

Table 1 Composition Ranges for Glass Fibers

	A GLASS	C GLASS	D GLASS	E GLASS	ECR _{Glas} [®]	AR GLASS	R GLASS	S-2 GLASS [®]
Oxide	%	%	%	%	%	%	%	%
SiO ₂	63-72	64-68	72-75	52-56	54-62	55-75	55-60	64-66
Al ₂ O ₃	0-6	3-5	0-1	12-16	9-15	0-5	23-28	24-25
B ₂ O ₃	0-6	4-6	21-24	5-10		0-8	0-0.35	
CaO	6-10	11-15	0-1	16-25	17-25	1-10	8-15	0-0.2
MgO	0-4	2-4		0-5	0-4		4-7	9.5-10
ZnO					2-5			
BaO		0-1						
Li ₂ O						0-1.5		
Na ₂ O + K ₂ O	14-16	7-10	0-4	0-2	0-2	11-21	0-1	0-0.2
TiO ₂	0-0.6			0-1.5	0-4	0-12		
ZrO ₂						1-18		
Fe ₂ O ₃	0-0.5	0-0.8	0-0.3	0-0.8	0-0.8	0-5	0-0.5	0-0.1
F ₂	0-0.4			0-1		0-5	0-0.3	

Table 2 Properties of Glass Fibers

PHYSICAL PROPERTIES								
	A GLASS	C GLASS	D GLASS	E GLASS	ECR _{Glas} [®]	AR GLASS	R GLASS	S-2 GLASS [®]
Density, gm/cc	2.44	2.52	2.11-2.14	2.58	2.72	2.70	2.54	2.46
Refractive Index	1.538	1.533	1.465	1.558	1.579	1.562	1.546	1.521
Softening Point, °C (°F)	705 (1300)	750 (1382)	771 (1420)	846 (1555)	882 (1619)	773 (1424)	952 (1745)	1056 (1932)
Annealing Point, °C (°F)		588 (1090)	521 (970)	657 (1215)				816 (1500)
Strain Point, °C (°F)		522 (1025)	477 (890)	615 (1140)			736 (1357)	766 (1410)
Tensile Strength, MPa								
-196°C		5380		5310	5310			8275
23°C	3310	3310	2415	3445	3445	3241	4135	4890
371°C				2620	2165		2930	4445
538°C				1725	1725		2140	2415
Young's Modulus, GPa								
23°C	68.9	68.9	51.7	72.3	80.3	73.1	85.5	86.9
538°C				81.3	81.3			88.9
Elongation %	4.8	4.8	4.6	4.8	4.8	4.4	4.8	5.7

Table 3 Properties of Glass Fibers

	A GLASS	C GLASS	D GLASS	E GLASS	ECRGLAS®	AR GLASS	R GLASS	S-2 GLASS®
<i>Durability (% weight loss)</i>								
<i>CHEMICAL PROPERTIES</i>								
<i>H₂O: 24 hr</i>	1.8	1.1	0.7	0.7	0.6	0.7	0.4	0.5
<i>168 hr</i>	4.7	2.9	5.7	0.9	0.7	1.4	0.6	0.7
<i>10% HCl: 24 hr</i>	1.4	4.1	21.6	42	5.4	2.5	9.5	3.8
<i>168 hr</i>		7.5	21.8	43	7.7	3.0	10.2	5.1
<i>10% H₂SO₄: 24 hr</i>	0.4	2.2	18.6	39	6.2	1.3	9.9	4.1
<i>168 hr</i>	2.3	4.9	19.5	42	10.4	5.4	10.9	5.7
<i>10% Na₂CO₃: 24 hr</i>		24	13.6	2.1		1.3	3.0	2.0
<i>168 hr</i>		31	36.3	2.1	1.8	1.5		2.1
<i>ELECTRICAL PROPERTIES</i>								
<i>Dielectric Constant 1MHz</i>	6.2	6.9	3.8	6.6	6.9	8.1	6.4	5.3
<i>10 GHz</i>			4.0	6.1	7.0			5.2
<i>Dissipation Factor 1MHz</i>		0.0085	0.0005	0.0025	0.0028		0.0034	0.0020
<i>10 GHz</i>			0.0026	0.0038	0.0031		0.0051	0.0068
<i>Volume Resistivity (ohm-cm)</i>	1.0E +10			4.02E +14	3.84E +14		2.03E +14	9.05E +12
<i>Surface Resistivity (ohms)</i>				4.20E +15	1.16E +16		6.74E +13	8.86E +12
<i>Dielectric Strength (volts/mil)</i>				262	250		274	330
<i>THERMAL PROPERTIES</i>								
<i>Specific Heat J/g °C (BTU/lb °F)</i>								
<i>23°C</i>	0.796 (0.190)	0.787 (0.188)	0.733 (0.176)	0.810 (0.193)			0.732	0.737 (0.176)
<i>200°C</i>		0.900 (0.215)		1.03 (0.247)	0.97 (0.232)		0.938	
<i>Thermal Expansion</i>								
<i>Coefficient (x 10⁻⁷)</i>	°C (°F)	°C (°F)	°C (°F)	°C (°F)	°C (°F)	°C (°F)	°C (°F)	°C (°F)
<i>-30°C to 250°C</i>	73 (41)	63 (35)	25 (14)	54 (30)	59 (33)	65 (36)	33 (18)	16 (8.9)