

Contents

PART ONE:	MAKING OF OPTICAL FIBRES <i>J.P. Boutruche</i>	1
CHAPTER I:	MANUFACTURE OF OPTICAL FIBRES	3
SECTION A:	PRODUCTION OF PREFORMS	6
	1. Starting from Molten Glass	6
	2. By Reforming Preformed Glass Bodies into a Preform	12
	3. By Chemical Means	22
SECTION B:	DRAWING OF OPTICAL FIBRES	91
	1. Starting from the Molten Glass	
	Double-Crucible Technique	91
	2. Starting from a Preform	99
	3. Combined Systems	114
SECTION C:	POST-TREATMENT OF OPTICAL FIBRES	121
	1. Organic Coatings	121
	2. Inorganic Coatings	132
CHAPTER II:	MATERIALS USED IN THE PRODUCTION OF OPTICAL FIBRES	139
SECTION A:	DOPED SILICA FIBRES	141
	1. Characteristics	141
	2. Pure Silica Optical Fibres	141
	3. Silica Containing Titanium Oxide	141
	4. Silica Containing Aluminium Oxide	142
	5. Silica Doped with Alkali Metal Oxides	143
	6. Silica Doped with Cerium Oxide	143

	7. Silica Doped with Nitrogen Compounds	143
	8. Silica Doped with Oxides of B, P, Ge and F	144
SECTION B:	OXIDE GLASSES CONTAINING NO SILICA	151
	1. Oxides of Aluminium and Phosphorus	151
	2. Other Kinds of Glass Containing Phosphorus	151
	3. Glasses Containing Germanium Oxide (and no Phosphorus)	151
	4. Glasses Containing Tellurium Oxide	153
	5. Glasses Containing B ₂ O ₃	154
SECTION C:	MULTICOMPONENT GLASSES	155
	1. Glass of the Type SiBNa	155
	2. Glass of the Type SiB-Alkali or Tl Oxide	163
	3. Silicate Glass Containing Al ₂ O ₃	164
	4. Glasses of the Type SiO ₂ -R ₂ O-R' ₂ O	166
SECTION D:	NON-OXIDE GLASS	171
	1. Halide Glass	171
	2. Chalcogenide Glass	173
PART TWO:	CONNECTORS, TERMINALS, BRANCHES <i>G. Beaven</i>	177
CHAPTER I:	THE BACKGROUND TO CONNECTOR DESIGN	179
	1. Introduction	179
	2. Criteria and Problems	179
	3. Kinds of Energy Loss	181
	4. Kinds of Connector: Splices, Demountable	182
CHAPTER II:	FIBRE END PREPARATION	185
	1. Removing Protective Layers	185
	2. Mechanical Stripping	185
	3. Chemical Stripping or Non-Mechanical Stripping	188
	4. Cleaving or Cutting an Optical Fibre	189
CHAPTER III:	SPLICES (PERMANENT CONNECTIONS)	197
	1. Fusion Splices	198
	2. Alignment of Fibre Ends Before Splicing	211
	3. Reinforcement of Splice Joints	216
	4. Mechanical Splices	218
	5. Splice Boxes and Surplus Fibre Storage	217
CHAPTER IV:	FERRULE TYPE DEMOUNTABLE CONNECTORS	225
	1. Ferrule Fitting	226
	2. Connecting a Pair of Ferrules	235
	3. Connecting a Plurality of Pairs of Ferrules	244
CHAPTER V:	CONNECTORS USING GUIDE SURFACES	257
	1. Alignment by Grooves	258
	2. Alignment by Rods	259

3. Alignment by Balls	269
4. Alignment by Precision Bore of Tube	271
CHAPTER VI: EXPANDED BEAM CONNECTORS	275
CHAPTER VII: SIMPLE MULTIPOINT COUPLERS	289
1. Introduction	291
2. "T"-Couplers and Duplex Couplers	292
3. "Y"-Couplers	294
4. Three or Four Port Couplers Using Reflective Surfaces	297
5. Directional Couplers Using Lateral Coupling of Fibres	311
6. Coupling Light Through a Fibre Bend or Loop	313
7. Star Couplers	316
CHAPTER VIII: MULTIPLEXERS, DEMULTIPLEXERS	315
1. Introduction	315
2. Using Prisms	316
3. Using Wavelength Selective Filters	317
4. Using Diffraction Gratings	323
PART THREE: OPTICAL FIBRE TRANSMISSION <i>J. Geisler</i>	329
CHAPTER I: OPTICAL FIBRE TRANSMISSION	331
1. Fibre Propagation	331
2. Modulation and Multiplexing	341
3. Transmission Systems	351
CHAPTER II: TRANSMITTERS FOR OPTICAL FIBRES	353
1. The LED as an Optical Source	355
2. The Laser as an Optical Source	359
3. A General Comparison Between LEDs and Lasers	369
4. The Multiplexing Diode	369
5. The Driver	371
6. Optical Transmitter Linearization	378
7. Optical Transmitter Temperature Stabilization	394
8. Reducing some Laser Impairments	412
9. Improving the Reliability of the Transmitter	416
11. Optical Taps and Feedback Signals	429
CHAPTER III: OPTICAL FIBRE RECEIVERS	437
1. Direct Detection (Baseband or Incoherent Detection)	439
2. Optical Demodulation	447
3. Optical Fibre Detector/Preamplifier Realizations	449
4. Full Fibre-Optic Receiver Realization	467
5. The Automatic Gain Control	476
6. DC Coupling or AC Coupling	511
7. Improving the Dynamic Range	512
8. Improving the Reliability of the Receiver	517

CHAPTER IV:	OPTICAL REPEATERS	527
	1. Purely Optical Repeaters	528
	2. Demodulating Optical Repeaters	541
	3. Repeater Remote Powering	546
CHAPTER V:	OPTICAL TRANSCEIVERS	551
	1. Introduction	551
	2. Wavelength Division Duplex	552
	3. The Division Duplex (Half Duplex)	562
	4. Polarization Duplex	578
	5. Compensating Arrangements	579
	6. Retroreflection	585
LIST OF CITED PATENT DOCUMENTS		587
LIST OF PATENTEES		609
SUBJECT INDEX		633