

## Index

### **a**

- accelerators 133f., 137f., 309
- acoustic emission (AE) 232
- actuators 167, 169, 309
- additives
  - liquid-phase forming 432
  - tempering 11
- admixtures
  - air-entraining agents 139ff.
  - chemical 139f.
  - mineral 138f.
  - water-reducing agents 140f., 145
- aggregation
  - particles 120, 483
  - solid-solid 38
- Alkemade
  - line 65f.
  - theorem 64f., 69, 89
- Allen–Dynes–McMillan semi-empirical formula 527
- alumina 159, 161, 175ff.
  - $\alpha$ - 175, 186
  - activated 196
  - applications 185ff.
  - armor materials 192
  - $\beta$ - 161, 186, 194ff.
  - bioceramic 351, 357ff.
  - cutting tool bits 188ff.
  - direct copper-bonded (DCB) substrates 192
  - extraction 176f.
  - filter for molten metals 188
  - grinding materials 190f.
  - high-purity 175, 185
  - metastable 182
  - polycrystalline 187, 190
  - processing 176ff.
  - properties 176
  - sodium-sulfur battery 194ff.

- spark plugs 188
- structure of polymorphs 178ff.
- stuffed 185f.
- transitional phases 176, 179, 182ff.
- alumina-to-iron ratio (AR) 123
- aluminum nitride 452ff.
  - applications 454ff.
  - processing 452f.
  - synthesis 452f.
- amorphous
  - boron nitride 448
  - calcium phosphate (ACP) 370, 375
  - silicon boron nitride 423
  - silicon nitride thin films 462f., 466
- Association Internationale pour L'Etude des Argiles (AIPEA) 19, 26f.
- Aurivillius phases 274
- average annual growth rate (AAGR)
  - advanced ceramics 163, 168
  - ceramic coatings 166

### **b**

- Bardeen–Cooper–Schrieffer (BCS) approach 319, 322, 324, 331, 525ff.
- BaTiO<sub>3</sub> 256f., 270, 273ff.
  - grain size 268
  - single crystal 265
  - tetragonality 267f., 275
- Bayer process 177
- Becher process 237
- bending strength
  - advanced structural ceramics 159
  - four-point 185
  - zirconia 205, 363
- Bigot diagram 49
- binodal 83
- biactive
  - glasses 368f.

- hydroxyapatite 352ff.
- hydroxycarbonate apatite (HCA) 354
- bioceramics 160, 168, 347ff.
- bioapatite 349f.
- femoral ball heads 396ff.
- ferroelectric hydroxyapatite–barium titanate (HABT) 392
- Sponceram 363
- total hip replacement (THR) 348, 351f., 358
- bioceramic substrate
- Ti6Al4V 349, 362, 364, 382, 385ff.
- Ti6Al7Nb 349
- biocompatibility 352ff.
- materials 352f.
- Ti 365
- ZrO<sub>2</sub> 361ff.
- bioconductive ceramics 365ff.
- bioelectric phenomenon 388ff.
- bioglasses 365ff.
- applications 368
- hydrolytic stability 366
- PerioGlas 368
- S53P4 368
- bioinert materials 349, 353, 356
- alumina 359ff.
- Y-stabilized zirconia (Y-TZP) 361ff.
- biomimetic synthesis 484
- biomineralization 348f.
- BNT (bismuth sodium titanate) 273, 278ff.
- Bogue equation 122
- Boltzmann
- constant 527
- parameters 298
- bonding
- bioactive 367
- bone 366
- chemical 6f., 422
- cohesive 190
- covalent 260, 422f.
- ionic 260, 373, 422f.
- metallic 422f.
- mixed 423
- van der Waals 25
- bone growth
- acceleration 388ff.
- ectopic 357
- electric field 388ff.
- bone healing 389f.
- bone replacement material
- PGA (polyglutamic acid) 357
- PLA (polyactic acid) 357
- bony on-growth 359
- boron carbide 424ff.
- applications 424f., 427ff.
- mechanical properties 426
- processing 425
- structure 426
- boron nitride 161, 442ff.
- applications 447ff.
- cubic (c-BN) 442, 444ff.
- graphite-like 442, 445
- hexagonal (h-BN) 442ff.
- nanostructured 448, 452
- processing 443
- rhombohedral (r-BN) 445
- structure 445
- synthesis 443
- wurzite-type (w-BN) 442, 445ff.
- zinc blende-type (z-BN) 442, 445
- Bose–Einstein condensate 330f.
- Bourry diagram 48f.
- Box–Behnken design 485
- bricks 2, 8
- fireclay 84
- silica 79f.
- supersilica 79
- Bridgman technique, *see* single crystal
- Brillouin zone 507
- brittle 42, 196
- Brownmillerite, *see* ferrite
- bubble bridges 140f.
- building blocks 326ff.
- charge reservoir 329
- rocksalt 326f.
- structural 328f.
- Burns temperature 277
- butterfly loop 272
  
- c**
- Cahn free energy curve 522f.
- Cahn–Hilliard approach 523
- calcination 29
- alumina transitional phases 182ff.
- aluminum hydroxide 178
- carbides 424ff.
- BC, *see* boron carbide
- SiC, *see* silicon carbide
- carbon 161
- diamond-like (DLC) 406
- carbon nanotubes (CNTs) 171
- single-walled (SWCNTs) 322
- carborundum, *see* silicon carbide
- carbothermal reduction 197
- cast-iron 472f.
- cation-exchange capacity 49

- CaTiZr<sub>3</sub>(PO<sub>4</sub>)<sub>6</sub> 362, 382ff.
- in vivo performance coatings 388
- NASICON 382, 386, 392
- plasma-sprayed powder 385f.
- properties 382f.
- resorbable 393ff.
- solubility 383f., 286f.
- structure 382f.
- CCTO (CaCu<sub>3</sub>Ti<sub>2</sub>O<sub>12</sub>) 257
- cements
  - aluminate 88f.
  - blast furnace 120
  - belite 119
  - densified systems containing homogeneous arranged ultrafine particles (DSP) 142
  - environmental benefits 148f.
  - hardening 136
  - macro-defect-free (MDF) 120, 143f., 150
  - ordinary Portland (OPC) 120f., 143, 149
  - polymer fiber-reinforced 120
  - Portland cements 86, 88f., 119f.
  - setting 136
  - sulfate-resistant alumina 120, 130f.
  - sulfate-resistant Portland cements (SRPC) 139, 149
  - water paste (W/C ratio) 140
- ceramics
  - chemically bonded (CBCs) 7, 119
  - classification 6ff.
  - matrix composite (CMC) 170
- charge density waves (CDWs) 321
- chemical potential 56f., 66
- chlorite process 236
- CGG (calcium gallium germanate) compounds 294ff.
- electrical conductivity 297
- optical activity 298
- structure 295f.
- synopsis 300f.
- Clausius–Mosotti equation 262
- Clay Minerals Society (CMS) 27
- clay minerals 11ff.
  - formation 13ff.
  - illite 13, 16, 19ff.
  - immature 15
  - kaolinite 13, 18f., 100ff.
  - mature 15
  - mica 15
  - montmorillonite 22ff.
  - natural 12ff.
  - nomenclature 26ff.
  - smectite 13, 16, 23, 26
  - structure 16
- synthetic 27f.
- transformation 13ff.
- clay powder forming 30ff.
- clay powder processing 30
  - Hofmeister series 40ff.
  - structural viscosity 37ff.
- clinker 120f.
- formation 122, 127
- hydration 128ff.
- coating
  - antimicrobial coatings 243
  - atmospheric plasma spraying (APS) 226f., 230, 363, 375, 385ff.
  - cathodic arc deposition 362
  - chemical vapor deposition (CVD) 166, 182, 194, 233, 242, 462f., 467
  - cold gas dynamic spray (CGDS) deposition 242f.
  - dip- 166
  - electron beam physical vapor deposition (EB-PVD) 226ff.
  - high-temperature thermal barrier (HT-TBC) 494
  - high-velocity oxyfuel (HVOF) spraying 375
  - hydroxyapatite 352
  - laser-assisted thermal spraying 166
  - low-pressure plasma spraying (LPPS) technique 225f., 363, 372, 375, 386ff.
  - magnetron sputtering 242, 363
  - micro-arc oxidation (MAO) 166
  - nanocrystalline 167
  - physical vapor deposition (PVD) 166
  - porous 233
  - reinforcement 363ff.
  - thermal barrier (TBC) 216, 226ff.
  - thick thermal barrier (TTBC) 229
  - silicon nitride 462
  - sol-gel deposition 166, 242, 385
  - vacuum plasma spray (VPS) 230
- Cockbain relation 283
- coercitive strength, *see* electric field strength
- colloidal
  - gel 137
  - layer 134f., 138
  - suspension 484
  - wet processing 31
- Commission on New Minerals and Mineral Names (CNMMN) 26
- compatibility join, *see* conode
- composite materials
  - abrasion-resistant 143
  - bionanocomposites 25
  - ceramic–ceramic 406, 448

- ceramic matrix (CMC) 169f.
  - ceramic–polymer 271, 349, 406
  - HA<sub>x</sub>/zirconia 364
  - polymer–clay nanocomposites (PCNs) 25
  - superabsorbing polymer–clay nanocomposites (SAPCs) 25
  - compressive strength
  - alumina 358, 360
  - cement 145
  - zirconia 358, 361
  - concrete
  - autoclave aerated (AAC) 144f.
  - composite 138
  - fragmentation 152f.
  - high-performance (HPCs) 138ff.
  - mineral admixtures 138f.
  - recycling 145f., 151f.
  - conductivity
  - electrical 185, 221f., 260
  - ionic 194, 203, 220, 401
  - conjugate phase 64
  - conode 63ff.
  - Cooper pairing 321, 331f.
  - coprecipitation 11, 27
  - cordierite 113f., 161
  - based porcelain 115
  - glass ceramic 115f.
  - corrosion
  - chemical 111, 232
  - high-temperature 79
  - implants 354, 399
  - corrosion resistance 138
  - alumina 360
  - ceramic coatings 166
  - ceramics 157f.
  - cotectic triangles 88f.
  - cracks 112, 205f., 358f.
  - bridging 206
  - critical length 207
  - deflection 185
  - dissipating energy 185, 320, 358f.
  - growth 206
  - length 206f.
  - macro- 375, 400
  - micro- 203, 205f., 227, 375, 392, 400
  - propagation 204, 206
  - subcritical 205
  - tip 205
  - crystal
  - centrosymmetry 261f., 274, 290
  - polarity 261
  - single- 265, 289f., 294, 296f., 303, 432
  - crystallinity index standard (CIS) 21
  - crystallization 62
  - inhibition 137
  - porcelain 91
  - Portland cement 125ff.
  - crystallographic point group 261f., 290
  - crystallography
  - aluminum nitride 453
  - boron carbide 426
  - boron nitride 442f.
  - kaolinite 100
  - silicon carbide 435
  - silicon nitride 463f.
  - CTE, *see* thermal expansion coefficient
  - Curie temperature 263f., 266, 274, 276, 291, 294
  - Curie–Weiss law 264, 277, 280
  - cytocompatibility 361
  - cytotoxic 373
  - Czochralski growth, *see* single crystal
- d**
- Dauphine law 75f.
  - Debye cutoff energy 527
  - decomposition
  - amorphous 386
  - sequence 376
  - thermal 374ff.
  - defects
  - coating 227
  - density 432f.
  - dislocations 133
  - extrinsic 403ff.
  - Frenkel 401
  - intrinsic 403f., 434, 457
  - migration 22
  - ordered 220
  - point 133
  - structure 494
  - deformation energy 33
  - degrees of freedom 57, 63
  - delamination 231, 364
  - density
  - advanced structural ceramics 159
  - alumina 360
  - aluminum nitride 454
  - boron nitride 444
  - cement 121
  - non-oxide ceramics 423, 433
  - SiAlONs 469
  - silicon carbide 433
  - silicon nitride 460f.
  - zirconia 361
  - density functional theory (DFT) 179
  - dynamic 523

- with local-density approximation (LDA) 377f.
- deposition**, *see coating*
- desulfurization of fuel gases 148
- diagenetic-metamorphic zones 21
- dielectric**
  - constant 268, 434
  - loss 265, 268f., 280, 284, 295, 444
  - loss angle 268f., 283
- dielectric materials 256ff.
- history 258
- multiphase 283
- normal 258
- dielectric permittivity 45, 260
- BNT 280
- boron nitride 444
- CGG compounds 299f.
- electronic substrates 193f., 456
- ferroelectric ceramics 263
- giant 257
- PZT 276
- relative 260
- dielectric strength 193f.
- differential thermal analysis (DTA) 63, 103
- diffusion 101, 111
  - barrier 130
  - coefficient 143
  - gradients 389
  - ion 114, 128, 136, 138
  - rate 137
  - solid-state 285
- dilatancy 38f., 294
- dipole momentum 260, 262, 293f.
- direct chlorination 197
- displacement vector 293
- domain**
  - 90° 264, 268
  - 180° 264ff.
  - long-range ordered 277
  - movement 264
  - multi- 265
  - nanosized 277
  - reorientation 271ff.
  - single- 264f.
  - switching 254
  - wall 254
- doping 286
  - cation 220
  - n-type 324, 326, 331
  - p-type 324, 331, 528, 532
  - silicon 468
  - silicon carbide 433
- DRAM (dynamic random access memory) 307
- duplex structures
  - Al<sub>2</sub>O<sub>3</sub>-ZrO<sub>2</sub> ceramics 185
  - zirconia 219
- drying sensitivity index (DSI) 49
- dynamic light scattering 494
  
- e**
- elastic coefficients 300
- elastic modulus
  - alumina 185
  - cement 121
  - silicon carbide 433
- electric field strength
  - breakdown 312
  - coercitive strength 266, 271, 278
  - reverse 271
- electrical conductivity
  - β-alumina 185
  - boron nitride 427
  - CGG single crystals 297
  - n-type 324, 326, 331, 457
  - p-type 324, 331, 427, 457, 528, 532
  - silicon carbide 430
  - superconductors 320
  - zirconia 221f.
- electrical double layer 41ff.
- electrical resistivity
  - boron nitride 444
  - electronic materials 193f.
  - SiAlONs 469
- electrocaloric 254, 291
- electrolyte 30
  - β-alumina 196
  - electrophoretic velocity 45
  - solid-state 221ff.
  - solution 44
- electromagnetic effect 254
- electromechanical coupling
  - coefficient 266f., 272, 291f.
  - CGG compounds 294, 299
  - piezoelectrics 310
- electron density
  - distribution 101f.
  - valence 230
- electron
  - pairing mechanism 322
  - -phonon coupling 527
  - sticking 404f.
- electrooptic ceramics 301ff.
  - constants 302f.
  - coupling coefficient 74, 266, 302
  - Kerr effect 301ff.
  - linear 301
  - lithium niobate (LiNbO<sub>3</sub>) 302

- lithium tantalate ( $\text{LiTaO}_3$ ) 302
- Pockels effect 301
- electrostriction 254f., 259, 511
- emission
  - $\text{CO}_2$  146
  - greenhouse gases 150f.
  - $\text{NO}_x$  146
  - particulate 147
  - visual 147
- VOC (volatile organic compounds) 146
- toxic 145
- enantiomeric transitions (EDT\*),
  - see* transformation
- endoprosthetic implants 349ff.
- energetically distinguishable transformations (EDTs),
  - see* transformation
- energy-dispersive X-ray (EDX)
  - spectroscopy 103, 386
- enthalpy of hydration 128f.
- entropy 65f., 501, 511
  - configurational 502
  - mixing 502
- epitaxial growth 392f., 484
- epitaxy
  - liquid phase (LPE) 434, 487
  - molecular beam (MBE) 487
- erosion 232
  - resistant 215f., 423, 425
- eutectic
  - binary 68
  - composition 60
  - low-melting 109
  - point 60f., 63, 66, 215
  - quaternary 70, 123
  - reaction 505f.
  - temperature 60, 110
  - ternary 65f., 90, 101, 114
- eutectoid 506
- evaporation losses 303
- EXAFS (extended X-ray absorption fine structure) 493
- exothermic
  - peak 101
  - reaction 487
- extrusion 31, 36
  - alignment (EA) 461
- f**
- failure mechanisms 232
- fault current limiters (FCLs) 339
- femoral ball heads, *see* bioceramics
- Fermi
  - energy 526f.
  - liquid-phase 528
- ferrite 131f., 161, 256f.
- ferroelectric ceramics 257ff.
- applications 307ff.
- lead-free 167
- polycrystalline 266, 290
- relaxors 273, 277ff.
- types of structure 270f.
- ferroelastic effect 262
- ferroic materials 254
- ferromagnetics 256f., 266
- fiber
  - glass-fiber reinforced (GRP) 125, 192
  - glassy 83
  - zirconia 216f.
- fibrils 349f.
- firing
  - post 99
  - oxidizing 99, 106f., 109
  - reducing 99, 106, 109
- flame fusion 187
- flexural strength 49
  - alumina 358, 360
  - boron nitride 444
  - cement 143f.
  - ceramics 125, 158
  - electronic materials 193
  - metals 125
  - polymers 125
  - SiAlONs 469
  - silicon carbide 433
  - silicon nitride 460f.
  - structural materials 123
  - zirconia 358, 361
- flocculation 41f., 44, 482f.
- Fourier Transform Infrared (FTIR)
  - spectroscopy 372
- fracture strength 454
- fracture toughness 204
  - alumina 185, 358, 360
  - boron nitride 444
  - cement 144
  - ceramics 125, 157
  - metals 125
  - polymers 125
  - SiAlONs 469
  - silicon carbide 432f.
  - silicon nitride 460f.
  - structural materials 123
  - zirconia 358, 361, 363
- FRAM (nonvolatile ferroelectric random access memory) 307
- freeze-drying 11, 27
- freeze-thaw cycles 140

friction coefficient 397  
 frost resistance 139f.  
 fullerene cluster structure 323  
 functionalization 407

**g**

gas igniters 308  
 Gibbs–Duhem equation 65  
 Gibbs free energy 62, 65, 501f.  
 – curve 504f.  
 – expansion 508  
 – ferroelectric material 510  
 Gibbs' phase rule 55f., 71, 501  
 Gibbs–Helmholtz equation 510  
 Gibbs–Thompson equation 489  
 glass 6f., 101  
 – calcium sodium silicate 86  
 – crystallite model of glasses 515  
 – fiber 83  
 – melt furnace 79  
 – phase 106  
 – silica 198  
 – Y–Si–Al–O–N 470  
 Goldschmidt's tolerance factor 274  
 Graetzel cell 244  
 grain boundary 111, 133, 203  
 – conductivities 221f.  
 – divided deposits 281f., 286  
 – engineering 281ff.  
 – impurity segregation 282  
 – movement 360  
 grain growth 190  
 – abnormal 432  
 – microcrystal 281  
 – template (TGG) 461  
 grain size  
 – alumina 359f.  
 – BaTiO<sub>3</sub> 268  
 –  $\beta$ -silicon carbide 431f.  
 – fine-grained 33, 359, 431f.  
 – zirconia 361  
 grain size distribution 11f., 483, 487  
 – kaolinie 28f.  
 – monodispersed powders 483, 487  
 graphite intercalation compounds (GICs) 323  
 graphite-like boron nitride 445f.  
 green body 30, 167, 483  
 – clay 31, 47  
 – drying 47ff.  
 green processing 453  
 Griffith–Orowan fracture mechanics 204  
 Gutzwiller method 531

**h**

hardness  
 – advanced structural ceramics 159  
 – alumina 176, 190, 192, 360  
 – ceramics 157f.  
 – non-oxide ceramics 423  
 – SiAlONs 469  
 – Vickers 361, 473  
 – zirconia 361  
 Helmholtz–Gouy–Chapman layer,  
*see* electrical double layer  
 Hertzsprung–Russel diagram 429  
 Home's and Uemura's law 530  
 homoatomic 519  
 Honda–Fujishima effect 240  
 Hooke's law 32  
 hopping conduction 427, 530  
 hydraulic  
 – adhesive 6f.  
 – reactivity 122  
 hydration models  
 – delayed nucleation model 133f.  
 – protective layer model 134ff.  
 hydration of clinker  
 – calcium aluminato 129ff.  
 – calcium silicate 128f.  
 – enthalpy 128f.  
 – ferrite 131  
 – models 133ff.  
 – kinetics 132f.  
 – rate 132f., 136  
 hydrolysis 30, 485  
 – C<sub>1</sub>S 128f.  
 – delayed 119  
 hydrolytic polycondensation 485f.  
 hydrolytic stability  
 – bioglass 366  
 – zirconia 401  
 hydrothermal synthesis 29  
 hydroxide gel layer 137  
 hydroxyapatite (HAp) 347, 351, 362f., 369ff.  
 – biological 369ff.  
 – bone-like 371  
 – coatings 351, 363ff.  
 – crystallization 370f., 375  
 – crystallographic structure 370ff.  
 – dehydroxylation 370, 372  
 – nonsubstituted 369  
 – non-stoichiometric defect 377  
 – pore size 362  
 – silicon-doped 369  
 – stoichiometric 377  
 – synthetic 368ff.

- thin films 374
- thick films 374f.
- hydroxycarbonate apatite (HCA) 354, 366
- hysteresis loop 265
  
- i**
- illite 13, 16, 19ff.
- ilmenite 235
- impact resistance 157f.
- impedance 227, 292
- impurities 101, 133
  - concentration 221
  - dissolution 282
  - electroceramics 259
  - grain boundary 282
- indium tin oxide (ITO) 244
- inheritance 12
- injection-molding 31, 36
- insulated-gate field-effect transistors (IGFETs) 458
- integrated
  - circuits (ICs) 490, 494
  - high-temperature electronics 436f.
- intelligent materials 254f.
- interaction
  - bioglass–liquid 367
  - clay–water 8, 32
  - electrostatic 221
  - implants–living tissues 354ff.
  - ion–macromolecule 41
  - particle–particle 41
  - repulsive 330, 427, 482, 530
  - van der Waals 41
  - wetting 482
- intercalation 23ff.
- interface
  - air–water 140
  - bone–material 359
  - glassy phase–ceramic 361
  - liquid–solid 490
  - substrate–coating 364, 375
- interfacial
  - reaction 114
  - strength 366, 374, 390
- intergranular noncrystalline phases 432
- intermediate compound 59f.
- internal barrier layer capacitance (IBLC)
  - model 257
- International Mineralogical Association (IMA) 26
- International Thermonuclear Experimental Reactor (ITER) 332
- International Union of Crystallography (IUCr) 27
  
- invariant
  - equilibrium 59
  - eutectic point 60, 63, 70
  - phase system 58
- ion
  - disordered 221
  - mobility 220f.
  - pnictogen 323, 325
  - vacancies 181, 203f., 220
- ionic
  - conductivity 194, 203, 220, 401
  - radius 61, 104, 220
- isotherms 62, 67
  
- j**
- Jänecke prism, *see* SiAlONs
- Josephson
  - tunneling effect 321
  - tunnel junctions (JTJ) 341
- Joule–Quench technology 493
- Joule–Thompson equation 493
  
- k**
- kaoline, *see* raw materials
- kaolinite, *see* clay minerals
- KDP ( $\text{KH}_2\text{PO}_4$ ) 270f., 302
- kilns
  - cement 146
  - electro-steel 79
  - rotary 120
- kinetic
  - energy 288
  - of phase transition 511
- kinetic stages
  - condensation/repolymerization 367
  - diffusion-controlled 367, 487
  - migration 367
  - nucleation 367
  - surface-controlled 367
- Kondratieff cycles 5
- Kröger–Vink notation 203
- Kübler index (KI) 21f.
  
- l**
- Landau–Ginzburg thermodynamic theory 320, 507
- Landau theory 72, 508ff.
- langanite (LGN) 294f., 297ff.
- langasite (LGS) 294, 297ff.
- langataite (LGT) 294f., 297ff.
- lattice
  - constant 434
  - expansion 23
  - kaolinite 102

– strain 508  
 – tetragonal distortion 267f., 275, 324  
 – vortex 320f.  
 Lea and Parker's equation 127  
 lever rule 60, 504  
 lifetime  
 – coating 231  
 – controlling factors 228f.  
 – femoral ball heads 396  
 light-emitting diodes (LEDs)  
 – aluminum nitride 456f.  
 – organic (OLED) 467  
 – silicon carbides 430, 438  
 lime saturation factor (LSF) 123  
 liquidus  
 – curves 59, 61, 82f., 86, 504  
 – surface 66f.  
 logistic equations, *see* Verhulst equations  
 London penetration depth 525  
 Lorentz factor 262

**m**

magic angle spinning nuclear magnetic resonance (MAS-NMR) 80  
 magnetic field strength 266, 324  
 magnetic levitation 340  
 magnetic resonance imaging (MRI) 338f., 529  
 magnetic shielding 341  
 magnetocaloric effect 254f.  
 magnetoelectric effect 254  
 magnetooptic effect 74, 254  
 magnetostriction 254  
 magnets 164f.  
 Majolica 3  
 mechanical  
 – loading capacity 357  
 – mixture 503  
 Meissner effect 320  
 Meissner–Ochsenfeld effect 320, 340, 525ff.  
 melting  
 –  $\alpha$ -alumina 178  
 – congruent 82, 84, 86  
 – eutectic 82  
 – incongruent 82, 86, 90, 376, 380, 386  
 – skull 233f.  
 melting point  
 – depressing factor 489f.  
 – non-oxide ceramics 423  
 – silicon 432  
 metal insulator–semiconductor (MIS) memory devices 458  
 metal-oxide semiconductor field-effect transistors (MOSFETs) 436

metallic hard materials 422ff.  
 metastable regions 82  
 microelectromechanical system (MEM) 430, 490, 494  
 microgravity 482f., 485  
 microhardness, *see* hardness  
 microstructure  
 – homogeneous 481f.  
 – kaolinite 100  
 – porcelains 90, 92f.  
 – silicon carbide 432  
 microwave dielectric ceramics 165, 281ff.  
 – design 283ff.  
 – resonators 304ff.  
 mineralogical phase rule, *see* Gibbs's phase rule  
 Ming wares 3  
 miscibility gap 21, 70, 83, 211, 522  
 mixed-oxide theory 103  
 modulus of elasticity 32  
 – bioceramics 357  
 – boron nitride 444  
 – SiAlONs 469  
 – silicon nitride 460f.  
 – structural materials 124  
 monotectic 506  
 Monte Carlo simulation techniques 71  
 – reverse (RMC) 74, 78  
 morphotropic phase boundary (MPB) 255, 276f.  
 Mott insulating phase 330, 528, 530f.  
 mullite  
 – composition 83f.  
 – needle-like 93, 104  
 – structure 83f.  
 multilayer capacitors (MLCs) 165, 259, 307

**n**

nanoscaled powders  
 – applications 491  
 – characterization 493  
 – processing 492f.  
 – properties 488f., 492  
 nanotechnology 164  
 Néel temperature 330  
 neof ormation of clay minerals 12, 20, 22  
 Nernst equation 222  
 neutron absorption capability 425  
 neutron diffraction 323  
 neutron scattering 72  
 – diffuse total 78  
 – silica 78f.  
 Newton's law 32

- nondestructive testing (NDT) 231  
 non-oxide ceramics 6, 8, 421ff.  
 – AlN, *see* aluminum nitride  
 – BC, *see* boron carbide  
 – BN, *see* boron nitride  
 – properties 423  
 – SiC, *see* silicon carbide  
 – Si<sub>3</sub>N<sub>4</sub>, *see* silicon nitride  
 nonlinear materials 255  
 – coupling coefficient 266  
 normalized mass loss (NML) 148f.  
 nucleation  
 – bone-like apatite 391  
 – classic nucleation theory (CNT) 489  
 – cordierite glass ceramic 116  
 – homogeneous 485, 523  
 – hydroxyapatite 366f.  
 – inhibition 137  
 – kinetics 83  
 nuclear magnetic resonance (NMR)  
 – spectroscopy  
 – silicon boron nitride 423  
 – HAp 372
- o**
- object-oriented finite element (OOFE)  
 – method 231  
 Ohm's law 525f.  
 osteoblast 349, 356, 362, 365  
 osteoconduction 354, 356, 362, 373, 392  
 osteogenesis 359, 373  
 osteoinduction 354, 356f., 362  
 osteointegration 356  
 osteolysis 389  
 osteostimulation 356f.  
 osteotomy 390  
 Ostwald ripening 489  
 oxyapatite 370, 372, 375ff.  
 oxydation resistance 432  
 oxygen  
 – partial pressure 108, 222  
 – sensor 222  
 – vacancy 84, 204
- p**
- pair distribution function 517  
 paramagnetic resonance spectroscopy 509  
 particle size 49  
 – illite 21  
 – ultrafine SiC 432  
 peptization, *see* dispersion  
 peritectic  
 – point 110, 215  
 – reaction 505f.
- peritectoid 506  
 permittivity  
 – dielectric 45, 193f., 257, 260, 263  
 – electrical 254, 263, 512  
 – inverse 263, 512  
 perovskite 235  
 – complex 285, 288  
 – layered copper oxide 509  
 – partially-ordered complex 288  
 – pseudo-cubic 273  
 – titanate 273  
 phase boundary lines 58, 63f., 67  
 phase diagram  
 – Al<sub>2</sub>O<sub>3</sub> 71  
 – Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 81ff.  
 – Al<sub>2</sub>O<sub>3</sub>–ZrO<sub>2</sub> 191  
 – binary 59ff.  
 – CaO–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 88f., 126f.  
 – CaO–MgO–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 68f., 106, 109ff.  
 – CaO–MgO–SiO<sub>2</sub> 110  
 – CaO–Na<sub>2</sub>O–P<sub>2</sub>O<sub>5</sub>–SiO<sub>2</sub> 365  
 – CaO–Na<sub>2</sub>O–SiO<sub>2</sub> (CNS) 366  
 – CaO–P<sub>2</sub>O<sub>5</sub>–H<sub>2</sub>O 376  
 – CaO–P<sub>2</sub>O<sub>5</sub>–TiO<sub>2</sub>–ZrO<sub>2</sub> 406  
 – CaO–SiO<sub>2</sub> 86ff.  
 – Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>–CaNaPO<sub>4</sub>–CaKPO<sub>4</sub> 394  
 – 3-D ternary 65ff.  
 – equilibrium 58f., 505  
 – invariant 59, 505  
 – K<sub>2</sub>O–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 88f., 91  
 – MgO–Al<sub>2</sub>O<sub>3</sub>–Fe<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 113ff.  
 – MgO–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 115  
 – MgO–CaO–Al<sub>2</sub>O<sub>3</sub>–Fe<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 100, 112  
 – MgO–SiO<sub>2</sub> 84f.  
 – multicomponent 68, 149  
 – Na<sub>2</sub>O–K<sub>2</sub>O–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub>–H<sub>2</sub>O 16  
 – Na<sub>2</sub>O–K<sub>2</sub>O–CaO–MgO–P<sub>2</sub>O<sub>5</sub>–SiO<sub>2</sub> 368  
 – Na<sub>2</sub>O–SiO<sub>2</sub> 519  
 – one-component 57ff.  
 – peritectic systems 70  
 – quaternary 68ff.  
 – SiO<sub>2</sub> 58, 71ff.  
 – stability fields 62ff.  
 – ternary 62ff.  
 – ZrO<sub>2</sub>–CaO 208  
 – ZrO<sub>2</sub>–CeO 211ff.  
 – ZrO<sub>2</sub>–MgO 208f.  
 – ZrO<sub>2</sub>–Sc<sub>2</sub>O<sub>3</sub> 213ff.  
 – ZrO<sub>2</sub>–Y<sub>2</sub>O<sub>3</sub> 200f., 208f., 212f.  
 phase  
 – high-stress 232  
 – liquid melt 58, 63  
 – low-melting 111  
 – metastable 59

- primary 64f., 115
- secondary 432
- phase systems
  - binary mechanical mixture 501
  - C–N–O–B–Si–(Al,TM) 422
  - C–Si 432
  - Si–Al–N–O–Y 460
  - Y–Si–Al–O–N 470f.
- phase
  - ternary 115
  - vapor 58
- phonon
  - anharmonic 3-phonon coupling 283f.
  - mediated theory 322, 331
  - scattering 284
- phonon mode
  - soft 75, 266f., 507
  - thermal acoustic (TA) 283, 507
  - transversal optical (TO) 283, 507
- photostriction 255
- photovoltaic effect 254, 439f.
- piezoelectric ceramics 74, 164, 254f., 288ff.
  - applications 308ff.
  - lead-free 167
  - semiquantitative model 291ff.
  - sensors 167, 169
- piezoelectric
  - coefficients 266, 291
  - constants 272, 291f.
  - effect 254, 294
  - inverse effect 259, 291
  - single crystals 294ff.
- piezostrictive material 272
- plasticity, *see* workability
- PLZT ( $\text{PbO}-\text{La}_2\text{O}_3-\text{ZrO}_2-\text{TiO}_2$ ) 278, 303f.
- PMN ( $\text{PbO}-\text{MgO}-\text{Nb}_2\text{O}_5$ ) 255, 270, 277
- Poisson number 32, 433
- polarization
  - dipol 256, 269f.
  - dispersion 270
  - electron 269f.
  - inverse 512
  - ion 269f.
  - modes 269
  - orientation 269
  - remanent 271, 277
  - saturation 272
  - space charge 269f., 284
  - spontaneous 259f., 262ff.
  - surface charge 269f.
- polar regions 277
- polymer
  - glass-fiber reinforced (GRP) 125, 192
  - low-density polyethylene (LDPE) 125
  - poly(acrylamide) (PAM) 25
  - poly(methyl methacrylate) (PMMA) 125
  - thermoplastic 243
  - ultrahigh-molecular-weight polyethylene (UHMW-PE) 349, 399, 406
- polymer–clay nanocomposites (PCNs), *see* composite materials
- polymerization–condensation 30
- porcelains 89
  - bone China 3
  - microstructure 90, 92f.
  - soapstone 3
  - soft-paste 3
  - triaxial hard-paste 3
- pore
  - air-entrainment 140
  - capillary 138f.
  - coarse 139
  - intercolumnar 228
  - intracolumnar 228
  - macro- 144
  - morphologies 227
  - open 138
  - structure 111
- porosity 8, 86
  - aluminum nitride 454
  - clay green body 49
  - connected 228
  - polycrystalline ceramic 284
  - surface 233
- powder
  - advanced ceramic 170
  - aluminum nitride 452f.
  - h-BN 447f.
  - monodispersed 481ff.
  - nanosized ceramic 164, 488ff.
  - packing density 31
  - preparation 483ff.
  - ultrafine SiC 432
- power grid cables 336ff.
- precipitation 137, 177f., 281f., 485ff.
  - aluminum hydroxide 177f.
  - bone-like apatite 391
  - impurities 281f.
  - monodispersed powders 485f., 492
- precursor 11, 27, 482
- pressing
  - dry- 453
  - filter- 483
  - hot- 192, 303, 426, 432f., 450, 459, 466f.
  - hot-isostatic (HIP) 285, 303, 426, 432f., 459, 481
  - isostatic 99
  - uniaxial 99, 397

- pseudoplastic 39
- p-t diagram 72
- pyrochlore structures 274, 280
- pyroelectrics 74, 256f., 288ff.
  - coefficient 262, 290
  - effect 254, 257, 262, 288
  - nonlinear 289f.
- PZT ( $\text{PbO-ZrO}_2\text{-TiO}_2$ ) 255f., 275ff.
  
- q**
- quality factor
  - electrical 256f., 265, 268
  - intrinsic 283
  - mechanical 284, 310
- quantum critical fluctuations (QCF) 322, 530f.
- quantum effect (QE) 488f.
- size confinement 489
- quartz
  - $\alpha$ - $\beta$  transformation 76, 78
  - symmetry 73
  
- r**
- radicals 241, 271
- radial electron density (RED)
  - distribution function 515ff.
  - mapping 101ff.
- Ratzenberger Index 49
- raw density 49
- raw materials 5
  - bentonites 23, 25f.
  - clay 11ff.
  - Fuller earth 23
  - highly plastic 11
  - kaoline 11
  - natural 11f., 109
  - nonplastic 11
  - sparingly plastic 11
  - synthetic 27ff.
- Rayleigh process 434
- R-curve behavior 144, 205, 207
- reaction
  - kinetics 129
  - pathways 114
  - rate 57, 101
- recrystallization
  - alumina 360
  - ettringite 136
- redox behavior 99
- refractive index 233, 254
  - CGG compounds 298f.
- refractories 3, 81, 109
  - chromite 86
  - corundum 84
- dolomite 109f., 112f.
- magnesite 109
- $\text{MgO-CaO}$ -based 109ff.
- $\text{MgO-SiO}_2$  86
- mullite 84
- steatite ceramics 86
- zirconia-fibers 216
- reinforcement
  - alumina 185
  - boron nitride 451
  - cements 120
  - concrete 123f., 125
  - coating 363ff.
  - glass fiber 125, 192
  - particulate-reinforced 158
  - polymer 125
  - whisker 219, 431
  - Y-TZP 217f., 359
- relaxation 284
- surface bond 489
- reliability
  - electroceramics 311f.
  - femoral ball heads 397
  - long-term 466
- resonance frequency 259, 265
- temperature coefficient 256f., 268, 285ff.
- resonating valence bond (RVB) theory 322, 530ff.
- retardation 134, 137f.
- rheology of clay particle suspensions 32ff.
- theology models
  - Bingham 37f.
  - Maxwell-type 34ff.
  - nonlinear 37ff.
  - Prandtl-Reuss 37f.
  - Saint-Venant 33, 37f.
  - Voigt-Kelvin-type 34ff.
- rheopexy 46f.
- Rietveld refinement 79, 123, 180
- rigid unit mode (RUM) model 72, 74, 78, 292, 507, 515
- rotating magnetic field alignment (RMFA) 461
- rutile, *see* titania
  
- s**
- saddle point 65
- scanning electron microscopy (SEM)
  - monodispersed powders 485f.
  - PLZT 304
  - porcelain 93
- segregation
  - gravity-driven 482f.

- layer 282
- steady-state 487
- Seignette electricity. *see* ferroelectrics
- self-assembling monolayers (SAMs) 484
- self-cleaning effect 243
- self-propagating high-temperature synthesis (SHS) 453, 483, 488
- ceramic powder 487f.
- Sellmeier
  - coefficients 299
  - equation 298
- semiconductor 157
  - $\alpha$ -SiC 434
  - gas sensors 239f.
  - intrinsic 430
  - metal-oxide- (MOS) 192
  - packages 164
  - power 439
  - silicon 468
- Sénarmont compensator 303
- shape memory alloy 255
- shear
  - deformation 33f., 37, 40, 46, 293
  - hydrodynamic 43f.
  - modulus 32, 36
  - strain 38
  - stress 32f., 205
- sheet silicate network 16ff.
- shock freezing 486
- shrinkage 99, 233
- SiAlONs 468
  - applications 468, 472ff.
  - cutting tool 473f.
  - Jänecke prism 470ff.
  - processing 468ff.
  - properties 468f.
  - structure 470f.
  - synthesis 468ff.
- Siemens-Martin converter 79
- silica
  - amorphous 103f.
  - fume 142
  - module (SM) 123
  - polymorphs 71f., 76, 508
- silicon carbide 159, 161, 429ff.
  - applications 429f., 436ff.
  - infiltration by molten silicon ( $\text{SiSiC}$ ) 432f.
  - light-emitting diodes, *see* LEDs
  - lightning arrester 437f.
  - nuclear fission and fusion reactors 440ff.
  - photovoltaic applications 439f.
  - polytypes 430ff.
  - power semiconductors 439
  - processing 430ff.
  - properties 433ff.
  - reaction-bonded (RBSiC) 431ff.
  - solid state (SSiC) 431, 433
  - structure 435
  - thermal packaging of intergrated circuits 438
- silicon nitride 159, 161, 457ff.
- amorphous thin films 462f., 467
- applications 465ff.
- coatings 462
- dense sintered (SSN) 458ff.
- densification 432
- gas-pressure-sintered reaction-bonded (GPS-RBSN) 465
- hot-pressed (HPSN) 467
- internal combustion engine 465f.
- polytypes 464f.
- processing 458ff.
- properties 457
- reaction-bonded (RBSN) 458f., 465
- sintered reaction-bonded (SRBSN) 458f.
- structure 464f.
- synthesis 458ff.
- simulated body fluid (SBF) 362
- single crystal 265, 289f., 294, 296f., 303, 432
  - alumina 187
  - Bridgman technique 432, 484
  - CGG compounds 303
  - Czochralski growth 296f., 432, 484
  - firms 484
  - polymorph 434
  - silicon carbide 432
- sintering 99, 109
  - aids 272, 285
  - alumina 175, 191
  - liquid phase (LPS) 282, 432
  - microwave ceramics 285
  - multi-stage 303
  - pressureless 303, 425f., 431, 433, 470
  - relaxors 278
  - solid-state powder 267
- slags
  - blast furnace 89, 150
  - viscosity 112
- slip-casting 31, 45, 49, 84, 191, 453
- small-angle neutron scattering (SANS) 231
- smart materials 254f.
- smectite, *see* clay minerals
- sol-gel synthesis 11, 27, 482
- solid oxide fuel cells (SOFCs) 197, 215, 221ff.

- solid-solution 59f., 66, 281, 470
    - homogeneous 61
    - ideal 503f.
  - solid-state
    - charge-transfer reaction 108
    - diffusion 285
    - reaction 29, 100, 114
  - solidus 66f., 504
  - solubility
    - calcium phosphate 395
    - curves 59
    - hydroxide 137
    - isotherms 395
    - MgO 113
  - solution
    - ideal 503f.
    - real 503
  - solvus 522f.
  - spalling 112
    - micro 232
  - Spargue–Dawley rat femoral model 362
  - spinodal decomposition 70, 83, 521ff.
  - spintronics 342
  - spray-drying 11, 27
  - spring constant 32
  - static magnetic field alignment (SMFA) 461
  - steam-pressure hardening 145
  - sterilization 400ff.
  - stiffness 123
  - stoichiometric coefficient 56
  - stoneware 8
    - fine 8, 89
    - Siegburg 93
  - strain 32f.
    - electric field-induced 511
    - internal 265
  - stress
    - intensity factor 204, 206f., 217
    - mechanical 265
    - shielding 357
  - stress-strain curve 32
    - cement 142f.
    - concrete 143
  - stripe-spin-charge ordered state 529f.
  - subsolidus
    - exsolutions 83
    - immiscibility regions 82
    - surface 67
    - ZrO<sub>2</sub>–MgO 209
  - substrate
    - bioceramic 349, 362, 364, 382, 385ff.
    - electronic materials 192, 454f.
  - sulfate process 236
  - superabsorbing polymer–clay
    - nanocomposites (SAPC), *see* composite materials
  - superalloy 472f.
  - superconducting quantum interference devices (SQUIDs) 321, 338, 341
  - superconducting magnetic energy source (SMES) 340
  - superconducting 324
  - superconductors
    - applications 336ff.
    - BSCCO (Bi<sub>2</sub>Sr<sub>2</sub>Ca<sub>2</sub>Cu<sub>3</sub>O<sub>10</sub>) 330ff.
    - classification 323f.
    - crystal chemistry 324ff.
    - cuprates 326f., 333f., 509, 528
    - heavy-fermion 533
    - high-gradient magnetic separator (HGMS) 340
    - high-temperature (HTS) 171f., 323f., 333ff.
    - layered perovskite copper oxide 509
    - low-temperature (LTS) 172, 321f., 324, 340
    - history 320ff.
    - iron pnictides 325
    - magnets 339ff.
    - MgB<sub>2</sub> 324f., 332f.
    - Nb<sub>3</sub>Sn 332ff.
    - organic 322
    - pressure-induced 533
    - processing 331ff.
    - sensors 338
    - theory 331, 525ff.
    - type II 320, 332, 525, 534
    - YBCO (YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub>) 329, 331ff.
  - superparaelectrics 278
  - supersaturation 484
  - surface-guided acoustic waves (SAW) 300, 307
  - surface tension 140
  - susceptibility 260, 276
  - suspensions of clay–water 36, 38, 40ff.
- t**
- tan δ, *see* dielectric loss
  - tape-casting 31, 36, 453
    - alignment (TCA) 461
  - template grain growth, *see* grain growth
  - tensile adhesion strength 364
  - tensile strength
    - alumina 358, 360
    - cement 121, 142
    - concrete 123
    - zirconia 358, 361
  - tensile stress 33, 79

- Terfenol (Tb,Dy)Fe<sub>2</sub> 255
- terracotta 8
- tetragonality
  - BaTiO<sub>3</sub> 267f., 275
  - superconductors 324
- textured 272
  - silicon nitride 460f.
  - thin films 288
- thermal conductivity
  - advanced structural ceramics 159
  - aluminum nitride 454
  - electronic materials 193f., 456
  - non-oxide ceramics 423
  - SiAlONs 469
  - silicon carbide 433
  - silicon nitride 461
  - zirconia 227
- thermal cycling 232
- thermal expansion coefficient 113f.
  - advanced structural ceramics 159
  - aluminum nitride 454
  - anisotropy 114, 295
  - boron nitride 444
  - ceramics 157f.
  - electronic materials 193
  - monolithic cordierite 116
  - SiAlONs 469, 472
  - silicon carbide 433
  - silicon nitride 461
  - zirconia 227
- thermal insulation capacity of cement 145
- thermal shock resistance 114
  - advanced structural ceramics 159
  - SiAlONs 469
  - silicon nitride 461
  - zirconia 231
- thermal transformation
  - CaO–MgO–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub> 109ff.
  - illite 104ff.
  - kaolinite 99ff.
- thermally grown oxide (TGO) 227
- thermodynamic equilibrium 55, 61f., 502
  - modeling 71
  - stability 63, 82, 107
- thermoluminescence 405
- thin film
  - ferroelectric 307
  - hydroxyapatite 374
  - polycrystalline 290
  - sensor 484
  - silicon nitride 462f., 467
  - textured 288
- thixotropy 46f.
- titania
  - anatase 238, 240
  - antimicrobial coatings 243
  - applications 238ff.
  - enhanced acid regeneration system (EARS) process 237
  - gas sensors 239f.
  - photocatalysis 240ff.
  - photovoltaic applications 243ff.
  - pigments 238f.
  - processing 235ff.
  - properties 235f.
  - rutile 237f.
  - structure 237f.
  - synthetic rutile enhancement process (SREP) 237
- top-seeded solution growth (TSSG) 187
- toxic
  - emissions 145
  - liquid industrial waste 148
  - radioactive waste 149
- transducer 307, 309
- transformation
  - clay minerals 13ff.
  - cubic-monoclinic 232
  - cubic-orthorhombic (PZT)
  - cubic-tetragonal (PZT)
  - curve 58
  - diagenetic 16, 22
  - diffuse 277f., 280
  - displacive 73f., 294, 507ff.
  - enantiomorphic (EDT\*) 19
  - energetically distinguishable (EDT) 19
  - ferroelectric-paraelectric 263, 294
  - ferromagnetic 508
  - first-order 65
  - high-low 71, 75f., 79
  - invariant 504f.
  - liquid-solid 65f.
  - low-metamorphism 22
  - martensitic 201f., 205, 358
  - order-disorder (OD) 263, 510
  - rates 55
  - reconstructive 72, 79ff.
  - second-order 75, 509, 512, 527
  - solid-state dehydration of HAp 381
  - structural 329, 508
  - superconducting 320
  - tetragonal-monoclinic ZrO<sub>2</sub> phase 201f., 358ff.
  - tetragonal-orthorhombic (BaTiO<sub>3</sub>) 267
  - thermally-induced 380
  - thermodynamic continuous phase 508

- thermal 99ff.
- toughening 201f., 204ff.
- tricritical 510
- zone 204, 206
- transformers 309ff.
- transistors 192
- transition, *see* transformation
- transmission electron microscopy (TEM) 71, 103
- electron diffraction (ED-TEM) 493
- $ZrO_2$  203
- triple points 59, 89, 105
- TTB-type structures (tungsten bronze structures) 274
  
- u**
- ultraconductors 320
- ultrahigh-molecular-weight polyethylene (UHMW-PE), *see* polymer
- unit cell
  - $CaTiZr_3(PO_4)_6$  384
  - constant 179
  - distortion 275, 293, 324
  - volume 294
- United States Advanced Ceramics Association (USACA) 157
- univariant equilibrium 59
- uranium oxide 161
- UV
  - $\alpha$ -radiation 243
  - absorption efficiency 300
  - LEDs 456
  - photodiodes 438f.
  - transmittance 243
  - VIS-NIR light 243
  
- v**
- vacancy
  - clusters 221
  - concentration 386
  - ion 181, 203f., 220
  - oxygen 84, 204, 220
- Varma's pairing model 530, 532
- Verhulst equations 5
- very large-scale integration (VLSI) 192, 467
- Verneuil process, *see* flame fusion
- Versailles Project on Advanced Materials and Standards (VAMAS) 157
- viscoelastic simulations 33f., 36
- viscosity
  - apparent 38f., 46
  - dynamic 33, 38, 45
  - slag 112
  
- slurry 42
- structural 37ff.
- Volterra-Lotka equation 3
  
- w**
- waste, *see* toxic
- water
  - /cement ratio 138
  - partial pressure 376
  - pollution 147
- wear
  - femoral ball heads 399
  - -resistant coating layers 215f., 423
- wear model 112
- Weibull modulus 205, 431, 433
- whisker
  - $\beta$ -sialon 472
  - mixing 483
  - silicon carbide 431
  - zirconia 219
- Wolff's law 349, 373
- workability 11, 41
- Wyckoff parameter 180, 295
  
- x**
- X-ray diffraction (XRD) 21f.
  - $\beta$ -cristobalite 516
  - cement 123, 139
  - gibbsite 180
  - high-resolution synchrotron 378ff.
  - hydroxyapatite (HAp) 378ff.
  - illite 105
  - oxyapatite (OAp) 378, 380
  - silica 71f., 74, 76, 79, 516
  - single-crystal 378
- X-ray powder diffraction (XRPD) 21f.
  - BNT 278ff.
  - nanoscaled powders 493f.
- X-ray scattering
  - peak broadening (XSPB) 494
  - small-angle (SAXS) 494
  - wide-angle (WAXS) 493
  
- y**
- yield 32, 36
- stress 33, 37f.
- Young modulus
  - alumina 360
  - ceramics 125, 204
  - metals 125
  - polymers 125
  - structural materials 123
  - zirconia 230, 361

**z**

- zeta potential 42ff.
- Zhang–Rice singlets 322, 330
- zirconia
  - applications 215ff.
  - bioceramics 233, 357ff.
  - Ca-partially stabilized (Ca-PSZ) 218, 361
  - Ce-partially stabilized (Ce-PSZ)
  - cluster 218
  - crystallographic data 199
  - cubic 199f.
  - duplex structures 219
  - erosion-resistant 215f.
  - fine-grained crystalline 198
  - fully stabilized (FSZ) 197, 209, 222
  - galvanic gas sensors 222
  - immobilization of radioactive waste 234f.
  - in situ dispersion 218

- metastable polycrystalline 185f.
- Mg-partially stabilized (Mg-PSZ) 206f., 216, 361
- monoclinic ( $\text{m-ZrO}_2$ ) 199f., 207
- oxygen sensor 222
- partially stabilized (PSZ) 157, 197, 205f., 215, 228
- refractory fibers 216f.
- structure 199ff.
- tetragonal ( $\text{t-ZrO}_2$ ) 199f., 207
- tetragonally stabilized 185
- transformation toughening 201ff.
- $\text{t}'\text{-ZrO}_2$  210f., 230
- Y-stabilized tetragonal zirconia polycrystal (Y-TZP) 185, 199, 206, 347, 351, 358, 361ff.
- wear-resistant 215f.
- whisker-reinforced 219