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An American National Standard

Standard Guide for Selecting Materials to Be Used for Insulation, Jacketing and Strength Components in Fiber-Optic Cables[1]

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1. Scope

1.1 This guide is intended to provide a list of materials commonly used in components that provide insulation, jacketing and strength in fiber-optic cables. Where these materials are covered by ASTM standards, an appropriate reference is made. Due to changing technology, not all materials being used are necessarily listed here.

1.2 This guide does not include materials used in components for optical purposes (optical fiber and its coating) or external metallic armoring (such as for a barrier to rodents).

1.3 This guide offers two general lists of materials:

1.3.1 A subdivision of fiber-optic cable construction into components that are used for insulation, jacketing, or strength, with a generic material classification for specific applications in each component (see Section 5); and

1.3.2 An alphabetical list of the generic material classifications, showing ASTM standards where they exist (see Table 1).

TABLE 1 Materials in Current Use

Material	ASTM Specification
Acrylates	...
Aramids:	
fibers	D 3317
tape	...
Fluoroplastics:	
ECTFE	D 3275
ETFE	D 3159
FEP	D 2116
PFA	D 3307
PTFE	D 1457
PVDF	D 3222
Glass fibers	...
Glass-fiber reinforced plastics	...
Grease and similar materials	D 4730, D 4731, D 4732
Nylon	D 4066
Polybutylene	D 4730, D 4731, D 4732
Polycarbonate	D 3935
Polyester tape	D 3664
Polyethylene	D 1248
Polyimide tape	...
Polypropylene	D 4101
Polyurethane	...
Poly(vinyl chloride)	D 2287
Rubber	D 4730, D 4731, D 4732
Silicone rubber	D 2526
Steel	...
Thermoplastic elastomer	D 4246
Thermoplastic polyester	D 4507

2. Referenced Documents

2.1 *ASTM Standards:*

D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials[2]

D 1457 Specification for Polytetrafluoroethylene (PTFE) Molding and Extrusion Materials[3]

D 1711 Terminology Relating to Electrical Insulation[4]

D 2116 Specification for FEP-Fluorocarbon Molding and Extrusion Materials[2]

D 2287 Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds[2]

D 2526 Specification for Ozone-Resisting Silicone Rubber Insulation for Wire and Cable[5]

D 3159 Specification for Modified ETFE-Fluoropolymer Molding and Extrusion Materials[6]

D 3222 Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding, Extrusion, and Coating Materials[6]

D 3275 Specification for E-CTFE-Fluoroplastic Molding, Extrusion, and Coating Materials[6]

D 3307 Specification for PFA-Fluorocarbon Molding and Extrusion Materials[6]

D 3317 Specification for High Modulus, Organic Yarn and Roving[7]

D 3664 Specification for Biaxially Oriented Polymeric Resin Film for Capacitors in Electrical Equipment[5]

D 3935 Specification for Polycarbonate (PC) Unfilled and Reinforced Material[6]

[1] This guide is under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.18 on Solid Insulations, Nonmetallic Shieldings, and Coverings for Electrical and Telecommunications Wires and Cables.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

[3] Discontinued; see *1995 Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 10.01.

[5] *Annual Book of ASTM Standards*, Vol 10.02.

[6] *Annual Book of ASTM Standards*, Vol 08.02.

[7] Discontinued; see *1986 Annual Book of ASTM Standards*, Vol 15.03.

D 4066 Specification for Nylon Injection and Extrusion Materials[6]
D 4101 Specification for Propylene Plastic Injection and Extrusion Materials[6]
D 4246 Specification for Ozone-Resistant Thermoplastic Elastomer Insulation for Wire and Cable, 90°C Dry—75°C Wet Operation[5]
D 4507 Specification for Thermoplastic Polyester (TPES) Materials[8]
D 4730 Specification for Flooding Compounds for Telecommunications Wire and Cable[5]
D 4731 Specification for Hot-Application Filling Compounds for Telecommunications Wire and Cable[5]
D 4732 Specification for Cool-Application Filling Compounds for Telecommunications Wire and Cable[5]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology D 1711.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *buffer, n*—a material that is applied over an optical fiber's protective coating to further protect the fiber from physical damage and provide mechanical protection.

3.2.2 *composite buffer, n*—polymeric material(s) surrounding the optical fiber so that the inner layer is in intimate contact with the fiber cladding or coating with a tightly extruded buffer material overall.

3.2.3 *loose tube(s), n*—a buffer material that surrounds the optical fiber(s) so that it forms a tube or channel whose inside dimension is greater than the fiber's outside diameter (or combined diameters).

3.2.3.1 *Discussion*—When required, the space between the fiber(s) and the inside of the tube may be filled with a suitable filling compound or with strength or cushioning elements, or both.

3.2.4 *slotted core, n*—an element(s) with helical grooves assembled around a central strength member, in which optical fibers, optical fiber ribbons or copper conductors can be placed.

3.2.5 *strength member(s), n*—material(s) used in fiber optic cable construction which provide mechanical integrity and stability.

3.2.6 *tight buffer, n*—a material surrounding the optical fiber so that it is in intimate contact with the coating on the fiber.

4. Significance and Use

4.1 The lists of components and materials can assist the user in understanding the technology and construction of fiber-optics cables and the development of performance standards for cables.

4.2 This guide is intended for use by all parties involved with fiber optics: materials suppliers, cable manufacturers, and end-users.

5. Construction Terminology and Material Selection Options

5.1 Fiber-optic cable components and materials that have been used for each:

5.1.1 *Buffers/Tubes*:
5.1.1.1 *Tight Buffers*:
(*a*) Fluoroplastic.
(*b*) Nylon.
(*c*) Thermoplastic Polyester.
(*d*) Poly(vinyl chloride).
5.1.1.2 *Loose Tubes*:
(*a*) Fluoroplastic.
(*b*) Nylon.
(*c*) Thermoplastic Polyester.
(*d*) Polycarbonate.
(*e*) Polyethylene.
5.1.1.3 *Composite Buffers*—Silicone rubber.
5.1.1.4 *Slotted Cores*:
(*a*) Polyethylene.
(*b*) Polypropylene.
5.1.1.5 *Pipes*—Polyethylene.
5.1.1.6 *Sheaths*:
(*a*) Fluoroplastic.
(*b*) Nylon.
(*c*) Silicone rubber.
(*d*) Thermoplastic elastomer.
(*e*) Polyethylene.
5.1.1.7 *Ribbons*:
(*a*) Acrylates.
(*b*) Silicone Rubber.
5.1.2 *Jackets*:
5.1.2.1 *Outside Jackets*:
(*a*) Fluoroplastics: Ethylene Tetrafluoroethylene (ETFE), Ethylene-chlorotrifluoroethylene (ECTFE), Perfluoroalkoxy (PFA), Polytetrafluoroethylene (PTFE), Polyvinylidene Fluoride (PVDF).
(*b*) Polyethylene.
(*c*) Poly(vinyl chloride).
(*d*) Thermoplastic elastomer.
5.1.2.2 *Inner Jackets*:
(*a*) Fluoroplastics (ECTFE, PVDF).
(*b*) Polyethylene.
(*c*) Polyurethane.
(*d*) Poly(vinyl chloride).
(*e*) Thermoplastic elastomer.
5.1.3 *Strength Members*:
5.1.3.1 Aramid fibers.
5.1.3.2 Glass-fiber reinforced plastic.
5.1.3.3 Glass fibers.
5.1.3.4 Steel.
5.1.4 *Wrapping Tapes*:
5.1.4.1 Aramid.
5.1.4.2 Polyester.
5.1.4.3 Polyimide.
5.1.5 *Filling and Flooding Compounds*:
5.1.5.1 Grease and similar materials.
5.1.5.2 Polybutylene.
5.1.5.3 Rubber.

[8] *Annual Book of ASTM Standards*, Vol 08.03.

6. Materials in Current Use

6.1 Table 1 lists materials in current use as defined in the applicable ASTM specification. It is intended only as a guide and does not include all possible classifications. It is not a function of this guide to provide specific engineering data for design purposes.

7. Keywords

7.1 acrylates; aramids; fluoroplastics; glass fibers; glass-fibers reinforced plastics; grease and similar materials; nylon; polybutylene; polycarbonate; polyester tape; polyethylene; polyimide tape; polypropylene; polyurethane; poly(vinyl chloride); rubber; silicone rubber; steel; thermoplastic elastomer; thermoplastic polyester