kivcet furnace, 1:464  
 Knudsen diffusion coefficient, 1:46  
 Kunii–Kunugi process, 1:400
- L**  
 Lagrangian particle tracking, 1:592–593  
 Laminar flow  
   in metallurgical processing, 1:155  
   in stirred tanks, 1:626  
   in straight microchannels, 1:575  
 Langmuir kinetics, 1:50  
   Arrhenius curve for, 1:18  
 Langmuir–Hinshelwood theory, 1:19  
   in bimolecular reactions, 1:51  
   oxidation rate of NO, 1:217  
 Large Eddy Simulation (LES), 1:639 2:1047  
 Laser heating, 1:456  
 Layer of protection analysis (LOPA), 2:1036  
 Lenz's law  
   for furnaces, 1:470  
 Lewis number, 1:74  
 Life-cycle analysis  
   micro process technology, 1:497  
 Lightnin' A 315, 1:628  
 Lightnin' KT-3, 1:632  
 Limiting oxygen concentration, 2:925  
 Linde's isothermal reactor, 1:326  
 Linz–Donawitz Arbed Centre process (LDAC), 1:454  
 Linz–Donawitz process (LD), 1:454  
 Liquefied petroleum gas  
   fuel, 2:728  
 Liquid chromatographic reactor, 1:268  
 Liquid fuel  
   characterization, 2:725  
   combustion systems, 2:734  
   types, 2:726  
 Liquid–liquid biphasic catalysis, 2:820  
 Liquid–liquid systems  
   in stirred tanks, 1:634  
 Liquids  
   combustibility, 2:921  
 Liquid-solid fluidized-bed reactor  
   mathematical modeling, 1:406  
 Ljungström heat-exchanger, 1:351  
 Lockhart–Martinelli parameter, 1:656  
 Log-normal distribution, 2:1028  
 Loss control concept, 2:1104  
 Lower explosion limit, 2:925  
 Lower flammability concentration, 2:1055  
 Lower flammability distance, 2:1053  
 Lubricants  
   in biochemical engineering, 1:125  
 Lumus SRT-1 furnace, 1:669  
 Lurgi fixed-bed gasifier, 1:398  
 Lurgi Sand-cracker, 1:400
- M**  
 Macroconvection  
   in gas-evolving electrodes, 1:278  
 Macrofluid, 1:22  
 Macrokinetics, 1:21  
   heat transfer, 1:74  
   mass transfer without reaction, 1:32  
   mass transfer with reaction, 1:36  
 Macromixing, 1:22, 630  
 Macromixing, 1:22, 630  
   residence-time distribution in, 1:22  
 Magnetizing roasting, 1:443  
 Major accident hazards, 2:972  
 Major accident prevention policy (MAPP), 2:971  
 Major Industrial Accidents Council of Canada (MIACC), 2:979  
 Maleic anhydride  
   from benzene and butane, 2:798  
 Management  
   business continuity, 2:1124  
   of change process, 2:1126  
   crisis, 2:1124  
   emergency response, 2:1124  
   work procedure, 2:1127  
 Management system  
   audits and reviews, 2:1129  
   contractors process, 2:1119  
   design and principle, 2:1116  
   holistic, 2:1135  
   integrated, 2:1131  
   process safety process, 2:1120  
   success factors, 2:1132  
   training process, 2:1118  
 Marangoni effect  
   in gas-evolving electrodes, 1:279  
 Mass-expansion coefficient, 1:210  
 Mass transfer  
   airlift loop reactor, 1:242  
   bubble columns, 1:234  
   effectiveness factor, 1:72  
   enhancement factor, 72, 1:70, 1:72  
   gas side, in trickle-bed reactors, 1:657  
   in a nonporous particle, 1:37  
   in a porous particle, 1:46  
   in gas-evolving electrodes, 1:285  
   in microreactors, 1:589  
   in thin-film reactors, 1:644  
   liquid side, in trickle-bed reactors, 1:657  
   macrokinetics in, 1:32  
   microconvective, 1:286  
   single-phase convection, 1:286  
   two-phase convective, 1:286  
   with reaction in series, 1:36  
   with simultaneous reaction, 1:45  
 Mass-transfer coefficient, 74, 1:35  
   of film theory, 1:56  
   of Higbie penetration model, 1:54  
   of surface renewal model, 1:55  
 Maximum experimental safe gap, 2:918, 1007  
 Maximum explosion pressure  
   gas, 2:920  
   powder, 2:925  
 Maximum oxidizing gas concentration, 2:914  
 Maximum permissible flammable gas concentration, 2:914  
 Maximum rate of pressure rise, 2:920  
 Maximum temperature of synthesis reaction, 2:950  
 Maximum temperature of technical reason, 2:950  
 Mazzoni multitube reactor, 1:648  
 Membrane bioreactor  
   integrated or submerged, 1:433  
   recirculated or external, 1:433  
 Membrane contactor, 1:422  
 Membrane distributor, 1:422  
 Membrane extractor, 1:421  
 Membrane filter  
   in biochemical engineering, 1:147  
 Membrane preparation, 1:435  
 Membrane reactor, 1:419  
   catalytically active membranes, 1:434  
   catalytically inert or passive membrane, 1:434  
   classification, 1:419  
   inorganic membranes, 1:423  
   membrane-assisted catalysis, 1:434  
   organic membranes, 1:426  
   process intensification, 2:887  
 Membranes  
   catalytic, 1:429  
   catalytically active, 1:434  
   catalytically inert or passive, 1:434  
   photoreactor, 1:428  
 Mesomixing, 1:631  
 Metallurgical furnace, 1:439  
 Metallurgical processes  
   equilibria control, 1:160  
   kinetic process, 1:160  
   modeling, 1:164

- rate equations via artificial intelligence, 1:166
- real, 1:159
- residence time distribution, 1:159
- Metallurgical processing
  - reaction engineering, 1:153
- Methane
  - combustion, 2:722
  - dream reaction, 2:807
- Methanol
  - fuel, 2:727
- L-Methionine
  - production in chromatographic reactor, 1:270
- MFI (silicalite) membrane, 1:424
- Michaelis–Menten kinetics, 1:20
- Microalgae
  - aeration, 1:487
  - carbon dioxide supply, 1:487
  - light attenuation, 1:485
  - light fluctuation, 1:486
  - light saturation and dilution, 1:484
- Microalgae reactor, 1:483
  - computational fluid dynamics, 1:487
  - surface-to-volume ratio, 1:485
  - types, 1:488
- Microcalorimetry
  - plant and process safety, 2:946
- Microchannel
  - converging–diverging, flow in, 1:577
  - curved, flow in, 1:576
  - curved, heat transfer in, 1:582
  - straight, flow in, 1:575
  - straight, heat transfer in, 1:582
- Micro chromatography, 1:558
- Microcombustion, 2:744
- Microconvection
  - in gas-evolving electrodes, 1:278
- Micro distillator, 1:556
- Microemulsion
  - process intensification, 2:829
- Microevaporators, 1:550
- Micro extractor, 1:554
- Microfluid, 1:22
- Micro heat exchanger, 1:537, 587
  - classification, 1:539
  - fouling, 1:548
  - heat exchange fundamentals, 1:537
  - heat transfer in microchannels, 1:545
  - scale-out, 1:548
- Microkinetics, 1:11
- Micro membrane reactor, 1:559
- Micromixer, 1:590
  - chaotic, 1:592
  - cross-channel, 1:594
  - multilamination, 1:594–595
  - process intensification, 2:847
- Micromixers
  - banded, 1:527
  - chaotic advection, 1:526
  - classification, 1:518
  - design development, 1:528
  - diffusion-based, 1:521
  - hydrodynamics, 1:531
  - lamellae flow, 1:522
  - microfabrication, 1:528
  - mixing characterization by PIV, 1:530
  - mixing principles, 1:518
  - modeling, 1:528
  - multilamination mixing, 1:522
  - split and recombine, 1:524
  - T-type, 1:521
  - turbulent, 1:527
  - Y-type, 1:521
- Micromixing, 1:590, 630
  - in a stirred vessel, 1:28
- Microorganism
  - growth and bioreaction, 1:87
  - growth rates and Michaelis–Menten constant, 1:88
  - suitable equipment for specific processes and products of, 1:118, 120, 122
- Micro process technology, introduction
  - concepts, 1:496
  - constraints, 1:495
  - green chemistry, 1:498
- Microreactors
  - 3D solution to flow distribution problems, 1:579
  - micro process technology, 1:500
  - multichannel flow domains, 1:578
  - multichannel, heat transfer, 1:584
  - process intensification, 2:850
  - reduced-order flow model, 1:579
- Microreactors, modeling and simulation
  - CFD simulations, 1:579
  - chemical kinetics, 1:600
  - flow distribution, 1:575
  - heat transfer, 1:581
  - mass transfer, 1:589
- Micro rectification, 1:557
- Microseparator
  - process intensification, 2:855
- Microwave dielectric heating, 2:833
- Microwave-assisted organic synthesis, 2:836
- Minimum ignition energy, 2:923
- Minimum ignition temperature, 2:923
- Minimum required amount of inert gas, 2:914
- Miniplant, 2:765
  - automation stages, 2:767
  - construction, 2:766
  - disadvantages, 2:768
  - miniaturization limits, 2:767
- Mixing
  - in biochemical engineering, 1:96
  - in fluidized beds, 1:389
  - horizontal, of solids, 1:391
  - hydraulic, 1:98
  - of gas in bubbling fluidized beds, 1:393
  - of gas in circulating fluidized beds, 1:393
  - macromixing, 1:22
  - micromixing, 1:28
  - pneumatic, 1:98
  - in stirred tank reactors, 1:628
  - time to blend, 1:629
  - vertical, of solids, 1:390
- Mixing principles, 2:849
- Model reactor, 1:179
- Molecular design
  - process intensification on phase level, 2:817
- Molecular diffusion, 1:32
- Molecular dynamics simulation
  - process intensification, 2:812
- Monod equation, 1:20
- Monod model, 1:88
- Monte Carlo simulation
  - process intensification, 2:812
- Moving bed, 1:378
- MRF-Z radial flow reactor, 1:327
- MultiPak technology, 1:617
- Multiphase reactor
  - concepts, 2:860
- Multiple-hearth furnace, 1:445
  - roasting of sulfide ores in, 1:447
  - tungsten slag oxidation in, 1:448
  - vanadium production in, 1:448
- Multiple Reference Frame model (MRF), 1:639
- Multiple stage flash (MSF), 2:697
- Multiplicity
  - of steady states, 1:76
- Multitubular reactor
  - characteristic numbers, 2:854
- MUSIG model
  - bubble columns, 1:238
- N
- Nafion membrane, 1:429
- Nanofibers
  - process intensification, 2:864
- Natural gas
  - fuel, 2:728
- Nernst's law, 1:36
- Net present value (NPV)
  - energy management, 2:689
- Neural network models
  - in metallurgical processing, 1:166
- Newtonian fluid
  - stirred tanks, 1:626
- Newton–Raphson method, 1:215
- Newton number (power number)
  - for stirred tanks, 1:626

- Non-Newtonian fluid
  - stirred tanks, 1:626
- Noranda furnace, 1:452
- Notification of Installations Handling Hazardous Substances (NIHSS)
  - Regulation, 2:977
- Nozzle plate
  - in fluidized-bed reactors, 1:379
- Nusselt correlations, 1:546
- Nusselt number
  - for gas-evolving electrodes, 1:287
- O**
- Occupational exposure limits (OEL), 2:935
  - application of, in electrothermal furnaces, 1:458
  - for three-dimensional electrodes, 1:294
- Organized structures radiation model, 2:1067
- Overpotential
  - in gas-evolving electrodes, 1:287
- Oxygen uptake rate, 1:90
- P**
- Packed-bed reactor, 1:198
  - bed porosity of, 1:203, 1:656
  - energy balance, mathematical treatment of, 1:199
  - mass balance, mathematical treatment of, 1:199
  - mass transport in, 1:204
  - mathematical treatment of, 1:205
- Palladium membranes, 1:423
- Parallel-plate cell, 1:298
- Particle-pellet model
  - in metallurgical processes, 1:170
- Particle size distribution
  - of bed solids, 1:392
- Péclet number, 1:204
- Peat
  - fuel, 2:726
- Penetration theory, 1:33
  - see also Higbie penetration model; Danckwerts penetration model; Surface renewal model; Film theory; Stagnant film model*
- Penetration time, 1:34
- Perfluoroalkanes
  - process intensification, 2:821
- Peristaltic pump
  - in biochemical engineering, 1:148
- Personal protective equipment, 2:959
- Pervaporation
  - in membrane reactor, 1:424
- Phase inversion temperature, 1:635
- PHAST, 2:1046
- Phenol
  - cumene process vs. direct oxidation with nitrous oxide, 2:800
- Photocatalysis
  - process intensification, 2:832
- Photocatalytic membrane reactor, 1:429
- Photocatalytic reactor, 2:832
- Photosynthesis–irradiance
  - microalgae, 1:484
- Pinch analysis, 2:706
- Pinch principle, 2:709
- Pinch technology, 2:705
  - cold composite curve, 2:707
  - energy–capital trade-off, 2:710
  - grand composite curve, 2:709
  - hot composite curve, 2:707
- Pipe
  - in biochemical engineering, 1:142
- Piston pump
  - in biochemical engineering, 1:148
- Pitched blade turbine, 1:626
  - Plant and process safety, introduction, 2:901
- Plant and process safety, risk communication
  - informal procedures, 2:1145
  - normative procedures, 2:1142
- Plant design
  - energy efficiency, 2:691
- Plant information system, 2:700
- Plant operation
  - control design, 2:700
  - energy efficiency, 2:700
- Plasma furnace, 475, 1:456
- Plug flow, 1:154
  - deviations from, 1:158
- Plug flow model
  - in microreactors, 1:602
- Plug-flow reactor (PFR)
  - mathematical treatment of, 1:26–27
  - schematic, 1:154
- Poincaré map
  - for microreactors, 1:593
- Poiseuille flow
  - in microreactors, 1:599
- Polydimethylsiloxane (PDMS) membrane, 1:426
- Polyimide membrane, 1:427
- Poly(*N*-isopropylacrylamide), 2:824
- Polymerization
  - complex reaction scheme for, 1:16
- Polymers
  - in biochemical engineering, 1:124
- Pool fire, 2:1057
  - bounding materials, 2:1059
  - large, 2:1062
  - modeling, 2:1064
- Population balance methodology
  - in metallurgical processes, 1:171
- Porous-media model, 1:580
- Power law
  - equation, 1:15
- Power number, 1:626
  - see also Newton number*
- Power plant
  - cogeneration, 2:737
  - combined cycle, 2:738
  - distributed and centralized, 2:738
  - pulverized coal, 2:736
  - thermal, 2:735
  - trigeneration, 2:737
- Prandtl number, 1:235
  - for gas-evolving electrodes, 1:287
  - for microreactors, 1:582
- Pressure-relief device, 2:997
- Process control engineering
  - control system, 2:987
  - equipment, 2:988
  - initiation of safety devices, 2:993
  - monitoring system, 2:987
  - operation of safety systems, 2:991
  - principles of safety systems, 2:990
  - safety instrumented system, 2:987–988
  - safety techniques, 2:985
  - systems, classification of, 2:986
- Process design
  - coupled distillation, 2:715
  - energy efficient, 2:712
  - feed-effluent heaters, 2:715
  - fluid–fluid heat transfer, 2:715
  - multi-stage designs, 2:714
  - in reactive distillation, 1:613
  - steam generation, 2:713
- Process development
  - basic flow diagram, 2:774
  - chemical plant structure, 2:754
  - costs, 2:759
  - criteria for reducing variant numbers, 2:760
  - cyclic pattern, 2:758
  - data banks, 2:760
  - depreciation, 2:782
  - economic risk, 2:788
  - energy costs, 2:778
  - energy management in, 2:689
  - evaluation, 2:773
  - expert system, 2:762
  - feedstock costs, 2:778
  - fundamentals, 2:749
  - improving technical reliability, 2:783
  - integrated trial plants, 2:765
  - investment, 2:775
  - ISBL investment costs, 2:776
  - laboratory experiments, 2:763
  - microplant, 2:765
  - miniplant, 2:765
  - OSBL investment costs, 2:777
  - pilot plant, 2:768
  - plant construction, 2:768
  - process flow diagram, 2:775
  - production costs, 2:778



- project execution, 2:769
  - in reactive distillation, 1:615
  - return on investment, 2:786
  - simulation program, 2:760
  - small-scale tests, 2:764
  - staff costs, 2:781
  - stages, 2:756
  - study report, 2:773
  - tasks, 2:755
  - waste-disposal costs, 2:780
  - waste-disposal flow diagram, 2:775
  - Process hazard assessment and safety evaluation (PHASE), 2:941
  - Process intensification
    - classification, 2:796
    - comparison of conventional and microplant process, 2:846
    - constituents of, 2:795
    - definition, 2:794
    - micro process technology, 1:499
    - miniaturization of equipment, 2:845
    - molecular descriptors, 2:799
    - at molecular level, 2:797
    - phase level, 2:821
  - Process optimization, 2:716
  - Process Safety Management (PSM), 2:978
  - Process simulators, 2:716
  - Production site management
    - energy efficiency, 2:701
  - Propane
    - fuel, 2:728
  - Propylene oxide
    - reaction routes, 2:801
  - Pseudohomogeneous model
    - in trickle-bed reactors, 1:660
  - Pseudo-steady state, 1:14
  - Pseudo-steady-state approximation
    - in metallurgical processes, 1:170
  - Public Safety and Emergency Preparedness Canada (PSEPC), 2:979
  - Pullman–Kellog Millisecond furnace, 1:670
  - Pump cell, 1:298
  - Pyrox process, 1:403
- Q**
- Quantum chemical calculation
    - process intensification, 2:811
- R**
- Rachette furnace, 1:449
  - RADFRAC
    - for simulation of reactive distillation processes, 1:615
  - Rate-controlling step
    - in trickle-bed reactors, 1:660
  - Reaction, chemical
    - influence of concentration, 1:12
    - influence of temperature, 1:11
    - principles of reaction engineering, 1:9
    - selectivity of reactions in series, 1:42
    - selectivity of simultaneous reactions, 1:62
  - Reaction engineering potential
    - chemical intensification, 1:510
    - transport intensification, 1:508
  - Reaction, equilibrium, 1:13
  - Reaction kinetics
    - chemical rates, 1:10
  - Reactive chromatography
    - continuous, 2:885
    - discontinuous, 2:884
  - Reactive distillation, 1:609
  - Reactor
    - degree of reactor utilization, 1:60–61
    - design equations for model reactors, 1:179
    - desorptive cooling, 2:875
    - monolithic, 2:859
    - optimization of, 1:214
    - production of biogas, 1:405
    - sorption-enhanced, 2:886
    - with three-dimensional electrodes, 1:292
  - Reason model, 2:1106
  - Reduction resistance furnace, 1:460
    - production of carbides in, 1:462
    - production of ferroalloys in, 1:462
    - production of lead from sulfide ores in, 1:464
    - production of matte in, 1:463
    - slag cleaning in, 1:464
  - Refining resistance furnace, 1:464
  - Reporting of Injuries, and Dangerous Occurrences Regulations (RIDDOR), 2:977
  - Residence time
    - stirred tanks, 1:637
  - Residence time distribution
    - continuous stirred-tank reactor, 1:155
    - micromixer, 1:531
    - plug flow reactor, 1:154
    - of solids in fluidized beds, 1:392
    - in thin-film reactors, 1:643
  - Resistance furnace, 1:458
    - indirect heating, 1:455
    - production of nickel/ferro-nickel in, 1:458, 463
    - with direct resistance, 1:455
  - Return on investment (ROI)
    - energy management, 2:689
  - Reversed-flow reactor (RFR), 1:254
  - Reynolds Average Navier–Stokes (RANS), 1:639
    - approach, 2:1047
  - Reynolds number, 1:235
    - in curved channels, 1:576
    - for fluidized beds, 1:377
    - for gas-evolving electrodes, 1:285–286
    - for microreactors, 1:583
    - in multichannel reactors, 1:580
    - SAR mixer, 1:598
    - for stirred tanks, 1:625
    - for trickle-bed reactors, 1:655
  - Rhodes and Geldart model
    - for fluidized beds, 1:382
  - R-Phrases, 2:933
  - Riser cracker, 1:396
  - Rising-film reactor, 1:642
  - Risk
    - acceptance criteria, 2:1096
    - analysis, 2:1095
    - communication, 2:1141
    - individual, 2:1097
    - limit values, 2:1099
    - perception, 2:1139
    - permit-to-work systems, 2:964
    - plant life cycle, 2:1143
    - requirements SIL1 and SIL2, 2:989
    - requirements SIL3, 2:990
    - societal or collective risk, 2:1099
  - Risk Management Plan (RMP), 2:979
  - Risk management process, 2:1130
  - Root cause analysis, 2:1107
    - incident reporting, 2:1109
  - Rotary kiln
    - design of, 1:439
    - ore reduction in, 1:442
    - production of cement clinker in, 1:442
    - roasting and calcining in, 1:441
  - Rotating cylinder, 1:298
  - Rotating packed bed
    - process intensification, 2:839
  - Rushton impeller, 1:97
  - Rushton turbine, 1:624
- S**
- Saccharomyces cerevisiae
    - production of ethanol with, 1:405
  - Safe failure fraction, 2:989
  - Safety
    - characteristics derived from explosion diagram, 2:913
    - handling of chemicals, 2:960
    - inherent, 2:1104
    - maintenance and inspection, 2:1125
    - plant and process safety, 2:956
    - production process operation, 2:1122
  - Safety concept, 2:1008
    - process control engineering, 2:985
  - Safety devices, 2:993
  - Safety integrity level, 2:989
  - Safety Management System (SMS), 2:972
  - Safety regulation
    - Accident Ordinance, 2:976
    - Canada, 2:979
    - European Union, 2:969
    - Germany, 2:975

- USA, 2:978
  - Safety Report, 2:972
  - Safety tasks
    - plant and process safety, 2:1103
  - Safety valves, 2:993
    - properties, 2:995
  - Sampling
    - plant and process safety, 2:961
  - Sauter diameter
    - bubble columns, 1:231
  - Scaba 6SRGT, 1:633
  - Scale-up
    - of fluidized-bed reactors, 1:411
  - Schmidt number
    - for gas-evolving electrodes, 1:286
    - for trickle-bed reactors, 1:658
  - Segregation
    - complete segregated fluid, 1:30
  - Selectivity, 1:11
    - of reactions in series, 1:42
    - of simultaneous reactions, 1:62
  - Self-accelerating electron gun
    - Pierce type, 1:476
  - Semenov temperature profile, 2:939
  - Semiquantitative fault tree analysis (SQUAFTA), 2:1037
  - Separation, reactive
    - process intensification, 2:877
  - Seveso Directive, 2:970
    - legal requirements, 2:1115
    - management systems, 2:1115
  - Seveso II Directive, 2:970
    - structure, 2:972
  - Shaft furnace, 1:378, 449
  - Shell-and-tube heat exchanger, 1:642
  - Shell HDS process, 1:661
  - Sherwood number, 1:243
    - for gas-evolving electrodes, 1:286
    - for thin-film reactors, 1:644
    - for trickle-bed reactors, 1:658
  - Shrinking core model, 1:40
    - limitations, 1:170
    - in metallurgical processes, 1:168
    - variants, 1:170
  - Silgrain process, 1:172
  - Silicon carbide furnace, 1:466
  - Simulated moving bed chromatographic reactor (SMBR)
    - process intensification, 2:885
  - Simulated moving bed chromatographic reactor (SMBCCR), 1:251
  - Single-phase fluid
    - mixing, 1:629
  - Slag–matte furnace, 1:461
  - Sliding Mesh model, 1:639
  - SL/RN process
    - for sponge iron production, 1:444
  - SMART process
    - reactor, 1:324
  - Sohio process, 1:397
  - Solid fuel
    - characterization, 2:725
    - combustion systems, 2:732
    - types, 2:725
    - process intensification, 2:822
  - Solid–liquid systems
    - in stirred tanks, 1:631
  - Solid-phase synthesis
  - Solid polymer electrolyte cell, 1:298
  - Solids
    - in stirred tanks, 1:631
  - Solid-state resistance furnaces, 1:465
  - Solix reactor, 1:489
  - Solvent-resistant nanofiltration (SRNF) membranes, 1:427
  - Solvent system
    - temperature-dependent multicomponent, 2:830
  - Söderberg electrode, 1:460
  - SPAR-H, 2:1034
  - Specific target organ toxicity, 2:934
  - Spill fire, 2:1057
    - fuel effect, 2:1060
  - Spinning disk reactor
    - process intensification, 2:840
  - Split-and-recombine (SAR) micromixer, 1:524
  - Split-and-recombine (SAR) mixer, 1:597
  - Staggered herringbone mixer (SHM), 1:593
  - Stagnant film model, 1:34
    - see also Penetration theory*
  - Standard airlift reactor
    - in biochemical engineering, 1:130
  - Stanton number, 1:235
  - StarLam interdigital multilamellae mixer, 1:524
  - State diagram
    - Geldart, for fluidized-beds, 1:377
    - Reh, for fluidized-beds, 1:377
  - Static helical mixer, 1:488
  - Static mixer
    - process intensification, 2:862
  - Steel
    - vessel material in biochemical engineering, 1:117
  - Sterilization
    - in autoclave, 1:92
    - in biochemical engineering, 1:91
    - continuous water/steam, 1:93
    - “empty” sterilization in place (SIP), 1:93
    - “full” sterilization in place (SIP), 1:93
    - steam, 1:92
  - Stirred tank reactor (high relevance), 1:624
    - baffled, 1:624
    - batch, 1:637
    - in biochemical engineering, 129, 1:97
    - cascade of, 1:638
    - continuous, 1:637
    - mixing, mathematical treatment, 1:27
    - semi-batch, 1:637
  - Stirrer
    - co-axial, 1:630
    - high shear, 1:628
    - radial flow, 1:633
  - Stoichiometric coefficient, 1:10
  - Stone & Webster USC furnace, 1:670
  - Stripping, reactive
    - process intensification, 2:879
  - Strouhal–Froude number relationship, 2:1060
  - Strouhal number, 2:1060
  - Submerged-arc furnace, 1:460
  - Sucrose
    - inversion of, in a chromatographic reactor, 1:268
  - Sulfonation
    - in Mazzoni multitube reactor, 1:648
    - in multitube reactors, 1:648
    - in single-tube reactors, 1:648
  - Sundaram and Froment kinetic model, 1:678
  - Supercritical fluid
    - physical properties, 2:827
    - process intensification, 2:824
  - SuperFocus interdigital micromixer, 1:523
  - Supersonic flows, 2:838
  - Supported ionic liquid phase catalysis (SLIP), 2:820
  - Surface renewal model, 1:34
    - see also Penetration theory*
  - Swiss-roll cell, 1:298
  - SYNTHESIZER
    - for design of reactive distillation processes, 1:614
  - Synthol reactor, 1:398
- T**
- TAME process, 1:620
  - Tanks-in-series model, 1:159
  - Taylor–Aris analysis
    - microreactors, 1:599
  - Taylor–Aris dispersion, 1:599
  - Taylor flow, 2:866
  - Taylor number
    - for thin-film reactors, 1:644
  - Taylor vortex, 1:488
  - Taylor vortice, 1:112
  - Technique for human error rate prediction (THERP), 2:1030
  - Thermal-expansion coefficient, 1:210
  - Thiele modulus, 1:47
    - Aris shape-generalized, 1:49
    - shape-generalized, 1:48
  - Thin-film reactor
    - back-mixing in, 1:643
    - falling film, 1:642
    - fluid dynamics in, 1:643
    - mass transfer in, 1:642
    - rising film, 1:642

- sulfonation in, 1:647
- temperature profile in, 1:644
- wiped film, 1:642
- Three-electrode arc furnace, 1:467
- Three-phase trickle-bed reactor, 1:651
  - flow regimes in, 1:653
  - liquid holdup in, 1:655
- TNT equivalency method, 2:1076
- Transport disengaging height (TDH), 1:382
- Trickle tower cell, 1:298
- 1,3,5-Trimethylbenzene
  - hydrogenation of, in a chromatographic reactor, 1:267
- True moving bed chromatographic reactor (TMBCR), 1:251
  - process intensification, 2:885
- Tubular reactor, 1:665
  - coking and carbon formation, 1:677
  - for gas-phase chlorocarbon cracking reactions, 1:673
  - for gas-phase halogenation processes, 1:675
  - microalgae growth in, 1:491
  - for olefin production, 1:666, 668
  - for perhalogenation, 1:677
  - reactor design, 1:668
  - for substitutive bromination, 1:677
  - for substitutive chlorination, 1:675
  - temperature control, 1:671
  - turbine, 1:191
- Turbulence promoters, 1:298
- Turbulent flow
  - in stirred tanks, 1:626
- Two-effect distillation, 2:695
- Two-fluid model (Euler–Euler model)
  - bubble columns, 1:236
- U
- Ultrahigh power furnace (UHP), 1:468
- Ultrasound
  - process intensification, 2:837
- Uninhibited growth, 1:20
- Unipol–Shell fluidized-bed process, 1:399
- Unipol process, 1:399
- Unit step function, 1:25
- V
- Vacuum arc refining (VAR) furnace, 1:468
- Vacuum induction furnace, 1:456
- Vacuum melting, 1:455
- Valve
  - in biochemical engineering, 1:137
  - electrode, 1:290
- Van Krevelen–Hofijzer approximation, 1:68
- Vapor cloud explosion, 2:1076
- Vibromixer, 1:98
- Vortex formation, 1:626
- W
- Waelz process, 1:444
- Wall heat-transfer coefficient
  - for packed-bed reactors, 1:205
- Waste
  - fuel, 2:726
  - waste-to-energy, 2:734
- Water electrolysis, high-temperature, 1:277
- Water-bed reactor, 1:488
- Weber number
  - bubble columns, 1:231
- Wetting
  - of large catalyst zones, 1:659
  - of a particle, 1:659
- Winkler gasification, 1:403
- Wirbelfliess process, 1:400
- Wood
  - fuel, 2:725
- Z
- Zeolite membranes, 1:424
- Zero-gap cell, 1:298

