

Glass Fiber Attributes

- Moderate Density
- Low Modulus
- High Strength
- High Strain
- Low CTE
- Isotropic
- Low Cost
- Moderate Service Temperature
- Insulating
- Good Chemical Resistance
- Poor Abrasion Resistance
- Moisture Sensitive Surface

GLASS FIBER PROPERTIES

<u>PROPERTY</u>	<u>E GLASS</u>	<u>S GLASS</u>
Diameter, microns	10	10
Specific Gravity	2.54	2.49
Tensile Modulus, GPa (msi)	72.4 (10.5)	86.9 (12.6)
Tensile Strength, GPa (ksi)	3.5 (500)	4.3 (625)
Strain to Failure, %	4.8	5.0
CTE, microns/m/°C	5	2.9
Poisson's Ratio	0.2	0.22

TABLE 2.1 Typical Properties of Commercial Reinforcing Fibers

Fiber	Typical diameter (μm) ^a	Specific gravity	Tensile modulus, GPa (10 ⁶ psi)	Tensile strength, GPa (10 ³ psi)	Strain to failure (%)	Coefficient of thermal expansion (10 ⁻⁶ m/m per °C, 0-100°C) ^b	Poisson's ratio
Glass							
E glass	10 (round)	2.54	72.4 (10.5)	3.45 (500)	4.8	5	0.2
S glass	10 (round)	2.49	86.9 (12.6)	4.30 (625)	5.0	2.9	0.22
PAN-carbon							
T-300 ^c	7 (round)	1.76	228 (33.5)	3.2 (470)	1.4	-0.1 to -0.5 (longitudinal) 7-12 (radial)	-0.2
AS ^d	7 (round)	1.77	220 (32)	3.1 (450)	1.2	-0.5 to -1.2 (longitudinal) 7-12 (radial)	
T-40 ^c	6 (round)	1.81	276 (40)	5.65 (820)	2		
HMS ^d	7 (round)	1.85	344.5 (50)	2.34 (340)	0.58		
GY-70 ^e	8.4 (bilobal)	1.96	483 (70)	1.52 (220)	0.38		
Pitch-carbon							
P-55 ^c	10	2.0	380 (55)	1.90 (275)	0.5	-0.9 (longitudinal)	
P-100 ^c	10	2.15	690 (100)	2.2 (325)	0.31	-1.6 (longitudinal)	
Kevlar 49 ^f	11.9 (round)	1.45	131 (19)	3.62 (525)	2.8	-2 (longitudinal) +59 (radial)	0.35
Boron	140 (round)	2.7	393 (57)	3.1 (450)	0.79	5	0.2
SiC	133 (round)	3.08	400 (58)	3.44 (485)	0.84	1.5	-
Al ₂ O ₃	20 (round)	3.95	379.3 (55)	1.90 (275)	0.4	8.3	

2 MATERIALS

FIBERS

^a1 μm = 0.000039 in.

^b1 m/m per °C = 0.556 in./in. per °F.

^cAmoco.

^dHercules Inc.

^eCelanese.

^fDuPont.

Fiber Costs

E-glass	\$	0.80/lb
S-glass		6
Aramid, Kevlar 49		18
Carbon, AS-4C		13
AS-4		24
SiC		~100
Boron		320