

Index

a

- acrylamide, monomers 271
- activation energy 103f, 108ff, 126
 - of creep 320
- adamite 34f
- adelite 40
- aerosol decomposition technique 281
- aircraft engine 440f
- ²⁷Al MAS NMR spectroscopy 200
 - solid-state 268
 - spectrum 194
 - triple-quantum spectra 199
- ²⁷Al NMR spectroscopy 97, 116, 121, 123, 269
 - solid-state 268
- albite 389
- alkali aluminates 4, 29, 33
 - mullite-type 33
- alkali gallate 4, 33
- Al₂O₃-rich mullite 356
- Al₂O₃-SiO₂ glasses, tetrahedral tricluster 124
- Al₂O₃-SiO₂ phase diagram 227ff
 - simulation 236
- Altex fibers 384
- alumina 448
 - decomposition 182
- α-alumina 31, 233, 252
 - crystals 234f
 - liquidus 231, 233, 237
 - nucleation 234
 - particles 232
 - porous layers 240
 - skeleton 369
- ι-alumina 28
- alumina microcomposite, silica-coated 448
- alumina particle reinforcement 461
- alumino siloxane 272
- aluminosilicate
 - homogeneous 232
 - non-crystalline 94
- aluminosilicate fiber compacts
 - porous 412
- aluminosilicate fibers 381, 392
- aluminosilicate gels 100f
- aluminosilicate glass 238
- aluminosilicate glass fibers
 - activation energy 103f
 - nucleation and growth 104
 - viscosity 103
- aluminosilicate phases 242
- aluminosilicate powder 232
 - heterocoagulation 276
- aluminum, fivefold coordinated 101
- aluminum borate 76
 - mullite-structured 203
- aluminum carboxylates 383
- aluminum dibutoxide ethylacetoacetate 272
- aluminum fluoride 252, 292
- aluminum hydroxide 252f, 256, 269, 274, 277, 281, 299, 308
- aluminum hydroxide chloride 415
- aluminum isopropoxide 381
- aluminum metal 447
- aluminum metal reinforcement 463ff
 - reactive metal penetration 463
- aluminum oxygen 178
- aluminum phosphate hydroxide 415
- aluminum sec-butoxide 382
- aluminum-silicon disorder 151
- aluminum tris-isopropoxide, synthesis 264
- andalusite 2, 4, 7, 19, 33f, 46, 101, 151f, 174ff, 180, 252
 - decomposition processes 179
 - mullite transformation 176f
- anorthite 391
- antiferromagnetism 37
- apuanite 7, 14f, 18
 - group 14
- aristotype 1ff, 9, 12
- arsenate 33

- arsen-desclowitzite 41
- atomic coordination 122f
- atomic diffusion 156
- Auger electron spectroscopy (AES) 76
- austinite 41
- average structure 57, 60
- b**
- ball milling 95, 148
- Bärnighausen tree 5, 7, 9, 12, 37
- barrier coatings 369
- bauxite 252
- bending strength 257, 298, 308ff.
- $\text{Bi}_2\text{M}_4\text{O}_9$ group
 - edge-shared MO_6 octahedra 14
 - MO_4 tetrahedra 14
 - MO_5 square-pyramidal polyhedra 14
- binder 418
- blunting of crack tips 455
- B_2O_3 109
- Boltzmann-Matano interface 231
- bond lengths 149
- bond strength 149
- boralsilite 7, 33, 42ff
 - group 42
- boron aluminates 4, 33, 37ff, 43, 46, 181
 - $\text{Al}_{6-x}\text{B}_x\text{O}_9$ 43
- Brillouin scattering 146
- brittle failure 428, 436
- bulk modulus 312
- burner rigs 367
- c**
- calciovolborthite 41
- calcium oxide 254, 261
- calorimetry 151
- catalyst supports 398
- catalytic convertors 442
- échérite 38
- ceramic belts 301
- ceramic liners in aircraft 441
- ceramic matrix composites
 - graphite 437
 - interphase 437
 - porous matrices 426
 - turbostratic carbon 437
- ceria (CeO_2) 164, 410
- chains 178
- charge-transfer (CT) reactions 167
- chemical dipping 436
- chemical resistance 324
- chemical vapor deposition (CVD) 283, 290, 336, 350
 - coatings 350ff
 - metalorganic (MOCVD) 351
- chemical-mullite 32, 256
- chromium clusters 77
- chromium-doped mullite
 - Rietveld refinement 81
- chromium-doped-mullites 77
- cleavable oxides
 - hexaaluminates 438
 - magnetoplumbites 438
 - phyllosilicates 438
- coatings 368
 - ceramic 337
 - environmental barrier 349
 - flame-sprayed 367, 372
 - fugitive 411, 438
 - functionally graded 357
 - multi-layered environmental barrier 371
 - oxidation barriers 364
 - plasma-sprayed 369
 - plasma-sprayed thermal barrier 372
 - protective 337, 373
 - thermal shock resistance 357
- cobalt-doped mullite 89
- compressive stress 143
- congruent melting 227ff
- conichalcite 41
- continous fiber formation 381ff
- continous fiber reinforcement
 - fabric processing 405
 - fiber compacts without matrix 412f
 - matrix fillers 413
 - mechanical properties 421ff
 - non-oxide composites 423ff
 - oxide/oxide composites 425ff
 - slurry infiltration of bundles 417ff
 - slurry injection 414
 - winding technique 404
- contrast simulation (HREM) 49ff
- copper arsenate 35f
- corrosion resistance 327, 443
- crack bridging 457
- crack deflection 422, 436, 457
- crack resistance 432
- creep 141, 317f
 - resistance 423
- cristobalite 252, 366
- critical thermal shock 315
- crystal field spectra, unpolarized 78
- crystal growth techniques
 - Czochralski method 259
 - solution-sol-gel process 259
- crystal structures
 - mullite-type 1ff
- crystalline mullite 355

d

damage tolerance 403
 decomposition 179ff, 240, 242
 deformation 312
 – mechanism 143
 delamination 417, 428
 descloizite 38, 40f
 dielectric constant 323
 dielectric loss tangent 324
 differential thermal analysis (DTA) 263
 – kaolinite 170
 – metakaolin 170
 diffractometry in situ single-crystal 191
 diffuse scattering 49, 54ff
 diffusion couples 231
 diphasic gels 276f, 282, 300ff
 diphasic mullite 420
 diphasic precursor 94
 diphasic sols 277
 diphasic xerogels 299
 – mullite crystalline seeds 300
 – mullite nanocomposites 300
 dissolution 179
 doctor blade method 424
 double angle spinning (DOR) 191, 200
 duftite 41
 dynamic stress response 149

e

easy-cleavage interphases 437
 èèchite 38
 effect of reaction atmosphere 256
 effect of structural defects 256
 elastic constant 312
 elastic modulus 142ff, 149, 312
 electrical conductivity 165ff
 electrical conductors 467
 electrical insulators 467
 electrical properties
 – dielectric constant 323
 electrical resistivity 169
 electron diffraction 48f
 – pattern 30
 – studies 171
 electron micrograph 179
 electron paramagnetic resonance (EPR)
 spectroscopy 74, 189, 192, 206ff
 – Cr-doped mullites 207
 – Co-substituted mullite 209
 – Fe-doped mullite 206
 – Ti-doped mullite 209
 – V-doped mullite 209
 electronic chip substrates 463
 electronic packaging 332

electronic substrates 466
 electrophoretic impregnation 405, 411
 enthalpy 149, 151
 entropy 151
 environmental barrier coatings (EBCs) 243
 epidote 3,4
 epitactical nucleation 179, 187
 eptactical growth, mullite on muscovite 172
 equiaxed grain structures 287
 equilibrium phase diagram 229
 ethylene glycol 269, 281
 ethylenediaminetetraacetic acid (EDTA) 271
 europium-doped mullites 93
 eutectic melting 86
 eutectic temperature 291
 eveite 34f
 exsolution 179
 – of aluminum from mullite 184
 extended X-ray absorption fine structure
 (EXAFS) 80

f

fatigue parameter 316
 ferromagnetism 37
 fiber coatings 436
 fiber cracks 422
 fiber debonding 422f
 fiber fabric infiltration routes
 – electrophoretic deposition 404
 – polymer impregnation pyrolysis 404
 fiber failure 390
 fiber fracture 429
 fiber pull-out 427, 436
 fiber/matrix bonding 427
 fiber/matrix debonding 436
 fiber/matrix interfaces 425, 427
 fiber/matrix interphase
 – easy cleavage 437ff
 – fugitive 438f
 – low toughness 438
 – porous 438
 fiber-matrix contact 421
 fiber-reinforced composites, non-oxide 423
 fibers, creep behavior 382
 filters, hot gas dust-trap 443
 fireclay 327
 fivefold coordination 19, 30, 33, 35, 39, 42f
 fluorine salts 242f
 foreign cation incorporation 70
 – boron 91
 – chromium 77
 – cobalt 89
 – europium 93
 – gallium 91

- iron 83
- manganese 81
- molybdenum 93
- other 91
- sodium 91
- tin 92
- titanium 74
- vanadium 76
- zirconium 92
- formation of mullite
 - from andalusite 172ff
 - from kaolinite 167ff
 - from muscovite 170ff
 - from sillimanite 175ff
 - from X-sialon 178
- Fourier-transform infrared (FTIR) spectroscopy 207, 209
- fracture behavior in-plane 430
- fracture toughness 400, 447
- friction coefficient 316
- fused-mullite 31f, 251, 260ff, 289ff, 327f

g

- gallate 33
- gas permeability 437
- gas-phase-deposited Al_2O_3 -rich mullite, the structure 357
- gas-phase-deposited coatings
 - alumina 352
 - ceramic substrates 352
 - chemical (CVD coatings) 350
 - growth kinetics 352
 - microstructure of 352
 - mullite 352
 - silicon carbide 352
 - silicon nitride 352
 - thermodynamics 350
- gas-phase-deposited mullite
 - high-temperature phase transformations 359
 - hot-corrosion 364
 - oxidation 364
 - recession protection 364
- gas-transport reactions, whisker formation 378
- germanium mullite 32f, 40
 - Al_2O_3 -rich 40
- Gibbs energy 150
- glass forming ability 95f
- glass phase 262, 383
- glasy film, intergranular 290
- gottlobite 41
- grain boundary mass transport 286, 290, 312, 314, 317ff

- grain boundary phases 146
- grain coarsening 438
- grain growth 162ff
 - inhibitor 164
 - intergranular inclusions 164
- grandidierite 4, 7, 19f, 33, 46, 206
- group 19

h

- Hall-Petch correlation 381
- Hall-Petch equation 309f
- heat capacity c_p 144, 147, 151f, 154f, 186f, 189
 - high-temperature 189
- heat exchangers 329, 442
- heat of fusion 151
- heat regenerator 331
- high creep resistance 377
- high thermal conductivity 423
- high-alumina mullite 160
- high-purity mullite 256
- high-resolution electron microscopy (HREM) 47ff
 - diffuse scattering 49
 - oxygen-vacancy distribution 48
 - videographic real-structure simulations 54
- high-resolution transmission electron micrograph (HRTEM) 302
- high-temperature behavior 238
- high-temperature engineering materials 331
- high-temperature gas filters 336
- hollow mullite microspheres 277
- homogeneous precipitation method 274
- hot gas filters 442
- hot isostatic pressing (HIP) 290, 301
- hot pressing 457
- hot-corrosion barrier 367
- hydralite 282
- hydrolysis 266
 - incomplete 279
- hydrothermal technique 72
- hydrothermally produced mullite 281

i

- illite 172
- inclination angle ψ 1ff
- incongruent melting 227ff
- infiltration
 - colloid precursor 411
 - metal melt 404
 - sol-gel 404
 - slurry 404, 417ff
 - vacuum or pressure 414f
 - vapor 403

- vibro 416
- interstitial Cr^{3+} incorporation 77
- interphases
 - low-toughness 438
 - porous or gap-producing 438
- inter-vacancy correlation vectors 59, 62ff
- intragranular contacts 428
- ionic conductivity 159
 - oxygen vacancy hopping 169
- IR spectroscopy 2f, 16f, 33, 189, 192, 207, 210ff
 - mullite formation 208
 - spectrum 217
- iron oxide 244, 254, 255

j

- Jahn-Teller distortion 40, 42, 82, 90
- Jahn-Teller effect 42

k

- kanonaite 34
- kaolinite 172, 251
 - formation 169
 - NMR spectroscopic studies 200
 - thermal decomposition 171
- kiln furnishings 442
- Knudsen equation 309
- kyanite 35, 151, 180, 252
 - decomposition 179

l

- laser flash technique 157
- laser heating 391
- layered composites 427
- libethenite 34f
- linear thermal expansion 322
- liquid-phase sintering 296f, 302, 311
- liquid-state-derived mullite 259
- load-deflection curve 431
- low temperature eutectics 229
- low thermal expansions 463
- low-expansion oxide phases
 - cordierite 462
 - silica glass 462
 - teillite 462

m

- magic angle spinning (MAS) 191, 197, 204
- magnesium oxide 254, 261
- magnetic structure 37
- manganese oxide 261
- manganese-doped mullites 81
 - ground state 82
 - high-spin state 82

- manganese-substituted mullites 90
- MAS NMR spectroscopy 120
 - ^{27}Al 269, 276
 - materials for heat exchangers 331
 - ^{29}Si 268, 276
- matrix composites 397ff
 - dense mullite 409
 - dense oxide 409ff, 425f
 - hot pressing 407
 - non-oxide fiber-reinforced 407
 - oxide fiber-reinforced 409
 - silicon carbide fibers 407
- matrix porosity 430
- mechanical properties 141ff, 399, 421, 460
 - bending strength 310
 - corrosion resistance 350
 - creep resistance 307f, 317, 327, 350
 - elastic modulus 307, 312
 - fatigue behavior 307, 316
 - fracture toughness 307f, 310, 316f
 - hardness 307, 314f, 334
 - high-temperature strength 350
 - mechanical strength 303, 307ff, 310, 332, 336
 - microhardness 314ff
 - mullite ceramics 307ff
 - thermal shock resistance 307, 315
 - toughness 141, 307ff, 350
 - wear resistance 307, 316
- melting behavior 236
- melting point 236
- metal-reinforced composites
 - aluminum 463
 - molybdenum 466
- metastable crystallization 233
- metastable immiscibility 101f
 - aluminum silicate glasses 102
 - immiscibility gap 103
 - miscibility gap 103
 - in $\text{SiO}_2\text{-Al}_2\text{O}_3$ 101
- metastable liquid immiscibility 283
- microcomposites 306
- microcrack toughening 450
- microcracking 438, 455
- microhardness 146f, 314
 - amorphization 148
 - temperature dependence 147ff
- microwave furnace 417
- mineralizer
 - effects 254
 - potassium carbonate 255
- miscellaneous oxide particle-reinforced composites 461
- miscellaneous particle reinforcement 461ff

- miscellaneous properties 435
- miscibility gap 28
- molecular dynamics (MD) simulations 191
- molten aluminum silicon alloys 410
- molten sodium salts 241
- molybdenum metal reinforcement 466
- molybdenum/mullite composites 466
- monolithic mullite 400, 456, 459
- mosaic-type mullite 386
- Mössbauer spectroscopy 190, 192, 203, 210ff
 - ^{57}Fe 205
 - Fe-containing mullites 213
 - ferric iron in mullite 217
 - of iron depend mullite 84
 - of iron-rich mullite 84
 - of 3:2 mullite 217
- mottramite 38
- mozartite 7, 40ff
 - group 40
- mullite
 - 2/1-type 231
 - aluminum-rich 187
 - chromium-doped 168
 - congruent melting 230, 231
 - incongruent melting 230f, 234
 - liquidus 232
 - orthorhombic 29, 271
 - oxygen vacancies 191
 - peritectic temperature 232
 - in porcelain bodies 377
 - pseudo-tetragonal 28, 265, 268, 270ff, 277, 281, 286
 - real structure 46
 - silica-rich 187
 - structure variants 60
 - tetragonal 28
 - vanadium-rich 77
- 3/2-mullite, solid-solution range 235
- mullite beads 336
- mullite ceramic fabrication techniques 288
 - reaction bonding of mullite 288
 - reaction sintering of Al_2O_3 - and SiO_2 -containing reactants 288
 - reaction sintering of chemically produced mullite precursors 288
 - sintering of mullite powder compacts 288
 - transient viscous sintering of composite powders 288, 306
- mullite ceramics
 - applications 328
 - damage tolerance 397
 - dense 274
 - hot pressed 311
 - infrared-transparent 299
 - optically translucent 167
 - polycrystalline 146
 - porous 328, 336
 - processing 286
- mullite coatings 283
 - chemically vapor-deposited (CVD) 365
 - deposition of 372
 - miscellaneous techniques 372
 - plasma-sprayed 367
- mullite composites
 - by tape casting 399
 - continuous fiber-reinforced 403
 - hot pressing 399
 - silicon nitride 402
 - whisker-reinforced 399, 401
- mullite crystallization 104, 124, 453
 - heterogeneous 125
 - homogeneous 125
 - kinetics 108
 - mechanisms 108
 - type I single-phase aluminosilicate glasses 125
- mullite crystals
 - growth 104, 128
 - with high aspect ratios 303
 - prismatic 291
- mullite decomposition 237
- mullite fiber mats 277
- mullite fibers 377
 - application of 393
 - continuous melt-grown 391
 - polycrystalline 144
 - single-crystal 391
- mullite formation
 - diffusion-controlled 111
 - interface-controlled 111
 - kinetics 108
- mullite glasses 96
 - aluminium coordination 120
 - single phase 94
- mullite growth 109
- mullite matrices
 - porous 413
 - nano-pores 412
- mullite matrix composites 298, 307, 327f, 397ff
 - continuous fiber-reinforced 398
 - dense oxide fiber-reinforced 425
 - fiber-reinforced 397
 - metal-reinforced 398, 463
 - platelet- and particle-reinforced 443
 - porous 412, 433, 440
 - whisker-reinforced 402
 - zirconia-toughened 446

- mullite matrix materials, whisker-reinforced 338
- mullite needles 282
- mullite nucleation 108f
 - epitactical 111
 - topotactical 111
- mullite powders
 - microwave heating 271
 - sintering atmosphere 287
 - sintering mechanisms 286
 - ultrafine 270
- mullite precursors 94, 117
 - aluminum coordination 120
 - aluminum sec-butyrate 96, 108
 - aluminum-isopropylate 96
 - condensation 98
 - dehydration 98
 - differences 117
 - microcomposites 105f
 - nanocomposite 106
 - preparation 282, 299
 - produced by coprecipitation 301
 - similarities 117
 - single phase 94
 - tetrahedral triclusters 120
 - of zirconia 448
- mullite properties
 - creep 142, 162
 - creep resistance 142, 162
 - strength 143
 - toughness 143
- mullite refractories 240, 262
- mullite seeds 449
- mullite single crystals 230
 - compressive strength 143
 - elastic constants 144
- mullite solid solution 20ff
- mullite synthesis
 - fused-mullite 251
 - hydrothermal process 251
 - sinter-mullite 251
 - solid-state processes 251
 - solution-sol-gel (SSG) processes 251
 - vapor-state process 251
- mullite-type family of crystal structures 1
- mullite whiskers 240, 377
- mullite-based refractory 328
- mullite-glass composite 332f
- mullite-mullite transformations
 - compositional 180ff
 - phase 183
 - structural 186ff
- mullite-type gels 93
- mullite-type glasses 93
- mullite-type structure family 1
- mullitization 171
 - activation energies 109
 - diffusion distance 126
 - hydrothermal treatment 270, 282
 - microcomposites 109
 - process 127
- multicomponent systems 246
- multiple quantum (MQMAS) NMR 191, 193, 196, 198, 201
- multi-slice approximation 49
- muscovite 172, 251
 - dehydroxylation 172
- n**
- Nabarro-Herring equation 318
- nanocomposites 461f
- nanocrystalline 355
- nanocrystalline layer 356
- nanoparticles 445
- needle-like mullite 274
- neodymium phosphate 412, 426
- neutron diffraction data 24
- Nextel 610 alumina 431
- Nextel 720 aluminosilicate fibers 163, 386, 390, 411, 420
- Nextel fibers 385ff
- nickel-austinite 41
- Nivity fibers 385
- NMR spectroscopy 24, 28, 39, 46, 198ff
 - ^{27}Al 191f, 195f, 198ff, 269
 - ^{27}Al triple-quantum MAS NMR 195
 - aluminosilicate mullite 194
 - amorphous aluminosilicate gels 200
 - ^{11}B 201f, 204f
 - ^{71}Ga 199f
 - gallium and germanium mullites studies 201
 - ^{25}Mg 203ff
 - ^{23}Na 191ff
 - nutation studies 198
 - ^{17}O 191, 195, 199f, 203
 - octahedral and tetrahedral resonances 198
 - powders 269f
 - ^{29}Si 24, 191, 194, 198f, 202ff, 269
 - T* tricluster sites 198
 - ^{89}Y 203
- non oxide ceramics 283, 307, 311
- nucleation 103f, 108f, 111, 114, 120, 124, 128
 - barrier 187
 - period 294
- nucleophilic reaction 266f

O

- ¹⁸O diffusivity measurements 373
- ¹⁷O MAS NMR spectrum 197
- olivine 7, 35f
 - group 35
- omineite 20
- optical materials 333f
- optical properties 164f
 - mullite single crystals 324
- ordering scheme of vacancies 54, 68f
- oxide fiber/mullite matrix composites, thermal protection systems 372
- oxide fiber-reinforced composites 413, 425
- oxide/oxide composites 393
- oxygen conductivity 17f
- oxygen diffusion 156ff
- oxygen ion conductivity 336
- oxygen ion conductor 336f
- oxygen ion implantation 375
- oxygen vacancies 17, 24f, 29ff, 33, 40, 46
 - distribution 68f

P

- packing density 418
- particle suspensions 414
- particle-reinforced composites 456
- peritectic composition 229
- peritectic reaction 233
- perovskite, derivative structures of 9
- phase diagram, Al₂O₃-SiO₂ 229
- phase equilibria 229
- phase separation, nanometer-scale 187
- phase-equilibrium diagrams
 - alkaline earth oxide-Al₂O₃-SiO₂ 246
 - alkaline oxide-Al₂O₃-SiO₂ 245
 - iron oxide-Al₂O₃-SiO₂ 245
 - MnO-Al₂O₃-SiO₂ 247
 - ternary X-Al₂O₃-SiO₂ 245
 - TiO₂-Al₂O₃-SiO₂ 247
- phosphates 33
- physical vapor deposition (PVD) 95, 117ff, 350, 372, 436
- plasma spraying 96, 373
 - conventional 368
- plastic deformation 150
- platelet and particle reinforcement 441ff
- P₂O₅ 109
- Poisson's ratio 312f, 315
- polycrystalline fibers 393
- polycrystalline mullite, creep 143
- polymerization 266ff, 270, 281, 285, 306
- pore agglomeration 438
- porous composites 426
- porous materials, filters 336

- porous microstructures 430
- porous mullite 324, 335ff
- porous networks 420
- porous oxide matrices 412, 426ff
- porous weak interphase 438
- potassium oxide 254
- powder particle agglomerations 287
- powerplant applications 440f
- precursor layer, nanocrystalline 360f
- precursors
 - chemically homogeneous 279
 - dehydration 98
- pressure filtration 414
- primary mullite 286
- prismatic mullite 287, 291, 302f, 305
- properties
 - electrical 168
 - infrared 167
 - miscellaneous 167
 - optical 167
- protective coatings
 - chemical vapor deposition (CVD) 350
 - deposition from an aqueous slurry 350
 - physical vapor deposition (PVD) 350
 - plasma and flame spraying 350
 - self oxidation 350
- pseudo-tetragonal metric 28, 43
- pulse electric current sintering (PECS) 467
- pulsed-laser deposition (PLD) 373
- pyrobelonite 38
- pyrophyllite 251
 - thermal decomposition 172

R

- radial distribution function 100, 122f
- radiant burners 398
- Raman spectroscopy 207, 209
- rapid solidification 96
- reaction bonding 447
 - of ceramics 288, 298
 - technique 298
- reaction couples 232
- reaction sintering 448ff
 - alumina 297
 - alumina and silica 253, 288, 291
 - silica 297
- reaction-bonded mullite (RBM) systems 410
- reactive metal penetration technique 463
- reactive wetting 165
- real structure 46ff
 - mullite 143
- reducing conditions 240
- reducing environments 236
- refractory bricks 258

- refractory materials 327
- resonance ultrasonic spectroscopy 312
- S**
- satellite transition (SATRAS) NMR 192ff, 199
- scanning electron micrographs
 - cross-section 186
 - glass/mullite system 186
- schafarikite 7, 13ff, 18
 - group 13
- seeding 449
- sensors 398
- shear modulus 312
- shear strength 428
- short-range order 68ff, 121, 125
- ²⁹Si NMR spectroscopy 24, 99, 107, 115, 117f, 196, 269
 - solid-state 268
- β-sialon 463
- signal transmission delay time 332
- silica 448
 - devitrification 361
- silica glass binders 413
- silica sources
 - α-alumina 253
 - alumina sources 253
 - boehmite 253
 - cristobalite 253
 - diaspore 253
 - fumed silica 253, 281
 - fused silica 253
 - gibbsite 253
 - quartz 253
 - silica glass 253
 - silicic acid 253
- silicon alkoxide 264, 266, 269ff, 275, 279, 281, 285, 383
- silicon aluminum ester 272
- silicon carbide 283, 298, 307f, 311, 313ff, 325f, 328, 334, 445, 447
 - oxidation 366
- silicon carbide matrix composites (SiC_F/SiC), thermal cycling conditions 368
- silicon carbide nanoparticles 458
- silicon carbide platelet reinforcement
 - fabrication 456ff
 - mechanical properties 459f
- silicon diffusion 159ff
- silicon nitride 283, 298, 307f, 311, 314ff, 317, 323, 325f
- silicon oxycarbide (SiOC), non-crystalline 458
- silicon tetrafluoride (SiF₄) 244
- silicon tetrakis-isopropoxide 264
- sillimanite 4, 7, 9, 21, 24f, 28ff, 35ff, 76, 141, 148, 151f, 174, 180, 229, 252
 - decomposition 182
 - growth 179
 - transformation to 3/2 mullite 178
- sillimanite group 35
 - compounds 37
- simulation techniques 56
- single phase 252, 269, 282
 - gels 282, 382f
 - precursor 94
- single-crystal mullite, elastic properties 144
- single-crystal X-ray diffraction (XRD), high-pressure 146f
- sintering
 - characteristics 286
 - composite powders 288, 306
 - liquid-phase 451
 - liquid-state 305
 - of mullite and zirconia 446
 - powder compacts 288
 - solid-state 286, 289, 302, 305
 - spark plasma 452
 - transient viscous 306
- sinter-mullite 31, 251, 256ff, 289, 327f
- small-angle X-ray scattering (SAXS) 97, 120
- smectite 172
- sodium aluminate, mullite-structured 202
- sodium oxide 254, 261
- sol precursors, hydro-thermally treated 276
- sol-gel precursors 462
- sol-gel process 95f
- sol-gel route synthesis
 - chromium 72
 - iron 72
 - vanadium 72
- sol-gel-derived mullites 251, 262, 291
- solid-state nuclear magnetic resonance (NMR) 190f
 - double angle spinning (DOR) 191
 - dynamic angle spinning (DAS) 191
 - multiple quantum (MQ) techniques 191
- solid-state reaction
 - α-alumina particles 295, 306
 - silica grains 295
- sol-plus-sol process 275
- solution/precipitation 112
- solution-plus-sol process 272
- solution-plus-solution process 263
 - in situ hydrolysis 264
 - monophasic gels 264
- solution-sol-gel (SSG) approach, water-free 269
- solution-sol-gel (SSG) process 251, 262, 269

- sol plus sol 262, 275
 - solution plus sol 262, 272
 - solution plus solution 262f
 - solution-sol-gel-derived mullite 262
 - spacecraft applications 440
 - spinodal demixing 94
 - spin-off 442f
 - splat cooling 96
 - spodumene 463
 - spray pyrolysis 95f
 - spray pyrolysis approach
 - atomizers 278
 - ultrasonicators 278
 - spray pyrolyzed mullite 279, 291
 - sputtering 436
 - stability of mullite 229
 - stable crystallization 233
 - standardization method 4ff, 12f, 37
 - starch 271
 - static fatigue behavior 455
 - staurolite 252
 - steady-state creep rate 317
 - stiffness 432
 - strenght 141
 - stress-strain curves 435
 - stress-strain rate 320
 - structural materials 331
 - structural transformation 188
 - structure refinement of mullite 190
 - STRUCTURE TIDY 5
 - structure variants 60ff
 - structures rutile-type 9
 - sub-critical crack growth 390
 - subsolidus liquid 292
 - superalloys 441
 - surface and pore burners 442
- t**
- tangeite 41
 - tape casting 416
 - tensile strengths 391f
 - ternary phase diagram of $\text{AlCl}_3\text{-SiCl}_4\text{-CO}_2\text{-H}_2$ 353
 - ternary systems 243ff
 - tetracluster 29
 - tetraethyloxysilane (TEOS) 263, 383
 - acid hydrolyzed 276
 - tetragonal zirconia 447, 452
 - tetragonal-like mullite 286
 - tetrahedral double chains 149
 - tetrahedral triclusters 120f, 124f, 187
 - tetramethoxysilane (TMOS) 264
 - thermal barrier coatings 468
 - thermal conductivity 155ff, 322, 435
 - thermal decomposition reactions
 - montmorillonite 201
 - muscovite mica 201
 - pyrophyllite 201
 - thermal diffusivity 157, 322
 - thermal expansion 152ff, 434, 448
 - behavior 154
 - coefficients 154, 315
 - thermal properties 434
 - enthalpy 151
 - entropy 151
 - Gibbs energy 151
 - thermal conductivity 322
 - thermal expansion 322
 - thermochemical data 151
 - whisker-reinforced mullite matrix composites 402
 - thermal properties of mullite ceramics 149ff
 - enthalpy 321
 - enthalpy of formation reaction 321
 - entropy 321
 - Gibbs energy 321
 - Gibbs energy of formation 321
 - heat capacity 321
 - thermal conductivity 321f
 - thermal expansion 321f
 - titanium oxide 109, 254, 262
 - topaz 252, 380
 - thermal decomposition 380
 - topological material 335
 - topotactical transformation 175
 - toughening
 - crack-deflection 444
 - by modulus load transfer 444
 - nanoparticle 445
 - transformation 443ff
 - toughening mechanisms
 - grain-boundary strengthening 454
 - microcrack toughening 454
 - strengthening due to crack bowing 454
 - stress-induced toughening 454
 - surface-compression toughening 454
 - toughening due to crack deflection 454
 - transient viscous sintering (TVS) 105, 399
 - transition alumina 106f
 - transition metal, stability relations 72
 - transition metal incorporation 70, 89
 - aluminum substitution 74
 - chromium substitution 77
 - cobalt substitution 89
 - general remarks 89
 - iron substitution 83
 - manganese substitution 81
 - titanium substitution 74

- vanadium substitution 76
- translucient mullite 286
- translucent mullite 335
- transmission electron microscopy (TEM)
 - 150, 160, 171, 282, 306
- cross-sectional 360
- high-resolution 179
- transparent gels 267
- tribological materials 335
- tricluster 24
- triethanolamine 269, 281
- trippkeite 14
- turbine engines 367
- turbostratic boron nitride (BN) 437
- type I glasses
 - co-precipitation 95
 - melt-derived 96
 - preparation 95
 - sol-gel method 95
 - spray hydrolysis 95
- type I precursors 94f, 103, 117, 119, 265, 285
 - aluminum sec-butyrate 97
 - chemically derived 95
 - co-precipitation 95
 - dried gel stage 97
 - gelation 97
 - hydrolysis 97
 - hydrolysis-polymerization 95
 - preparation 95
 - single-phase 118
 - sol-gel method 95
 - spray hydrolysis 95
 - tetraethyloxysilane 95, 97
 - wet (solution) stage 97
- type II precursors 94, 105f, 276, 285
 - diphasic 105, 118
 - synthesis 105
- type III precursors 114f, 117
 - aluminum sec-butyrate 115
 - synthesis 115

V

- vanadium-doped mullites 76
- vapor-state-derived mullite 283
- versiliaite 7, 18f
 - group 17
- vibro impregnation 414
- videographic method 56ff
 - fourier transformation 58
 - supercell 58

- videographic reconstructions, two-dimensional 62
- videographic simulations, three-dimensional 64
- viscosity of the melt 392
- viscous flow 304, 420, 433
- viscous silica phase 421
- volatile compounds 239
- vuagnatite 40ff

W

- water-gas shift reaction 352
- werdingite 3f, 7, 33, 43ff
 - group 46
- wetting behavior 162ff
- WHIPOX 417ff
- whisker formation
 - from gas-transport reactions 378
 - from melts 377
 - process 378
- whisker reinforcement 398ff
 - fabrication 399
 - mechanical properties 399ff
 - miscellaneous properties 403
 - thermal properties 402

X

- X-phase sialon, silicon aluminum oxynitride compounds 204
- X-ray diffraction (XRD) 24, 54ff, 76, 263
 - single-crystal 175
 - situ high-temperature 157
- X-ray single-crystal diffraction 47
- X-sialon 4, 180
 - formation from 180

Y

- Young's modulus 312ff, 431
- yttria 410

Z

- zeolites 6
- zirconia 447f
 - cyclic infiltration 453
 - teragonal 453
 - yttria stabilized 449
- zirconia particle-reinforced composites 446
- zirconia particle reinforcement
 - fabrication 445ff
 - mechanical properties 453ff
 - thermal properties 455