

Index

A

- Abrasion resistance, 55, 57
- Accelerators, *see* Curatives
- Accuracy, 9
- Acetone extract, 67–68
- Acidity
 - ground coal, 114
 - sulfur, 141
- Acid number, rubber processing and extender oils, 129–130
- Acid value, stearic acid, 157
- Acrylonitrile-butadiene rubber, 78, 85
- After-cure dynamic properties, 49–50
- Air oven aging, 51–52
- Alkylated diphenylamines, 160–161, 163
- N-Alkyl-N'-aryl-p-phenylenediamines, 159
- Alpha quartz, ground coal, 113–114
- Ambers, grades, 61–62
- American process, zinc oxide, 152
- Aniline point, rubber processing and extender oils, 129–130
- Antidegradants, 158–164
 - abbreviations, 161–162
 - alkylated diphenylamines, 160–161
 - N-alkyl-N'-aryl-p-phenylenediamines, 159
 - aromatic phosphites, 161
 - N,N'-dialkyl-p-phenylenediamines, 159–160
 - diphenylamine-ketone condensates, 161
 - phenolics, 160
 - p-phenylenediamine, 158–160
 - structures, 159
 - test methods, 161, 163
 - trimethyl-dihydroquinolines, 160
- AOT plots, 192–193
- API gravity, rubber processing and extender oils, 130–131
- Appraiser variation, 10
- Aromaticity, rubber processing and extender oils, 124–126
- Aromatic phosphites, 161, 163
- Ascending order trend plots, 192–193
- Ash test, 67, 82
 - ground coal, 113
 - p-phenylenediamine, 163
 - recycled rubber, 174
 - rubber accelerators, 149
 - stearic acid, 158
 - sulfur, 141
- Asphaltenes, 126–127
- ASTM C 18, 224
- ASTM C 1070, 220
- ASTM D 70, 134, 222
- ASTM D 87, 164–165, 225
- ASTM D 92, 132, 137, 222
- ASTM D 97, 129, 221
- ASTM D 185, 118, 221
- ASTM D 280, 118, 152–153, 221, 224
- ASTM D 297, 172, 173–175, 195, 205, 226–227
- ASTM D 380, 201
- ASTM D 395, 54–55, 59, 215
- ASTM D 396, 217
- ASTM D 412, 47–49, 59, 176, 195, 205, 215
- ASTM D 429, 59
- ASTM D 430, 53, 59, 195, 205, 215
- ASTM D 445, 129, 166, 221, 226
- ASTM D 454, 195
- ASTM D 471, 53–54, 59, 195, 215
- ASTM D 572, 195
- ASTM D 573, 51–52, 59, 195, 215
- ASTM D 575, 59, 195, 205
- ASTM D 611, 129, 221
- ASTM D 623, 52, 195, 205, 215
- ASTM D 624, 50–51, 59, 195, 205, 215
- ASTM D 721, 165, 226
- ASTM D 751, 201
- ASTM D 813, 205
- ASTM D 865, 51, 59, 195, 215
- ASTM D 891, 134, 222
- ASTM D 925, 59
- ASTM D 926, 195, 205
- ASTM D 938, 164–165, 225
- ASTM D 945, 59, 195, 205
- ASTM D 974, 129, 222
- ASTM D 1053, 55, 59, 195, 205, 215
- ASTM D 1070, 112–113
- ASTM D 1148, 196
- ASTM D 1171, 56, 59, 215
- ASTM D 1208, 114, 117, 132, 220, 221

230 BASIC RUBBER TESTING

- ASTM D 1209, 134–135, 222
ASTM D 1218, 135, 161, 222, 225
ASTM D 1229, 196, 205
ASTM D 1278, 216
ASTM D 1298, 130, 222
ASTM D 1321, 166, 226
ASTM D 1329, 59, 196, 205
ASTM D 1349, 214
ASTM D 1394, 117–118, 221
ASTM D 1412, 214
ASTM D 1414, 201
ASTM D 1415, 196, 205
ASTM D 1417, 196, 205
ASTM D 1418, 73–74, 86, 214, 216
ASTM D 1485, 63–64, 187, 212, 216, 228
ASTM D 1646, 12, 20–30
ASTM D 1500, 132, 166, 222, 226
ASTM D 1506, 103, 203
ASTM D 1508, 101, 103, 203
ASTM D 1509, 103, 175, 203, 227
ASTM D 1510, 89, 92–93, 103, 203, 217–218
ASTM D 1511, 100, 103, 203, 219
ASTM D 1512, 103, 203
ASTM D 1513, 92, 100, 203, 218
ASTM D 1514, 101, 103, 203, 219
ASTM D 1519, 145, 161, 196, 205, 223, 225
ASTM D 1544, 134, 222
ASTM D 1618, 103, 203
ASTM D 1619, 103, 203
ASTM D 1630, 196, 205
ASTM D 1646, 196, 205, 213–214, 216
 measuring prevulcanization
 characteristics, 30–32
 Mooney stress relaxation test, 26–30
 Mooney viscosity, 22–26
 test conditions, 75
ASTM D 1707, 225
ASTM D 1725, 211–212
ASTM D 1747, 161, 165, 225
ASTM D 1765, 7, 91, 103, 107, 187, 213,
 218–219, 227
ASTM D 1799, 103, 187, 211–212, 228
ASTM D 1900, 103, 187, 211–212, 228
ASTM D 1917, 196, 205
ASTM D 1937, 102–103, 219
ASTM D 1951, 158, 224
ASTM D 1959, 85, 217, 224
ASTM D 1962, 135, 157, 222, 224
ASTM D 1965, 158, 224
ASTM D 1980, 157, 224
ASTM D 1982, 157, 224
ASTM D 1991, 151, 196, 205, 223
ASTM D 1992, 134, 222
ASTM D 1993, 108, 110, 196, 205, 219
ASTM D 2000, 57, 59, 215
ASTM D 2007, 127, 219
ASTM D 2008, 222
ASTM D 2084, 13, 30–31, 33–38, 154, 176,
 196, 202, 205, 213–214, 224
 test parameters, 34–37
ASTM D 2111, 134, 222
ASTM D 2137, 56, 59, 197, 205, 215
ASTM D 2196, 135–136, 222
ASTM D 2226, 127, 221
ASTM D 2227, 64–65, 216
ASTM D 2228, 55, 197, 205, 215
ASTM D 2240, 55–56, 59, 197, 205, 215
ASTM D 2288, 136, 222
ASTM D 2414, 92, 98, 103, 203, 218–219
ASTM D 2501, 125, 127–128, 221
ASTM D 2632, 197, 205
ASTM D 2663, 103, 203
ASTM D 2702, 163, 225
ASTM D 2804, 93
ASTM D 2887, 164
ASTM D 3037, 152–153, 224
ASTM D 3053, 103
ASTM D 3157, 69, 216
ASTM D 3158, 223
ASTM D 3174, 113, 220
ASTM D 3175, 114, 220
ASTM D 3182, 18, 20, 214, 218
ASTM D 3184, 69–70
ASTM D 3185, 77–78, 145, 199, 214
ASTM D 3186, 199, 214
ASTM D 3187, 77–78, 199
ASTM D 3188, 77–78, 199, 202
ASTM D 3189, 77–78, 199
ASTM D 3190, 77, 79, 200
ASTM D 3191, 102–103, 202–203, 219
ASTM D 3192, 92–93, 102–103, 202–203,
 218–219
ASTM D 3194, 68–69, 197, 205, 216
ASTM D 3196, 77
ASTM D 3265, 92, 103, 203, 218
ASTM D 3280, 152, 154, 224
ASTM D 3313, 102–103, 203
ASTM D 3314, 197, 205
ASTM D 3324, 12, 93, 103, 187, 211–213, 218,
 228
ASTM D 3346, 79, 197, 217
ASTM D 3389, 201
ASTM D 3403, 77, 79, 200
ASTM D 3461, 163
ASTM D 3484, 77, 200, 202
ASTM D 3492, 201
ASTM D 3493, 92, 99, 103, 203, 218–219
ASTM D 3533, 68, 85, 216–217
ASTM D 3566, 87, 217
ASTM D 3568, 77, 79
ASTM D 3616, 82, 197, 217
ASTM D 3629, 205
ASTM D 3639, 197
ASTM D 3720, 118, 221
ASTM D 3765, 89, 98, 103, 108, 203, 219–220
ASTM D 3848, 77
ASTM D 3849, 98, 103, 219
ASTM D 3853, 132, 145, 161, 222–223, 225
ASTM D 3896, 187, 211–212, 228
ASTM D 3900, 197, 205

- ASTM D 3944, 164–165, 225
 ASTM D 3958, 77, 79
 ASTM D 4004, 88, 197, 205, 216–217
 ASTM D 4026, 197, 205
 ASTM D 4075, 152–153, 158, 197, 224–225
 ASTM D 4122, 103, 187, 211–212, 228
 ASTM D 4295, 151, 187, 211, 223, 227
 ASTM D 4315, 152–154, 224
 ASTM D 4371, 115, 221
 ASTM D 4419, 164–166, 225
 ASTM D 4483, 181, 188–207, 210–212, 227–228
 AOT plots, 192–193
 background, 188–190
 incomplete database analysis, 193
 interlaboratory test program analysis, 189
 outlier deletion or replacement, 191–207
 outlier detection, 190
 outlier rejection, 190–191
 ASTM D 4527, 103, 203
 ASTM D 4528, 138, 187, 211–212, 222, 227
 ASTM D 4569, 139–141, 197, 223
 ASTM D 4570, 223
 ASTM D 4571, 139–140, 149, 163, 197, 223, 225
 ASTM D 4572, 139–141, 147, 197, 223
 ASTM D 4573, 139–141, 197, 205, 223
 ASTM D 4574, 139–141, 149, 163, 198, 223, 225
 ASTM D 4578, 138, 140, 198, 205, 222
 ASTM D 4583, 103, 188, 211–212, 228
 ASTM D 4620, 154, 224
 ASTM D 4676, 158, 161, 163, 187, 211–212, 225
 ASTM D 4677, 116, 221
 ASTM D 4678, 12, 184–195, 211–213, 227
 ASTM D 4817, 155, 187, 211–212, 227
 ASTM D 4818, 141, 143, 150, 187, 211–212, 223, 227
 ASTM D 4820, 91, 218
 ASTM D 4821, 11, 93, 103, 181, 211–213, 218, 227
 ASTM D 4924, 164, 225
 ASTM D 4929, 225
 ASTM D 4934, 150, 198, 223
 ASTM D 4936, 150, 198, 205, 223
 ASTM D 4937, 198, 205, 225
 ASTM D 5051, 151, 198, 205, 223
 ASTM D 5044, 198, 205
 ASTM D 5054, 151, 205, 223
 ASTM D 5230, 103, 203
 ASTM D 5239, 102, 219
 ASTM D 5289, 12, 38–40, 145, 154, 198, 205, 213–215, 223
 ASTM D 5297, 198, 205
 ASTM D 5376, 163, 198, 205
 ASTM D 5377, 111–114, 220–221
 ASTM D 5406, 211–212
 ASTM D 5409, 188, 228
 ASTM D 5603, 169, 171–174, 176, 187, 211–212, 226–227
 ASTM D 5604, 107, 110, 219
 ASTM D 5605, 7, 73, 213, 216
 ASTM D 5644, 171–172, 174, 176, 226–227
 ASTM D 5666, 198, 205
 ASTM D 5667, 82, 217
 ASTM D 5668, 81, 217
 ASTM D 5670, 85, 198, 217
 ASTM D 5712, 201
 ASTM D 5774, 80, 198, 205, 217
 ASTM D 5775, 87
 ASTM D 5805, 82, 217
 ASTM D 5816, 218
 ASTM D 5817, 103, 188, 211–212, 228
 ASTM D 5899, 213
 ASTM D 5900, 184–185, 211–212, 227
 ASTM D 5902, 85, 198, 205, 217
 ASTM D 5963, 198, 205
 ASTM D 6047, 86, 198, 205, 217
 ASTM D 6085, 182–183, 211–212, 227
 ASTM D 6086, 99, 108, 219
 ASTM D 6124, 201
 ASTM D 6147, 198, 205
 ASTM D 6204, 12, 40–47, 49–50, 70–71, 213–216
 new Part B, 47
 test conditions, 76
 ASTM D 6370, 198, 205
 ASTM D 6499, 201
 ASTM D 6515, 201
 ASTM D 6556, 89, 92, 97–98, 103, 203, 217–219
 ASTM D 6600, 181, 211–212, 227
 ASTM D 6601, 13, 49–50, 52, 213–215
 ASTM D 6602, 103
 ASTM D 6738, 109–110, 220
 ASTM D 6739, 109–110, 220
 ASTM D 6740, 109–110, 220
 ASTM D 6741, 109–110, 220
 ASTM D 6843, 110, 220
 ASTM D 6844, 110, 220
 ASTM D 6845, 108, 110, 219
 ASTM D 6854, 108, 110, 220
 ASTM D11 standards, 1–2
 ASTM E 28, 163
 ASTM E 203, 136, 222
 ASTM E 691, 188, 190
 Attrition, carbon black, 101
 Automotive applications, classification system for, 57, 59
- B**
- Base number, rubber processing and extender oils, 129–130
 Benzothiazyl disulfide, specification, 185
 BET nitrogen adsorption, silica, 107–108
 Biconical disk, 31, 33
 Bifunctional phenols, 160
 BIIR, 87

232 BASIC RUBBER TESTING

Bis-(triethoxysilylpropyl)sulfanes, 110
Boiling point, protective waxes, 164
Brightness, titanium dioxide, 118–119
Bromine, in presence of chlorine, 87
Bromo-isobutene-isoprene rubber, 79
Brookfield viscosity, synthetic plasticizers, 135–136
Butyl rubber, specification, 186

C

Cadmium content, 153
Calcium carbonate, 121–122
Calibration, 181
Carbon black, 89–104
 aggregate dimensions, 98
 aggregates and agglomerates, 90–91
 applications, 89, 106
 cetyltrimethylammonium bromide
 surface area, 98
 classification, 91–94
 compressed volume index, 99–100
 iodine adsorption number, 95–97
 mass strength, 102
 in masterbatch, 82–83
 oil absorption number, 98–99
 pelleted fines and attrition, 101
 pellet hardness, 101–102
 pellet quality, 100–102
 pellet size distribution, 100
 pour density, 100
 precision comparison, 203
 properties, 93–94
 in recycled rubber, 175
 rubber test recipes and properties, 102–104
 sieve residue, 101
 standard reference, 92, 95–97
 structure, 90–91
 surface area and activity, 89–91
 testing, 187–188
 test reproducibility, 95
 validation of test method precision and bias, 11, 95–96
Cetyltrimethylammonium bromide surface area, 98, 108
Chemical analysis
 actone extract, 67–68
 copper content, 66–67
 iron content, 67
 manganese, 67
 natural rubber, 65–68
 nitrogen, 68
 percent ash, 67
 percent dirt, 66
 recycled rubber, 173–176
 volatile matter, 66
Chloro-isobutene-isoprene rubber, 79
Chloroprene rubber, 79
CIIR, 87
Classification system, for automotive applications, 57, 59

Clay, 119–121
 particle size, 120
Clay-gel analysis, 127–128
Coal, *see* Ground coal
Color
 protective waxes, 166
 rubber processing and extender oils, 132
 synthetic plasticizers, 134–135
Color index, 69
Compounding ingredient storage system, 17–18
Compressed volume index, 99–100
Compression set, 54–55
Congealing point, p-phenylenediamine, 164–165
Consumer-producer agreement, synthetic rubber, 73
Copper content, 66–67
Cost savings, with test method rationalization, 2–4
Curatives, 137–158
 stearic acid, 154–158
 sulfur, 138–141
 zinc oxide, 151–154
 see also Rubber accelerators
Cured rubber compounds, physical properties, 50
Curing procedure, 20

D

"Delta Mooney" test, 79
Density, ground coal, 115
"Devulcanization" process, 170
DGP assay, rubber accelerators, 151
N,N'-Dialkyl-p-phenylenediamines, 159–160
n-Dibutyl phthalate absorption number, 108
Differential scanning calorimeter, 165
Diphenylamine-ketone condensates, 161
Dirt test, 66
DOTG assay, rubber accelerators, 151
Dynamic viscosity, 43–44

E

Elastic torque, 42
Electron microscope image analysis, carbon black, 98
EPDM, 79, 86
Ester plasticizers, 132–133

F

Fiber content, recycled rubber, 176
Flash point open cup
 rubber processing and extender oils, 132
 synthetic plasticizers, 137
Flex cracking resistance, 53
Fraunhofer Diffraction, 112
French process, zinc oxide, 152

G

- Gas chromatography, 110, 161, 164
- Gehman test, 55
- Goodrich flexometer heat buildup, 52
- Ground calcium carbonate, 121–122
- Ground coal, 111–115
 - acidity, 114
 - alpha quartz, 113–114
 - ash test, 113
 - density, 115
 - heat loss, 114
 - particle size, 111–113
 - properties, 112
 - sieve testing, 113
 - volatile matter, 114–115
- Ground rubber, 169–170
 - cryogenic, 170
 - wet, 170

H

- Heat loss
 - ground coal, 114
 - rubber accelerators, 149
 - synthetic plasticizers, 136
 - zinc oxide, 153
- High performance liquid chromatography, 110
- Hydrogenated acrylonitrile-butadiene rubber, test methods, 85–86
- Hydrolysis stability, aromatic phosphites, 163

I

- IARC carcinogen, 114
- Industry reference materials, 9, 17
- Infrared spectrophotometry, 85–86
- Insolubles
 - sulfenamides, 150
 - sulfur, 138, 140–141
- Interlaboratory test bias, 7–8
- Intuitive sampling, 182
- Iodine adsorption number, 95–97
- Iodine value, 85
- IRM 1, 185
- IRM 2, 185
- IRM 43, 185
- IRM 91, 186
- IRM 241, 186–187
- IRM 902, 186
- IRM 903, 186
- Iron content, 67
 - recycled rubber, 176
- ISO 787–2, 122
- ISO 787–10, 120
- ISO 3262–1, 122
- ISO 3262–7, 120
- ISO 3262–8, 120
- ISO 3262–9, 120
- ISO 3262–10, 120
- ISO 3262–11, 120

- ISO 3262–13, 120
- ISO 5725, 188
- ISO 5794–1, 106
- ISO 5795, 120
- ISO 5796, 121–122
- Isobutene-isoprene rubber, 78
- Isoprene, synthetic rubber, 79

K

- Kaolin clays, 119
- Karl Fischer method, synthetic plasticizers, 136–137
- Kinematic viscosity, rubber processing and extender oils, 129
- Kjeldahl method, 68

L

- Lead content, 153
- Linearity, 11–12
- Liquid immersion properties, 53–54
- Loss modulus, 43
- Low temperature properties, 55–56, 58

M

- Manganese test, 67
- Mass strength, carbon black, 102
- Material and safety data sheets, recycled rubber, 171
- MBT assay, rubber accelerators, 151
- MBTS assay, rubber accelerators, 151
- Measurement methodology, 180–182
- Melting point
 - p-phenylenediamine, 164–165
 - rubber accelerators, 145, 147
- Metals in polymers, 88
- Methyl ethyl ketone, 175
- Mineral fillers, 111–122
 - calcium carbonate, 121–122
 - clay, 119–121
 - ground coal, 111–115
 - titanium dioxide, 116–119
- Mixed aniline point, 129–130
- Mixer systems, 18–20
- Moisture content
 - recycled rubber, 175
 - sulfenamides, 150
 - titanium dioxide, 118
- Monofunctional phenols, 160
- Mooney stress relaxation test, 26–30
- Mooney viscometer, 79–80
- Mooney viscosity, 22–26, 192–193
 - target values, raw, 73
- Mooney viscosity test, 20–30
- Multifunctional phenols, 160

N

- Napthenic process oil, specification, 185
- Natural rubber, 61–71
 - ASTM D 1485, 63–64
 - ASTM D 2227, 64–65

Natural rubber (*continued*)

- carbon black, 102–104
- characterizing grades, 70–71
- chemical analysis, 65–68
- color index, 69
- evaluation, 69–70
- historic grades, 61–62
- plasticity retention index, 68–69
- in recycled rubber, 175
- testing, 187–188

Needle penetration, protective waxes, 166–167

Nitrogen adsorption, carbon black, 97–98

Nitrogen content, NBR, 85

Nitrogen test, 68

O

Oil

- in protective waxes, 165–166
- in sulfur, 141
- synthetic rubber, 81
- see also* Rubber processing and extender oils

Oil absorption number, carbon black, 98–99

Organic acid and soap, 81

Organosilanes, 109–110

Oscillating disk curemeter, 30–31, 33–38

cure test parameters, 34–37

Outlier

- AOT plots, 192–193
- deletion or replacement, 191–207
- detection, 190
- rejection, 190–191

Oxygen combustion, synthetic rubber, 87

Ozone resistance, 56–57, 59

P

Particle size

- recycled rubber, 172–174
- classification, recycled rubber, 174

Pelleted fines, carbon black, 101

Pellet hardness, carbon black, 101–102

Pellet size distribution, carbon black, 100

Percent extractables, recycled rubber, 174–175

Petroleum oil, specification, 186

Phenolic antioxidants, 161

Phenolics, 160

p-Phenylenediamine, 158–160, 163

- ash test, 163
- melting/congealing points, 164–165
- purity, 161
- volatile materials, 163

pH value, silica, 109

Pico abrasion test, 55, 57

Plasticity retention index, 68–69

Plasticizers, *see* Synthetic plasticizers

Polar compounds, rubber processing and extender oils, 126

Polybutadiene, extender oils, 124

Pour density, carbon black, 100

Pour point, rubber processing and extender oils, 129

Power law model, 26–27

Precipitated hydrated silica, 106

Precision, 180–181, 188–207

- calculation by computer program, 193
- interlaboratory, 189

Precision types, 194, 202

Prevulcanization characteristics, 23–24, 30, 32

- measuring, 30–32

PRI test, 68–69

Protective waxes, 163–167

- boiling point, 164
- color, 166
- needle penetration, 166–167
- percent oil, 165–166
- refractive index, 165
- test methods, 164–167
- viscosity, 166

Protocol sampling, 182–183

Q

Quality assurance, after-cure dynamic properties, 49–50

Quality testing, importance, 4–5

R

Reclaiming, recycled rubber, 169

Recycled rubber, 169–177

- chemical analysis, 173–176
- crumb, storage, 171
- cryogenic ground, 170
- "devulcanization" process, 170
- evaluation in compounds, 176–177
- ground, 169–170
- iron and fiber content, 176
- material and safety data sheets, 171
- need for standards, 170–171
- particle size and distribution, 172–174
- particle size classification, 174
- properties, 173–174
- reclaiming, 169
- sampling and test plans, 172
- test methods, 172–176
- wet ground, 170

Reference materials, 184–187

uses, 186–187

Refractive index

- protective waxes, 165
- synthetic plasticizers, 135

Repeatability, 9, 194

Reproducibility, 9, 194

Residue on ignition, 109

Ribbed smoked sheets, 61–63

- Rotoless curemeter, 38–40
- Rotoless shear rheometer, 40–47
 - dynamic viscosity, 43
 - elastic torque, 42
 - loss modulus, 43
 - shear thinning, 44
 - storage modulus, 43
 - tangent & delta, 43
 - test conditions, 45
 - viscous torque, 42–43
- Rubber
 - classification system, 13–15
 - formulation, 13, 16
 - hardness, 55–56
 - history, 1
- Rubber accelerators, 141–151
 - abbreviations, 145, 148–149
 - assay for DPG and DOTG, 151
 - assay for sulfenamides, 150–151
 - classification, 142
 - heat loss, 149
 - initial melting point, 145, 147
 - MBT assay, 151
 - MBTS assay, 151
 - percent ash, 149
 - percent insolubles, 150
 - percent moisture, 150
 - structures, 143–146
 - wet sieve, 147, 149
- Rubber hydrocarbon percent, recycled rubber, 175
- Rubber process, 12–13
- Rubber processing and extender oils, 124–132
 - acid and base number, 129–130
 - aniline point, 129–130
 - API gravity, 130–131
 - aromaticity, 124–126
 - asphaltenes, 126–127
 - ASTM oil classification, 127
 - average molecular weight, 126
 - classification, 125–126
 - clay-gel analysis, 127–128
 - color, 132
 - flash point open cup, 132
 - kinematic viscosity, 129
 - polar compounds, 126
 - pour point, 129
 - UV absorbance, 132
 - viscosity-gravity constant, 125, 128–129
 - volatility, 126
 - wax content, 127
- Rubber test laboratory, 17–20
 - compounding ingredient storage system, 17–18
 - curing procedure, 20
 - mixer systems, 18–20
 - weighing systems, 18–19
- Rutile content, titanium dioxide, 118
- S**
- Sample preparation, 63–64
- Sampling, 182–183
 - recycled rubber, 172
 - statistical, 182
- Saponification value
 - stearic acid, 157
 - synthetic plasticizers, 135
- Sensitivity, 181, 207–210
 - background, 207
 - categories, 209–210
 - concepts, 208–210
 - measurement process, 207–208
 - relative, 209
- Sieve testing
 - carbon black, 101
 - ground coal, 113
- Silica, 105–110
 - applications versus carbon black, 106
 - classification, 106–107
 - pH value, 109
 - structure, 108
 - surface area, 107–108
 - types, 105–107
 - volatile content, 109
- Silica-to-alumina mass ratio, clay, 120
- Silicon dioxide, *see* Silica
- Softening point, trimethyl-
dihydroquinolines, 163
- Specific gravity, 131, 134
- Stability, 10–11
- Statistical sampling, 182
- Statistical Thickness Surface Area Method, 97–98
- Stearic acid, 154–158
 - acid value, 157
 - ash test, 158
 - properties, 155
 - saponification value, 157
 - titer, 157
 - trace metal, 158
 - unsaponification matter, 158
- Storage, recycled rubber, 171
- Storage modulus, 43
- Stress relaxation test, 26–30
- Styrene-butadiene rubber, 78
 - bound styrene, 86–87
 - carbon black, 102–104
 - processability, 79–80
- Sulfenamides, 150–151
- Sulfur, 138–141
 - acidity, 141
 - ash test, 141
 - insolubles, 138, 140–141
 - percent oil, 141
 - properties, 138–139
 - wet sieve, 141
- Sulfur "bloom", 138

- Sulfur content
 - silanes, 109
 - zinc oxide, 154
 - Surface area, zinc oxide, 153
 - Synthetic plasticizers, 132–137
 - abbreviations, 132–133
 - Brookfield viscosity, 135–136
 - color, 134–135
 - flash point open cup, 137
 - heat loss, 136
 - Karl Fischer method, 136–137
 - refractive index, 135
 - saponification value, 135
 - specific gravity, 134
 - Synthetic rubber, 72–88
 - abbreviations, 74
 - ASTM test recipes, 77
 - "classification" letter, 72–73
 - consumer-producer agreement, 73
 - nomenclature, 72–73
 - physical tests, 75–76
 - standard test recipes and procedures, 77–79
 - testing, 187–188
 - Synthetic rubber, chemical tests, 80–88
 - carbon black in masterbatch, 82–83
 - gel, swelling index, and dilute solution viscosity, 82–84
 - oil, 81
 - organic acid and soap, 81
 - total and water soluble ash, 82
 - total extractables, 80–81
 - volatile matter, 81–82
- T**
- Tangent & delta, 43
 - Target values, 6–7
 - Tear resistance, 50–51
 - Technically specified rubber, 61, 63
 - grades, 64–65
 - Tensile properties, 47–49
 - Testing
 - carbon black, 187–188
 - natural and synthetic rubber, 187–188
 - precision, 188–207
 - sensitivity, 207–210
 - Testing bias, 7–8
 - Testing operations, 179–187
 - calibration, 181
 - measurement and data reporting, 183–187
 - measurement methodology, 180–182
 - planning, 180
 - precision, 180–181
 - sampling, 182–183
 - sensitivity, 181
 - traceability, 181–182
 - Test recipe, zinc oxide, 154
 - Tetramethyl thiuram disulfide,
 - specification, 185
 - Tint strength, titanium dioxide, 118–119
 - Titanium dioxide, 116–119
 - coarse particles, 117–119
 - moisture content, 118
 - pH, 117
 - properties, 116
 - purity, 117
 - rutile content, 118
 - tint strength and brightness, 118–119
 - "Tolerance stack-up", 5–6
 - Traceability, 181–182
 - Trace metal, stearic acid, 158
 - Trimethyl-dihydroquinolines, 160
 - purity, 163
 - softening point, 163
- U**
- Unsaponification matter, stearic acid, 158
 - UV absorbance, rubber processing and extender oils, 132
- V**
- Viscosity
 - protective waxes, 166
 - test conditions, 22, 25
 - Viscosity-gravity constant, rubber processing and extender oils, 125, 128–129
 - Viscous torque, 42–43
 - Volatile matter, 66
 - ground coal, 114–115
 - p-phenylenediamine, 163
 - silica, 109
 - synthetic rubber, 81–82
 - Volatility, rubber processing and extender oils, 126
 - Vulcanizing agents, *see* Curatives
- W**
- Wallace Plasticity Test, 68–69
 - Wax content, rubber processing and extender oils, 127
 - Wax, *see* Protective waxes
 - Weighing systems, 18–19
 - Wet sieve
 - rubber accelerators, 147, 149
 - sulfur, 141
 - Whiting, 121
- Z**
- Zinc oxide, 151–154
 - purity, 154
 - specification, 186
 - test methods, 153–154
 - treatment, 152–153
 - types, 151–152