Fibreglass Grades

Composition Ranges for Glass Fibres

Various glass chemical compositions described below from ASTM C 162 were developed to provide combinations of fibre properties directed at specific end use applications.

A GLASS
Soda lime silicate glasses used where the strength, durability, and good electrical resistivity of E Glass are not required.

ADVANTEX®
Calcium aluminosilicate glass introduced to provide most of the advantages of ECR glass with the cost of E-glass. Boron free composition reduces pollution.

C GLASS
Calcium borosilicate glasses used for their chemical stability in corrosive acid environments. Superior chemical resistance when compared to E glass.

D GLASS
Borosilicate glasses with a low dielectric constant for electrical applications.

E GLASS
Alumina-calcium-borosilicate glasses with a maximum alkali content of 2 wt.%. Commonly used as general purpose fibres where structural strength and high electrical resistivity are required. E glass has relatively poor acid resistance.

ECRGLAS®
Calcium aluminosilicate glasses with a maximum alkali content of 2 wt.% used where strength, electrical resistivity, and acid corrosion resistance are desired. Superior chemical resistance when compared to C glass. Certain ECR glass formulations also have good solubility resistance to dilute hydro fluoric acid.

AR GLASS
Alkali resistant glasses composed of alkali zirconium silicates used in cement substrates and concrete.

R GLASS
Calcium aluminosilicate glasses used for reinforcement where added strength and acid corrosion resistance are required.

S-2 GLASS®
Magnesium aluminosilicate glasses used for textile substrates or reinforcement in composite structural applications which require high strength, modulus, and stability under extreme temperature and corrosive environments.

	A Glass	C Glass	D Glass	E Glass	Advantex®	ECR Glass®	AR Glass	R Glass	S-2 Glass®
Oxide	%	%	%	%	%	%	%	%	%
SiO^2	63-72	64-68	72-75	52-56	59-62	54-62	55-75	56-60	64-66
AL^2O^3	0-6	3-5	0-1	12-16	12-15	9-15	0-5	23-26	24-26
B^2O^3	0-6	4-6	21-24	5-10	<0.2		0-8	0-0.3	<0.05
CaO	6-10	11-15	0-1	16-25	20-24	17-25	1-10	8-15	0-0.2
MgO	0-4	2-4		0-5	1-4	0-4		4-7	9.5-10.3
ZnO						2-5			
BaO		0-1						0-0.1	
Li^2O							0-1.5		
Na^2O+K^2O	14-16	7-10	0-4	0-2		0-2	11-21	0-1	<0.3
TiO^2	0-0.6			0-0.8		0-4	0-12	0-0.25	
ZrO^2							0-18		
$FewO^2$	0-0.5	0-0.8	0-0.3	0-0.4		0-0.8	0-5	0-0.5	0-0.1
F^2	0-0.4			0-1				0-0.1	

The chemical resistance of glass fibres to the corrosive and leaching actions of acids, bases, and water is expressed as a percent weight loss. The lower this value, the more resistant the glass is to the corrosive solution.

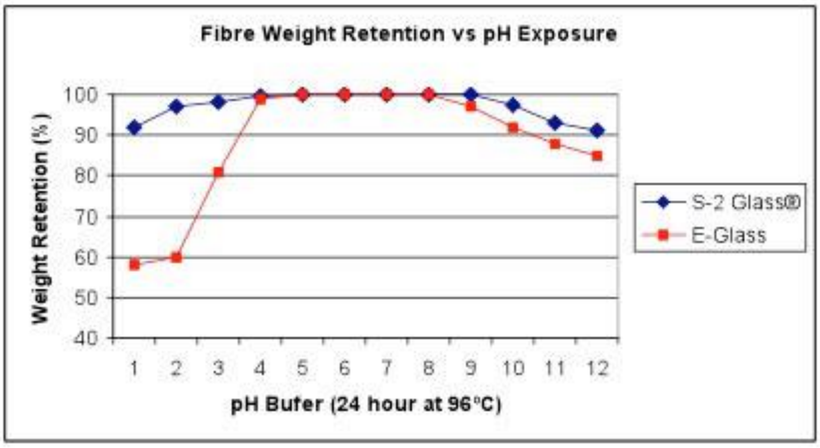
The test procedure involves subjecting a given weight of 10 micron diameter glass fibres, without binders or sizes, to a known volume of corrosive solution held at 96°C. The fibres are held in the solution for the time desired and then are removed, washed, dried, and weighed to determine the weight loss. The results reported are for 24-hr (1 day) and 168-hr (1 week) exposures.

As the table shows, the chemical resistance of glass fibres depends on the composition of the fibre, the corrosive solution, and the exposure time. It should be noted that glass corrosion in acidic environments is a complex process beginning with an initial fast corrosion rate. (Note the similarity in weight loss between the 1-day and 1-week samples treated with acid in the table.)

With further time, an effective barrier of leached glass is established on the surface of the fibre and the corrosion rate of the remaining unleached fibres slows, being controlled by the diffusion of compounds through the leached layer. Later, the corrosion rate slows to nearly zero as the non-silica compounds of the fibre are depleted.

For a given glass composition, the corrosion rate may be influenced by the acid concentration (see graph), temperature, fibre diameter, and the solution volume to glass mass ratio. In alkaline environments weight loss measurements are more subjective as the alkali affects the network and reprecipitates the metal oxides. Tensile strength after exposure is a better indicator of the residual glass fibre properties as shown in else where for 24-hour exposure at 96°C.

Chemical Properties @ 96°C Immersion Temperature									
Durability (% weight loss)		A Glass	C Glass	D Glass	E Glass	ECR Glass®	AR Glass	R Glass	S-2 Glass®
H^2O	24hr	1.5	1.1	0.7	0.7	0.6	0.7	0.4	0.5
	168hr	4.7	2.9	5.7	0.9	0.7	1.4	0.6	0.7
10% HCI	24hr	1.4	4.1	21.6	42	5.4	2.5	9.5	3.8
	168hr		7.5	21.8	43	7.7	3.0	10.2	5.1
10% H^2SO4	24hr	0.4	2.2	18.6	39	6.2	1.3	9.9	4.1
	168hr	2.3	4.9	19.5	42	10.4	5.4	10.9	5.7
10% Na^2CO^3	24hr		24	13.6	2.1	1.0	1.3	3.0	2.0
	168hr		31	36.3	2.1	1.8	1.5		2.1



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