
Index

- acomustic waves 34
- acrylates 2
- acrylic acid groups 174
- acrylic copolymers 3
- adhesion, effect of surfactants 190
- adhesion energy 159
- adsorption isotherms 192–3
- AFM *see* atomic force microscopy
- aggregation, definition of 20
- alkyd film 74
- anisotropic particles 259–61
- anisotropy 259
- anthracene 77, 81
- Arrhenius equation 166
- aspect ratio 240, 246
- atomic force microscopy 62–8, 144
 - cantilever 62, 68
 - experimental parameters 65
 - height artefacts 64
 - indentation depth 64
 - intermittent contact 63
 - microtomed cross-sections 67
 - particle deformation 67
 - phase imaging 66
 - contrast in 67
 - set point ratio 65
 - TappingMode™ 63
 - tip 69
 - contamination 68
- atom transfer radical
 - polymerization 220
- autocorrelation 45
- autohesion 151
- barrier resistance
 - effect of surfmers 206
 - in nanocomposites 216
- beam bending 32–34
- blocking 159, 169, 216, 245
- boundary layer 96
- Bragg's law 232
- brittle fracture 293
- brittleness 215
- Brown, Robert 1
- Brownian dynamics simulations
 - of drying 106
- Brownian motion 1, 44
 - applications of 50
- Brown mechanism 125
- capillary deformation 124–5, 135
 - experimental evidence 142
- capillary length 110, 111
- capillary pressure 111–3, 124, 230
 - effect on cracking 116
- capillary waves 157
- carbon nanotube 221, 234, 246, 263
- carboxylic acid groups 173
- carpet backings 6

- chain
 - branching 164–5
 - entanglement 159
 - length 249
 - pull-out 158
 - scission 159
- chalking 245
- chemical patterning 231
- Clausius-Mossotti equation 51
- clay
 - exfoliation 221
 - intercalation 221
- close packing, random 10, 23, 100
- cloudy-clear transition 29, 143
- coalescent reduction 268
- coalescing aid 174–5
 - effect on T_g 175
 - selection of 175
- coffee rings 110
- Col.9[®] 245
- colloidal crystal 23, 232
 - classification 238
 - growth 231
- colloidal stability, effect on drying 114
- colloid dispersion 1
- colloid science 17–23
- complex longitudinal modulus 35
- confocal microscopy 49–50
 - laser scanning 50
- confocal Raman microscopy 52, 74
- construction materials 6
- convection of surfactant 194
- core-shell particle *see* particle
- crack healing 152, 294
- cracking 116–7
 - in nanocomposites 235
 - relaxation mechanism 117
- crack point 29
- crack spacing 117
- creaming 275
- creeping flow 22, 273
- critical coagulation concentration 115
- critical energy release rate 295–6
- critical micelle concentration 191
- critical stress intensity factor 293
- critical volume fraction 234
- crosslinking 58, 73–4, 175
 - autoxidative 74
 - control parameter 179
 - molecular weight effects 178
 - two-pack 175
 - two-pack in one pot 175
- cryogenic electron microscopy *see* electron microscopy
- electron microscopy
- currant-bun particle 221
- dangling chains 178
- Darcy flow 112
- Darcy's law 104
- Debye length 18, 114
- deformation map 133–4, 139
- depletion interactions 17, 20
- Designed Diffusion[™] 269
- desorption of surfactant 199
- deuterium 44
- dew point 283
- dialysed latex 189
- diffraction limit 49
- diffusing wave spectroscopy 46, 263
- diffusion 10, 151
 - activation energy for 166
 - competition with crosslinking 175
 - effect of chain branching 164
 - effect of coalescing aids 174
 - effect of membranes 173
 - effect of molecular weight 164–5
 - effect of particle size 172
 - effect of reduced mobility 171
 - effect of temperature 165
 - in gel 177
 - near T_g 167
 - of core shell particles 172
 - particle shell effects 164
 - scaling prediction 165
 - scaling relations 157
 - shift factor 168
 - surfactant 195
 - tortuosity effects 169

- diffusion coefficient 22, 153, 166
- dirt pick-up 189, 245
- DLVO theory 17, 19
- double cantilever beam 294
- drag coefficient 22
- dry bulb temperature 282
- drying 10, 95–117
 - effect of Peclet number 104, 106
 - effect of salt 106, 115
 - effect of surfactant 114
 - horizontal 107–114
 - factors that affect 112
 - fronts 108, 109
 - MRI of 113
 - importance of 95
 - particle distribution during 99
 - three-stage process 98
 - two-stage process 98
 - vertical 99–107
 - factors affecting 102
- drying fronts 15
- dry sintering *see* sintering
- dwell time in MR profiling 277
- dynamic speckle 48
- elastic particles 127
- elastic spheres 128
- electrical conductivity 36, 216
- electrical impedance 36
- electric force microscopy 69–70
- electron beam damage 40
- electron microscopy 36–42
 - cryogenic scanning 37, 104, 108
 - cryogenic transmission 125
 - dark field 41
 - environmental, pump down 41
 - environmental scanning 36,
37–40, 145
 - design 39
 - scanning 36, 72–3
 - backscattering electron images
73
 - scanning transmission 36
 - transmission 41, 71–2
 - freeze-fracture 72
 - staining 72
 - wet STEM 41–2
- electron paramagnetic resonance 60
- electron scattering 40
- electrostatic repulsion 17, 18–19
- ellipsometry 50, 52, 143
- emulsion polymerisation 2
- emulsion polymers, market for 9
- encapsulated particle 221
- entanglement molecular weight
155, 160, 178
- enthalpy of air 283
- environmental (gaseous) detector
38
- environmental legislation 15–16
- environmental scanning electron
microscopy *see* electron microscopy
- EU Directive 2004/42/EC 15
- evanescent wave 49
- evaporation
 - effects on 97
 - rate 96, 296
- evaporative cooling 32, 96
- evaporative lithography 267
- face-centred cubic 225
- Fickian diffusion 153
- filler particles 168, 171
 - effect on diffusion 81, 170
- film formation
 - mechanical probe 32
 - stages of 10, 11
- film formation paradox 174
- film scratching 32
- film topography 267
- flame retardancy 214
- flammability 214
- flocculation, definition of 20
- flow, particle in Newtonian fluid
276
- flow instabilities 266
- fluorescence decay curves 80, 81
- fluorescence resonance energy
transfer 61, 76
 - simulations 79
- forced Rayleigh scattering 58, 59
- Forster radius 77

- Forster relation 76
fraction of mixing after
interdiffusion 79
fracture energy 159, 296
 effect of diffusion 160
 time dependence 162
fracture strength 159, 296
fracture toughness 159, 293–4
free radicals 40
Frenkel theory 128
FTIR spectroscopy 73
further gradual coalescence 151
GARField 56–58, 277–9
 experimental design 57
 experimental profiles 105
gel point 35
glass transition temperature,
 definition of 2
gloss, effect of surfactant 188
Graham, Thomas 1
gravimetry 32
Guinier plot 75
Halpin-Tsai equations 214
Hamaker constant 18
Hertz theory 127
hetero-flocculation 223–4
homogeneous particles 213–4
honeycomb 13
horizontal drying *see* drying
humidity 281–92
 definition of 95, 281
 relative, definition of 281–2
hybrid 213, 224
 types of 217–25
hydrophobicity 245
ideal gas equation 282
industrial coater 6
infrared microscopy 53, 146
infrared spectroscopy 52
inisurfs 205, 207
inks 6
inorganic nanocomposite particles
 219
inorganic nanoparticles 245
Institute Laue Langevin 43
interaction potentials 17
interdiffusion 152
 effects on 80
 techniques to study 74
interdiffusion distance 162
interfacial chain density 162
interfacial strength 247
interfacial width 75, 152
interparticle interference 51
interpenetration distance 75, 157
interphase 215
interstitial space between latex
 particles 169
inverse micro-Raman spectroscopy
 53, 263
iridescence 232
Janus particles 260
Johnson, Kendall and Roberts 127
Kelvin probe force microscopy
 69–70
knife point 29
Krieger-Dougherty expression 23
Langmuir isotherm 193
laponite 264
laponite clay 228
lapping time 111
latex
 blends 213
 definition of 1
 dialysed 189
 gloves 8
 market for 9
 natural 8
 sensitisation 8
latex film formation 10
 publications on 16
latex foam structures 173
light scattering 44, 83
 dynamic 45
 in nanocomposites 234
magnetic resonance imaging 55
magnetic resonance profiling and
 particle deformation 140
magnetogyric ration 54
Marangoni flows 199, 202

- Marangoni instabilities 200
mass transfer coefficient 97
mass transfer resistance 98
melt compression 232
membrane bending 34
membranes 172–3
meniscus 124, 125, 230
MFFT *see* minimum film formation
 temperature
micelle 191
microrheology 45
miniemulsion polymerisation 217
minimum film formation
 temperature
 and particle size ratio 236
 definition of 14
 effect of particle size 30
 effect of surfactant 191
 interpretation 30
 MFFT bar 29–31, 139, 143
 for studying deformation 138
 standard for 29
 time effects 30
modern art 189
moist sintering *see* sintering
molecular mobility 171
molecular weight 165
Monte Carlo simulation of drying
 106
MRI *see* magnetic resonance
 imaging
multispeckle 46
nanocomposites 213–49
 classification 213
 conductivity 216
 cracking in 235
 failure mechanism 247
 in paints 216
 light scattering in 234
 properties 214
 silica 227
 soft-soft 242
 stiffness of 214
 toughness of 215
 viscoelasticity 215
nanoparticle
 dispersion 233–4
 encapsulated 222
 hybrid 224
Navier-Stokes equation 22, 273–5
Newtonian fluid 22
NMR *see* nuclear magnetic
 resonance
non-adsorbing polymer 20
non-radiative energy transfer 58, 61
nuclear magnetic resonance 54
 MOUSE 56
 spectroscopy 74, 202
occupational exposure limits 15
oligomers 268
opal structure 232
 double-inverse 262
 inverse 262
open time 107, 111
optical cantilever *see* beam bending
optical clarity front 113
optical stethoscopy 70
optical transmission 143
optical transparency 14
packing, face-centered cubic 12
paints, formulation of 4
paper coatings 6
parameter map 131
partial pressure 296
particle
 core-shell 218–10, 226
 film formation 227, 264
 half moon 218
 lobed 218
 occluded structures 218
particle assembly 225, 261
particle blends
 advantages of 233
 film formation 234
 hard-soft 243
particle compressibility 102
particle deformation 10, 12
 atomic force microscopy 144
 driving forces 121, 122
 effect of particle size 139

- effect of temperature 137–9
- MFFT bar 143
- scaling argument 135
- particle deposition methods 230
- particle interfacial area 122
- particle packing 12, 260
 - effect of surfactant 191
 - front 109
 - size ratio effects 235–6
- particle spacing 51
- patterned substrate 231
- peak-to-valley height 144, 145
- Peclet number 101, 195
 - effect on drying 104, 106
- peel strength 190
- pendular rings 126
- percolation 238–42
 - effect on properties 241
 - model 239
 - of rods 240
 - thresholds 239
- phase separation 234
 - in particles 261
- phenanthrene 77, 81
- photoacoustic spectroscopy 73
- photon correlation spectroscopy 45
- photonic crystals 262
- Pickering emulsion polymerisation 222
- plane strain 293
- plane stress 293
- plasticisation 16, 81
 - by surfactant 187
- plasticisers 174
- plastic zone 295
- Plateau borders 146
- Poisson's ratio 127
- poly-condensation 217
- poly(dimethyl siloxane) 245
- Porod law 75–6
- pressure-limiting apertures 38
- pressure sensitive adhesives 190
 - application of 5
- psychrometric chart 283
- pulse gap in MR profiling 279
- quadrature spin-echo sequence 277
- quality factor 64
- quantum efficiency of energy transfer 78
- quartz crystal microbalance 73
- radiolysis 40
- radius of gyration 157, 170, 172
 - compared to diffusion distance 170
- Raman spectroscopy 52
 - surfactant analysis 202
- random coil 172
- raspberry particles 222
- Rayleigh theory 51
- reactive surfactant 205
- refractive index 143
 - measurement of 52
- replicas, transmission electron microscopy 71
- reptation 14, 152, 154
- reptation time 156
- Reynolds number 274
- rheology modifiers 4
- rhombic dodecahedron 13, 122
- root mean square displacement of chains 156
- Rouse entanglement time 156
- Rouse relaxation time 156
- Routh and Russel film deformation model 130
- Rutherford backscattering spectrometry, surfactant analysis 202
- saturated vapour pressure 296
- scanning electric potential microscopy 69–70
- scanning electron microscopy *see* electron microscopy
- scanning near-field optical microscopy 50, 70–1
- scanning transmission electron microscopy *see* electron microscopy
- scattering angle 43
- scattering techniques 42–52

- scratch resistance 216
- secondary ion mass spectrometry 201, 204
- sedimentation 275
- sedimentation coefficient 102
- sedimentation velocity 276
- seeded emulsion polymerisation 219
- shear force microscopy 70–1
- shear modulus 158
- Sheetz deformation 126, 136
- silica
- nanocomposites 227
 - nanoparticles 244
 - particles 169, 172
- sintering
- dry 123–4, 136
 - theory 129
 - moist 126
 - wet 123, 135
- skin formation 58, 107, 141, 146
- experimental evidence 142
 - study of 59
- skin layer 55, 115, 146
- small-angle neutron scattering 42–4, 145
- parameters for 43
 - surfactant analysis 202
 - to study interdiffusion 75
- small-angle X-ray scattering 42–4
- sodium dodecyl sulphate 187
- soft-soft nanocomposites 242
- sorptive capacity 107
- specific volume 282
- speckle
- commercial instrument 49
 - interferometry 48
- spectrophotometry 83
- specular reflection 188
- spin-casting 228
- spin-spin relaxation time 55, 58, 74
- star polymer 165
- steric stabilisation 234
- stick-slip 116
- Stokes-Einstein diffusion coefficient 22, 44, 101
- Stokes flow 22, 275
- stray-field imaging 55
- strength 214
- stress relaxation modulus 131
- styrene-acrylic copolymers 3
- surface patterns 230
- surface roughness 144
- surfactant 185–207
- anionic 185
 - cationic 185
 - classification of 185
 - convection of 194
 - desorption 187, 199
 - exudation 187
 - cause of 192
 - effect of surfmers 206
 - effect of T_g 199 - fate of 186–7
 - gloss effect 188
 - non-ionic 185
 - plasticisation by 187
 - segregation 198
 - solubility in polymer 187
- surfactant-free emulsion polymerisation 185
- surfactant-induced flow 267
- surfmer 205–7
- temperature, effect on particle deformation 137–9
- templates for drying 231
- tensile strength 160
- Texanol™ 174
- textile backings 6
- thermal conductivity 216
- thermoelectric applications 263–4
- thin film analyser 146
- time-temperature superposition 167
- tortuosity 169, 172
- toughness 215
- transmission electron microscopy
- see* electron microscopy
- transmission spectrophotometry 50
- transport coefficient 104

- transurfs 205, 207
- tube model 155
- turbidity 83
- ultramicroscopy 50
- ultrasonic reflection 34–35, 73
- van der Waals attraction 17, 128
- van der Waals forces 115
- varnishes, formulation of 4
- vertical deposition 228–9
- vertical drying profiles *see* drying
- viscoelastic particles 122, 130
- viscosity
 - dependence on volume fraction 23
 - measurement of 32
- viscous flow of particles 128
- VOC *see* volatile organic compounds
- volatile organic compounds 15, 138
- water
 - adsorption 190
 - diffusion coefficient of vapour 96
 - distribution profiles 141
 - surface tension 125
- water whitening 191
- wavevector 43
- wet bulb temperature 282
- wet sintering *see* sintering
- wet STEM *see* electron microscopy
- wetting 152, 157
- Williams-Landel-Ferry equation 167
- Winnik, M.A., 76
- X-ray photoelectron spectroscopy 201
- X-ray scattering 44
- Young's modulus 241