Index

A
Abbe number, 44
abrasion, 49
absorption filter. See color optical filter
acceptance quality level/limit (AQL), 65
acceptance sampling, 62
achromatic lens, 21
acid
durability, 48
resistance (RA), 47
resistance (SR), 46, 47
adhesive, 104
UV-curing, 104
advanced plasma reactive sputtering (APRS), 100
alkali resistance (AR), 46
aluminum (Al), 64, 65
angle block, 285
angle of incidence, 2
angularity, 282
annealing, 167
antireflective (AR) coating, 93
aspheric surface, 23
astigmatism, 17, 22
attenuation region, 6
autocollimator, 8, 284, 285
boresight, 146
brush technique, 129
bubble, 107
build to print (BTP), 132
build to specification (BTS), 132

C
cement defect, 113
cement wedge, 107
center wavelength (CWL), 6, 7
central thickness, 243
centration, 217
certificate of analysis (COA), 144
certificate of compliance/conformity (COC), 142
certificate of test (COT), 144
dehalon glass, 40
dechalcogenide glass, 40
chamfer, 269, 270, 271
chemical vapor deposition (CVD), 59
cromatic aberration, 16, 21
circularity. See roundness
cleaning solvent, 125
climatic resistance (CR), 46
coatings, 23
color optical filter, 36
coma, 17, 21
commonly used quality control (CWQC), 160
computer numerical control (CNC), 84
computer-generated hologram (CGH), 329
concentricity, 259
contact profilometer, 36
cosmetic defect, 81, 83
cotton swab technique, 130
CR-39, 40, 63
critical angle, 13, 14
Crosby, 158
crystal, 38, 54
tropic, 38
optical, 38
crystalline materials, 41
curvature of field, 17, 22
cut-off, 6
cut-on, 6
cylindrical lens, 327, 334
cylindrical surface, 293
Czochralski method, 58

D
decentering, 106
Deming, 156
density, 48
dial gauge, 232
diamond turning (DT), 71, 73
diffraction, 11
diffractional surface, 46
dig number, 103
dimming resistivity, 48
discoloration, 107
dispersion, 10, 44
distortion, 19, 22
barrel, 20
pincushion, 20
dome, 29
doublet, 27, 186
drop and drag technique, 129
durability tests, 11

E
dge chip, 108, 109
electrical resistivity, 177, 178
electromagnetic radiation, 7, 9
ethyl alcohol, 126
evaporation, 97
electron beam, 98
flash, 98
resistive, 98
thermal, 97

F
f-number, 207
Feigenbaum, 162
filter, 29
first article inspection (FAI), 182
First Contact™ Cleaning Solution, 137
flatness, 300
forward-looking infrared (FLIR), 38
freeform (FF) optics, 85
full width at half maximum (FWHM), 6

G
Garvin, 165
gauge block, 255
gemetric dimensioning and tolerancing (GD&T), 122, 126
gemetrical optics, 7, 11
germainum (Ge), 49
glass, 34, 41, 51
alumosilicate, 35
ceramic, 41
fused silica, 34
lead oxide, 34
optical, 34, 53
oxide, 35
soda lime silica, 34
sodium borosilicate, 34
goniometer, 291
goniometer-spectrometer, 151
gradient solidification method (GSM), 56
grain boundary, 52

H
half-bandwidth (HBW), 7
hardness, 48
heat treatment, 66
homogeneity, 45, 152, 153
hot isostatic press (HIP), 61
hybrid molding, 83
**Index**

<table>
<thead>
<tr>
<th>I</th>
<th>malleability, 67</th>
</tr>
</thead>
<tbody>
<tr>
<td>inclusion, 107</td>
<td>Material Safety Data Sheet (MSDS), 133, 136</td>
</tr>
<tr>
<td>inside edge, 273</td>
<td>mechanical axis, 217, 231</td>
</tr>
<tr>
<td>inspection, 184</td>
<td>metal substrate, 40</td>
</tr>
<tr>
<td>inspection report (IR), 134</td>
<td>metrology, 124</td>
</tr>
<tr>
<td>interference, 11, 22, 23</td>
<td>legal, 125</td>
</tr>
<tr>
<td>fringe, 321</td>
<td>scientific, 125</td>
</tr>
<tr>
<td>pattern, 23</td>
<td>micrometer, 237</td>
</tr>
<tr>
<td>interferometer, 8, 321</td>
<td>milspecs, 113</td>
</tr>
<tr>
<td>interferometric scale factor (ISF), 314</td>
<td>minimum resolvable contrast (MRC), 148</td>
</tr>
<tr>
<td>internal transmittance, 174, 176</td>
<td>minimum resolvable temperature difference (MRTD), 148</td>
</tr>
<tr>
<td>International Glass Code, 35</td>
<td>mirror, 31</td>
</tr>
<tr>
<td>International Organization for Standardization, 117</td>
<td>modulation transfer function (MTF), 144</td>
</tr>
<tr>
<td>International System of Units (SI), 125</td>
<td>molding, 36</td>
</tr>
<tr>
<td>intrinsic chemical durability, 48</td>
<td>monochromatic aberration, 17, 21</td>
</tr>
<tr>
<td>ion beam figuring (IBF), 87</td>
<td>monomer, 64</td>
</tr>
<tr>
<td>ion beam sputtering, 99</td>
<td>N</td>
</tr>
<tr>
<td>ion-beam-assisted deposition (IBAD), 98</td>
<td>negative lens, 246</td>
</tr>
<tr>
<td>irregularity, 302</td>
<td>noise equivalent temperature difference (NETD), 146</td>
</tr>
<tr>
<td>Ishikawa, 160</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J</th>
<th>optical aberration, 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juran, 159</td>
<td>optical anisotropy, 41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L</th>
<th>optical coating, 92, 338</th>
</tr>
</thead>
<tbody>
<tr>
<td>laser interferometer, 23</td>
<td>optical component, 27</td>
</tr>
<tr>
<td>latent scratch resistivity, 48</td>
<td>optical designer, 5</td>
</tr>
<tr>
<td>lean manufacturing, 169</td>
<td>optical filter, 5</td>
</tr>
<tr>
<td>length, 257</td>
<td>optical isotropy, 41</td>
</tr>
<tr>
<td>lens, 27</td>
<td>optical material, 33</td>
</tr>
<tr>
<td>linear coefficient of thermal expansion, 49</td>
<td>optical path difference (OPD), 174</td>
</tr>
<tr>
<td>long-wavelength pass filter, 7</td>
<td>optical system, 22, 25, 26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M</th>
<th>optics inspector, 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>magnesium fluoride (MgF₂), 38</td>
<td>packaging, 134</td>
</tr>
<tr>
<td>magneto rheological finishing (MRF), 81</td>
<td>peak transmission, 6</td>
</tr>
<tr>
<td>magnetron sputter deposition, 100</td>
<td>perpendicularly, 265</td>
</tr>
</tbody>
</table>
phosphate resistance (PR), 47
physical optics, 7, 15
plastic, 39, 41, 62
point spread function (PSF), 149
polariscope, 170
polycarbonate, 40
polymer, 62
positive lens, 244
power fringe, 193
precipitation hardening, 65
precision glass molding (PGM), 73
prism, 28, 186
profile plot, 25
profile projector, 284
profilometer, 208, 209

Q
quality, 3, 4, 18
  assurance (QA), 5, 155
  audit, 169
  costs, 170
  guru, 3
  management theories, 156
Quality Trilogy, 159

R
R-number, 207
radical initiator, 64
radius of curvature (ROC), 327
raw material certificate, 135
reflection, 9
refraction, 9, 10, 13
refractive index, 44, 146, 148
refractometer, 8
resolving power, 143
reticle, 186
root mean square (RMS), 279, 303
roughness, 39
roundness, 232
route card (RC), 139
rules of thumb, 127

S
sagitta (sag), 212, 214
sapphire, 52, 55
synthetic, 55
scattering, 12
seven wastes, 170
shelf item, 132
Shewhart, 163
shipping, 135
short-wavelength pass filter, 7
shrinkage, 106
silica gel, 135
silicon (Si), 49
singlet, 27, 185
slope, 6
slope error, 44
Snell’s law, 10
specification, 112
spectrophotometer, 8, 338
speed, 9
spherical aberration, 17, 21
spherical surface, 293
spindle grinding, 69
sputter deposition, 99
stain, 112
stain resistance (FR), 46
staining resistivity, 48
standard, 111
statistical quality control (SQC), 163
strain, 165, 166, 167
striae, 45, 159, 92
  designation, 163
surface
  defects, 95
  quality, 12
  texture, 276
synthesis, 64

T
temperature coefficient of refractive index, 49
tempering, 65
test plate, 23, 295, 296
thermosetting polymer, 64
thickness, 252
total indicator reading (TIR), 219
total internal reflection (TIR), 14
total quality control, 162
Total Quality Management (TQM), 156
transmission, 174
triplet, 28

U
uncured lens, 107

V
V-block refractometer, 149, 150
Vernier caliper, 235, 236
visual inspection, 82, 84

W
water resistance (RW), 47
weathering resistance (W), 47
window, 29, 186
wipe technique, 128
witness sample, 106, 14, 16

Z
Zeonex® E48R, 40
zinc
  selenide (ZnSe), 38
  sulfide (ZnS), 38, 60, 61
Michael Hausner was born in 1949 in Ukraine (former USSR republic) and immigrated to Israel with his parents and sister in 1959. In 1968, he graduated from technical school as a technician/tool operator, and in 1977 he graduated from the Technion (Israel Institute of Technology), External Studies Section, as a Certified Senior Electrician. In 1990, Hausner became a Certified Practical Electronics Engineer after studying at ORT Bialik College, and in 1996 he graduated from the Standards Institution of Israel (SII) as a Certified Quality Auditor. In 2001, he became a Senior Certified Teacher at the Practical Engineering School in the Technion. His quality management system has been certified for ISO 9001:2008 by the SII since 2013.

Since 1984, Hausner has spent his time in two fields:

- Optics, including the inspection and testing of optical elements (incoming and at the source of production), audits of optical element suppliers, writing procedures for optics inspections, handling nonconforming optical elements and corrective actions, consulting, and training inspectors.
- Quality assurance, including the oversight of QA training courses at several colleges (over 1500 hours of instruction).

He currently works as an independent optics inspector who assists various companies in Israel.