

Index

a

Absolute temperature 20
 Absorption band intensity 14, 15, 18
 Absorption loss 11–18, 27, 60, 62, 65
 Acetaldehyde 69
 Acrylate 84
 Acrylonitrile 84, 85
 Advection–diffusion equation 96
 Alcohol 69
 Aliphatic C–H absorption 16–18, 68
 Aliphatic C–H bond 17, 18, 67
 Amorphous polymer 23–26, 74
 Amplifier 107, 119, 123
 Angular dependence 20, 22, 65, 90
 Anharmonicity constant 13, 14, 18
 Anharmonic potential 13
 Anisotropic light scattering 19, 21, 23
 Aromatic C–H absorption 16, 18
 Aromatic C–H bond 17, 18, 67
 Atomic radius 23
 Attenuation 5–8, 12, 15–18, 26–28, 31, 32, 39, 43, 46, 51, 53, 60–62, 64, 65, 67, 68, 70, 81, 90, 91, 94, 105, 107–111, 120, 121, 122, 125–127
 Attenuation spectrum 27, 61, 67, 62
 Autocorrelation function 40, 41
 Avogadro's number 23
 Azimuthal mode number 44

b

Ball lens 128–132
 Ballpoint pen interconnection 128, 132–134
 Ballpoint pen termination 129–133
 Bandgap energy 12
 Bandwidth 1, 2, 4–8, 18, 31–39, 42, 46, 49, 51, 59, 60, 63, 101, 105, 111–114, 117, 127, 128, 134, 135

Base polymer material 59, 79
 Batch extrusion 79–81
 Batch process 79
 Beam quality 55
 Bending vibration 61
 Benzoyl peroxide (BPO) 93
 Benzyl acrylate (BzA) 84, 85
 Benzyl methacrylate (BzMA) 85, 86, 94
 BER. *See* Bit error rate (BER)
 Binary monomer system 84–85, 88
 Bit error rate (BER) 4, 32, 101, 119, 120, 122–127, 134, 135
 Bit rate 1, 6, 8, 60, 122, 132
 Boltzmann constant 20
 Bonding energy 14
 Bond length 13, 23
 9-Bromophenanthrene (BPT) 68
 Bulk 16, 17, 19–22, 39, 71, 74, 75, 79, 93
n-Butyl mercaptan (*n*-BM) 150

c

Carbonyl group 18
 Center launching condition 51, 53–55
 Centrifugal deposition method 94
 Centrifugal force 93–95
 C–F bond 15, 27, 62
 Chain transfer agent 72, 80
 C–H bond 12, 15–18, 62, 64, 65, 67
 Chlorotrifluoroethylene 74
 Chromatic dispersion 34, 126
 Cladding 3, 6, 32–34, 59, 63, 67, 79, 81, 92, 96, 101–104, 109, 110, 114, 130
 Coaxial cable 106
 C–O bond 27, 62
 Coextrusion die 81
 Column distillation 69
 Conjugation 12
 Continuous extrusion process 79, 81, 82

Copolymer 7, 8, 62, 65–67, 73–75, 83,
86–89, 91, 94, 95
Copolymer composition 65, 74, 75, 83, 88, 89
Copolymerization 7, 65, 66, 74, 82–90
Core
– base material 16, 60, 64, 67
– bulk 39
Core–cladding boundary 3, 4, 33, 92, 105,
110
Correlation function 20 40, 41, 44
Correlation length 20, 21, 41, 43–47, 65, 66,
90
Coupled mode equation 43
Critical angle 3
Crystalline structure 62
Cutback technique 108–110
Cutoff 49
N-Cyclohexyl maleimide 67
CYTOP 27, 28, 37, 38, 62–64, 70, 73, 109

d

Data communication 5, 11, 120, 127
Data transmission speed 64
– 3dB bandwidth 46, 49, 51, 60, 111
Debye plot 21
Decomposition temperature 72
Demultiplexer 119
Density 16, 19, 38, 40, 46, 53, 64, 69, 88, 94
Deuterium 15, 16, 27, 60, 109
Dibenzothiophene (DBT) 68
Dielectric constant 20 39, 40, 41, 43, 44, 63,
65, 66, 90
Diffusion coefficient 97
Diffusion section 96, 97
Diphenyl sulfide (DPS) 36, 44, 64, 91, 105
Dissociation energy 14
Distillation 26, 69, 71, 80
Distributed antenna system 50
Dopant 8, 34, 36, 59, 68, 69, 79, 90–92, 96,
97, 105, 110
Dopant concentration 8, 59, 68, 91, 97
Double cladding structure 63

e

Edge-emitting laser 126, 127
Einstein's fluctuation theory 21, 22
Electromagnetic interference 2, 5, 7, 127
Electronic transition absorptions 11–12, 16
Electrostatic interaction 84
Empirical estimation 23–26
Entanglement 23, 25
E/O converter 119
Equalizer 119, 123, 135
Ester group 11, 12

Excess scattering 20–23
Extrusion 27, 79, 80–82, 95–98
Eye
– diagram 119, 120–122, 124
– mask 122, 123
– opening 121–122
– pattern 121, 122
– safety 120

f

Face-to-face communication 6
Fiber-optic communication 101, 111, 123
Fiber-to-the-home (FTTH) 139
Fick's diffusion 152
Film 73, 74, 75
Finite element analysis 44
Fluctuation theory 23, 27
Fluorinated group 69
Fluorination 8, 15–18, 71, 109
Fluorine 15–18, 27, 61, 66, 69, 71, 73
Fluorine substituent 69
Fluorovinyl monomer 74, 75
Fontex 63
Forward error correction (FEC) 123, 135
Forward scattering 39, 41, 42, 44, 47, 55
Fractional distillation 69, 71
Free-radical polymerization 69 79, 84
Free volume 23, 73
Freeze–pump–thaw cycle 80
Frequency 11, 13, 14, 31, 32, 48–51, 53, 111,
112, 135

g

Gel phase 83, 90
GI. *See* Graded-index (GI)
Gigabit Ethernet 60, 122, 123, 126, 134–135
GINOVER 67
Glass optical fiber (GOF) 11, 63
– backbone 6
Glass transition temperature (T_g) 21, 40, 91
Glassy state 25
GOF. *See* Glass optical fiber (GOF)
Graded-index (GI) 3, 27, 33, 59, 79, 82–95,
101, 122
– preform 39, 64, 79, 80, 82–84, 86, 87, 91,
92, 93, 94
– profile 38, 46, 59, 79, 84, 85, 90–95, 98,
105, 110
Graded-index plastic optical fiber (GI POF)
6, 27, 35, 59, 79, 105, 122
Grignard reaction 69
Grignard reagent 69
Group delay 43–50
Group velocity 34, 44

h

Harmonic oscillator 13
 HD-SDI. *See* High-definition serial digital interface (HD-SDI)
 Heterogeneous structure 8, 20–21, 65, 66, 90, 95
 High-definition serial digital interface (HD-SDI) 132
 Higher-order structure 20, 39
 Home networking 50
 Homopolymer 61, 62, 64–66, 73, 82, 84, 86, 88
 Humidity test 61
 Hydrocarbon 61, 67, 69, 71
 Hydrogen atom 15, 16, 61, 69
 Hyflon AD 62

i

Impulse response 31, 35, 44, 49, 111, 112
 Information-carrying capacity 1, 2
 Infrared wavelength 12
 Initiator 12, 69, 71, 72, 75, 80, 81, 82
 Inorganic contaminant 27
 Input pulse 3, 31, 32, 35, 111, 112
 Integral band intensities 15
 Interfacial-gel copolymerization 82, 85, 86
 Interfacial-gel polymerization 64, 83, 90–92, 105, 110, 128
 Intermodal dispersion 32–34
 Intersymbol interference (ISI) 4, 32, 101, 123, 125–126, 134, 135
 Intramodal dispersion 31, 32, 34–35
 ISI. *See* Intersymbol interference (ISI)
 Isothermal compressibility 20, 23–25
 Isotropic light scattering 19, 24–26

k

8K 6, 132

l

LAN. *See* Local area network (LAN)
 Laser diode (LD) 106, 119, 125
 Light-emitting diode (LED) 31, 60, 133
 Light propagation 3
 Light scattering 16, 19–22, 24–27, 39, 40, 41, 65, 66, 90, 92, 95, 110, 111
 Link margin 120
 Link power budget 119, 120, 134, 135
 Link power penalty 122–125, 134
 Liquid–liquid transition temperature (T_{ll}) 25
 Local area network (LAN) 2, 106, 119, 127, 128
 Lorentz–Lorenz equation 25, 69, 88, 94

Low-loss window 27, 60, 109

LP mode 46

Lucina 27, 62

m

Material dispersion 8, 34, 37, 38, 59, 63, 97, 126
 Melting point 73
 Methacrylate 64, 84
 Microbending 38, 47, 48, 49, 50
 Microscopic heterogeneous structure 8, 39
 MMF. *See* Multimode fiber (MMF)
 Modal dispersion 3–8, 32–37, 59, 101, 113, 125
 Modal noise 2, 5, 50, 51
 Mode coupling 31, 38, 39, 41–55, 105, 107, 108, 112–115, 117
 Mode mixing 32
 Mode partition noise 126–127
 Mode power distribution 42, 46, 51, 52, 54, 105, 107, 108, 115
 Molecular refraction 23
 Molecular vibration absorption 11, 12–15, 27
 Molecular weight 8, 22, 23, 25, 62, 64, 72, 80, 88, 91
 Monomer reactivity ratio 8, 66, 82–84, 87, 88, 90
 Monomer unit 23, 25, 62, 64, 69, 87, 88, 93
 Morse code 1
 Morse function 13
 Morse potential energy 27
 Multi-core graded-index plastic optical fiber 96
 Multimode fiber (MMF) 2–5, 26, 31–34, 38, 39, 41–43, 47, 50–55, 101, 105–109, 111–113, 125, 133, 134
 Multiplexer 119

n

NA. *See* Numerical aperture (NA)
 Near-field pattern (NFP) 51, 114–117, 128, 129
 Near-infrared wavelength 12, 27
 Network 2, 5–8, 35, 39, 50, 60, 63, 105, 106, 110, 119, 120, 123, 124, 127–129, 134
 Newtonian fluid 97
 NFP. *See* Near-field pattern (NFP)
 Noise margin 120, 121
 Nozzle 81, 94, 96
 $n-\pi^*$ transition 11
 $n-\sigma^*$ transition 11
 Numerical aperture (NA) 32, 91, 102, 105, 125

o

O/E converter 119
 One-dimensional diffusion 97
 On-off keying 31
 Optical interconnection 130
 Optical isolators 50
 Optimum profile 33, 34, 38, 98, 114
 Orthogonal frequency-division multiplexing (OFDM) 135
 Orthogonality condition 42
 Output pulse 3, 31, 34, 35, 47–49, 111, 112, 113, 114, 125
 Overfilled launch condition 35, 36, 46, 106
 Overtone 12, 14–18, 27, 60, 61, 65, 67

p

para-Fluoro styrene (*p*-FSt) 16, 85, 86
 Partially crystalline structure 62
 Partially fluorinated polymer 16
 Partially halogenated polymer 63–70
 Pentafluorophenyl methacrylate (PFPhMA) 17, 64, 65
 Pentafluorostyrene (PFSt) 16
 Perdeuterated PMMA (PMMA- d_8) 27, 60, 61, 109
 Perfluorinated polymer 8, 27, 37, 61–63, 109
 Perfluoro(4-vinyl-1-butene) 159
 Perfluorodibenzoyl peroxide 71–73, 75
 Perfluorodioxolane 71, 73, 74
 Perfluoro-2-methylene-4,5-dimethyl-1,3-dioxolane 71
 Perfluoro-2-methylene-1,3-dioxolane 70–74
 Perfluoromethyl vinyl ether 74
 Phenyl methacrylate (PhMA) 16, 85
 Phosphorous pentoxide 69
 Photo-copolymerization 82, 83, 85–87, 90
 π – π^* transition 12
 Planck's constant 13
 Plasticization 59, 68, 91
 Plastic optical fiber (POF) 2, 11, 31, 59, 79, 101
 Polarizability 20
 Polarization 19
 Polarization mode 32, 111
 Polarization mode dispersion 31, 32, 111
 Poly(2,2,2-trichloroethyl methacrylate) (Poly(TCIEMA)) 64, 65, 67
 Poly(2,2,2-trifluoroethyl methacrylate) (Poly(TFEMA)) 64, 65, 97
 Poly(2,2,3,3-tetrafluoropropylmethacrylate) 93, 94
 Poly(2,3,4,5,6-pentafluorostyrene) 69
 Poly(2-trifluoromethyl styrene) 70
 Poly(carbonate) (PC) 12, 13, 21

Poly(methyl methacrylate) (PMMA) 11, 12, 13, 21–23, 25–27, 37, 39, 44, 59–61, 65, 67, 70, 90, 93, 94, 125
 Poly(styrene) (PSt) 12, 13, 16–18, 21, 25, 26, 67–70
 Poly(tetrafluoroethylene) (PTFE) 61
 Polymer 5, 12, 34, 59, 79, 109
 – rod 79
 – tube 83
 Polymer-dopant system 59, 91
 Polymerization
 – conversion 81
 – temperature 22
 Potential anharmonicity 12
 Power-law approximation 101–102
 Power penalties 120, 122–127, 134, 135
 Power transfer function 31, 111, 112
 PRBS. *See* Pseudorandom binary sequence (PRBS)
 Preferential dopant diffusion 90–92
 Preform 8, 39, 64, 79, 80, 82–95, 102, 128
 Preform-drawing process 62, 67, 79–80, 95
 Prepolymer 83
 Principal mode group 44, 47
 Profile dispersion 34, 36, 38
 Propagation constant 32, 42, 44, 107
 Propagation loss 139
 Pseudorandom binary sequence (PRBS) 121

q

Q-*e* map 84, 86

r

Radial mode number 44
 Radiation mode 42
 Radiation mode coupling 42
 Radical 82
 Radical polymerization 79, 84
 Radio frequency 50
 Radio over fiber (RoF) 39, 50, 51
 Random mode coupling 38, 41, 42, 44, 45, 48, 49
 Rayleigh–Debye scattering 40
 Rayleigh scattering 38
 Ray trajectory 3, 4, 103, 104
 Reactivity 8, 66, 74, 75, 82–84, 87, 88, 90
 Receiver 1, 108, 119, 120, 122–127, 134
 Recrystallize 73
 Reflection noise 50–53
 Refractive index (RI) 2–4, 8, 20, 23, 25, 27, 32–34, 59, 63, 66–69, 74, 75, 82–84, 86–89, 91–93, 97, 101–105, 110, 130

- Refractive index profile (RIP) 3, 4, 5, 7, 8,
33–38, 44, 47, 60, 64, 79, 84, 86, 93, 94, 96,
97, 101–105, 107, 110, 112–117, 125, 128,
134
– coefficient 161
Regenerator 119
Relative intensity noise 127
Resonance 12, 18
Resonance absorption frequency 14
Rod-in-tube method 64, 67, 91, 92, 95
Root mean squared (rms) width 31, 49
Roundtrip frequency 53
Rubbery state 91
- S**
Scalar wave equation 33, 44
Scattering 11, 16, 19–27, 38–42, 44, 46, 47,
51, 55, 65, 66, 90, 92, 95, 108, 110, 111
Scattering angle 19, 20, 44, 65, 90
Schrödinger equation 13
Semiconductor laser 60
Short-distance network 2, 5, 6, 35, 106, 110,
128
Signal-to-noise ratio (SNR) 119, 124, 127
Single-mode fiber (SMF) 2–6, 34, 50, 107,
113, 115, 119, 126, 127
Snell's law 3, 102
Speckle pattern 2, 52, 54, 55
Spectral width 34–38
Step-index (SI) 3–8, 26, 27, 32, 33, 35, 59, 60,
61, 67, 79, 80, 81, 91, 102, 107, 112, 113, 128,
129, 135
– profile 26, 33, 79, 102
Stretching overtone absorption 12, 15
Substitution 18, 60, 69
- t**
Teflon AF 62
Ternary monomer system 86–88
Terpolymer 85, 86, 88
tert-Butyl peroxyphthalate 75
Tetrafluoroethylene (TFE) 61, 62
Tetrafluorophenyl methacrylate (TFPhMA)
16
Tetrahydrofuran (THF) 69
Thermal dopant diffusion 91–92
Thermal drawing 79
- 3D 6
Timing jitter 119, 120, 122
Total internal reflection 3
Transfer function 31, 32, 111, 112
Transition-metal 27
Transition moment 14
Transmission distance 6, 8, 31, 60, 107,
111
Transmission loss 11–28, 37, 38, 107,
133
Transmittance 26, 59, 73
Transmitter 1, 119, 120, 122, 125, 134
Turbidity 19–21
Two-phase model 65, 66, 90
- u**
Ultra high definition (UHD) 132
Unshielded twisted pair (UTP) 6
Urbach's rule 12
- v**
Vertical-cavity surface-emitting laser (VCSEL)
51 53, 55, 60, 67, 106, 119, 127
Vinyl acetate 84, 85
Vinyl benzoate 84, 85
Vinyl phenyl acetate 84, 85
Visible light 12, 60
Volume scattering 42
- w**
Waveguide 11, 21, 110
Waveguide dispersion 34
Wavelength 2, 3, 11, 12, 15–18, 20–22, 27,
34, 36–38, 40, 44, 46, 60–62, 64, 65, 67, 70,
90, 103, 109, 110, 119, 125, 126, 130, 133
Wavelength division multiplexing 38
Weakly guiding approximation 39, 43
Wentzel–Kramers–Brillouin (WKB) method
36
W-shaped profile 86
- x**
X-ray scattering 21, 40
- z**
Zero-point energy 14

