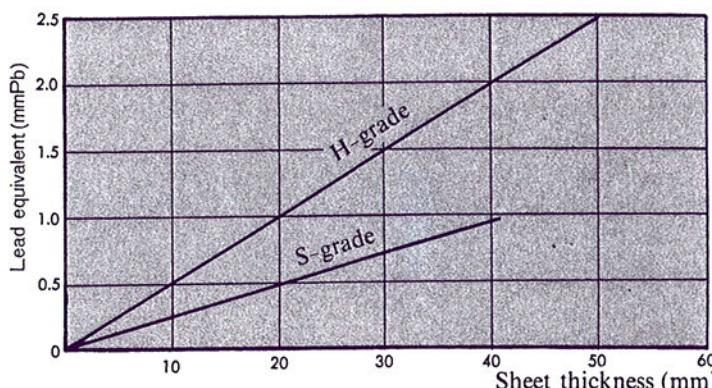


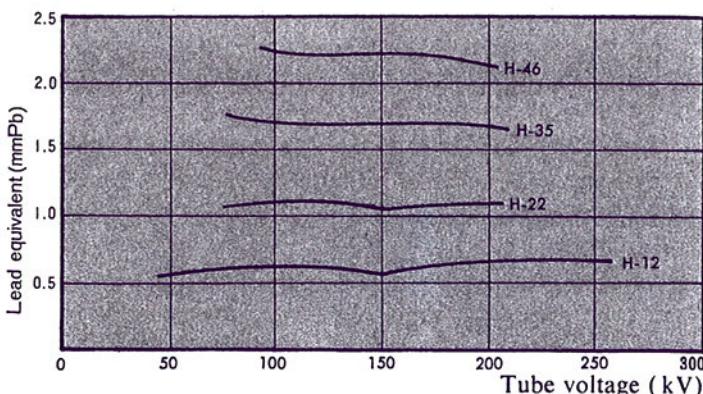
Physical Properties

1 Sheet thickness and lead equivalent :



Based on JIS Z 4501 (Japan Industrial Standard prescribing the lead equivalent test method for X-ray protective products).
Tube voltage/mA : 100kV/10mA
Attached filter : 2.0mmAl

2 Tube voltage and lead equivalent (H-grade) :



3 Linear and Mass Attenuation Coefficients :

Following table shows linear and mass attenuation coefficient KYOWAGLAS-XA shows relatively large attenuation coefficient against high energy γ -rays, displaying high lead equivalent.

X-ray energy (keV)	68.8		43.0	
	$\mu(\text{cm}^{-1})$	$\mu/\rho(\text{cm}^2/\text{g})$	$\mu(\text{cm}^{-1})$	$\mu/\rho(\text{cm}^2/\text{g})$
KYOWAGLAS-XA H-grade	1.93	1.20	5.13	3.19
KYOWAGLAS-XA S-grade	0.806	0.611	2.08	1.58
Acrylic	0.208	0.175	0.245	0.206
Lead glass*	8.04	1.84	—	—
Iron	6.47	0.830	23.0	2.95
Concrete	0.568	0.247	1.19	0.518
Plate glass	0.563	0.227	1.07	0.431

γ -ray source (energy)	Co-60(1.25MeV)		Cs-137(662keV)	
	$\mu(\text{cm}^{-1})$	$\mu/\rho(\text{cm}^2/\text{g})$	$\mu(\text{cm}^{-1})$	$\mu/\rho(\text{cm}^2/\text{g})$
KYOWAGLAS-XA H-grade	0.103	0.0646	0.152	0.0948
KYOWAGLAS-XA S-grade	0.0821	0.0632	0.115	0.0883
Lead glass**	0.25	0.057	0.38	0.087
Iron	0.28	0.056	0.47	0.094
Concrete	0.415	0.0532	0.573	0.0735
Lead	0.129	0.0560	0.179	0.0777

μ : Linear attenuation coefficient, cm^{-1} .

μ/ρ : Mass attenuation coefficient, cm^2/g .

* Lead content 51%.

** Changes in accordance with lead content.

ρ : Density of material, g/cm^3 .

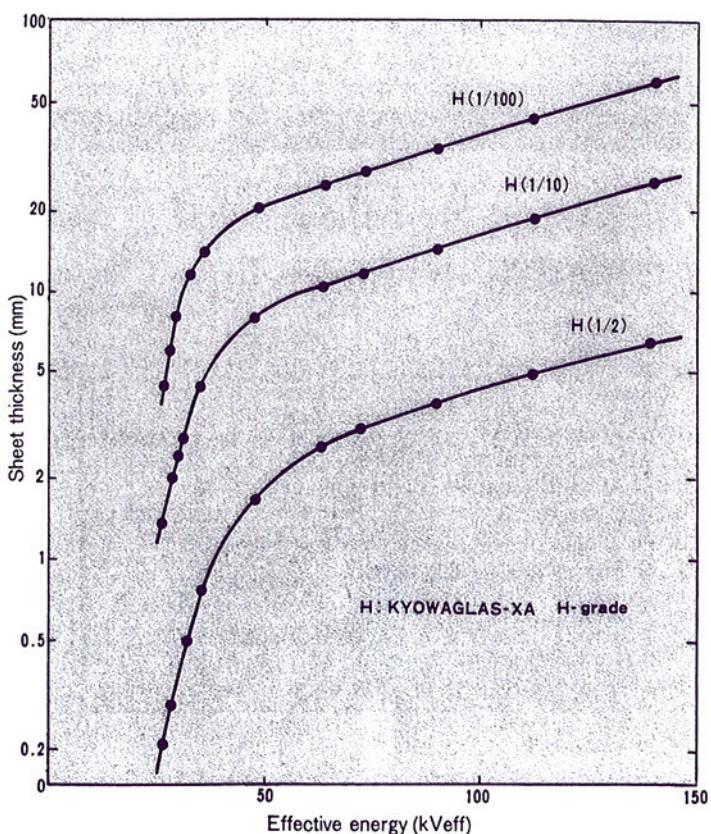
※ Weight Composition of Concrete (Density : $2.30\text{g}/\text{cm}^3$)

H_2 0.56% O_2 49.83 Si 31.58 Al 4.56 Cl 8.26 Fe 1.22
 Mg 0.24 Na 1.71 Ca 1.92 S 0.12

4 Energy of X(γ) rays and lead equivalent (mmPb) :

Photon Energy (keV)	68.8	122	302	356	511	662	835	1173	1333
H - 12	0.60	0.57	0.84	0.98	1.2	1.3	1.4	1.5	1.5
H - 22	1.1	1.0	1.5	1.8	2.2	2.3	2.5	2.7	2.7
H - 35	1.7	1.7	2.5	2.9	3.5	3.6	4.0	4.2	4.2
H - 46	2.2	2.2	3.2	3.8	4.6	4.8	5.3	5.6	5.6

5 Half-value, Tenth-value and Hundredth-value layers (H-grade) :



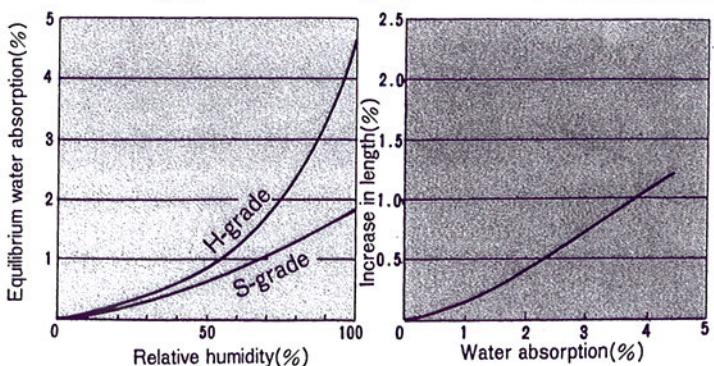
6 Basic Properties :

Items	Test method ASTM	Unit	KYOWAGLAS-XA		Acrylic
			H-grade	S-grade	
Specific gravity	D 792	—	1.6	1.3	1.2
Tensile strength	D 638	kg/cm ²	490	640	780
Elongation	D 638	%	18	4	6
Tensile modulus	D 638	kg/cm ²	2.4×10^4	3.8×10^4	3.3×10^4
Flexural strength	D 790	kg/cm ²	710	1020	1200
Flexural modulus	D 790	kg/cm ²	2.1×10^4	3.0×10^4	3.3×10^4
Rockwell hardness	D 785	—	M-73	M-100	M-100
Izod impact strength (Notched)	D 256	kg·cm/cm	3.0	1.5	2.2
Falling ball impact test* (Minimum breaking height)	—	cm	> 200	> 200	> 200
Lead glass : 25					
Heat deflection temperature (Stress 18.6 kg/cm ²)	D 648	°C	80	93	100
Coefficient of linear thermal expansion (Below 35°C)	—	cm/cm·°C	1×10^{-4}	7×10^{-5}	7×10^{-5}

Test conditions : 23°C, 65%RH * Steel ball : 115g
Thickness of test specimen : 5mm
Dimensions of test specimen : 15cm × 15cm

7 Water Absorption :

A change in atmospheric humidity causes a change in water content of KYOWAGLAS-XA by absorption or discharge of its own water and causes dimensional changes. Following figures show those properties of KYOWAGLAS-XA.



Relative humidity and equilibrium water absorption
Water absorption and increase in length (H-grade, S-grade)

8 Optical Properties :

Refractive and reflective indexes and light transmission of KYOWAGLAS-XA are shown below.

Item	KYOWAGLAS-XA		Acrylic sheet	Plate glass	Lead glass
	H-grade	S-grade			
Refractive index n	1.54	1.52	1.49	1.52	1.78
Reflective index ρ	0.0454	0.0426	0.0387	0.0426	0.0787
Ratio of reflective index	0.577	0.541	0.492	0.541	1.000

Light transmission (H-grade)

Type	Light transmission(%)
H - 12	81
H - 18	76
H - 22	73
H - 35	82
H - 46	80

9 Electrostatic Properties :

Decay time of static electricity is considerably small when compared with that of acrylic sheet and lead glass, and almost the same with that of plate glass. Because of this property, the dust does not readily stick to KYOWAGLAS-XA.

Electrostatic discharge

Relative humidity	Item	KYOWAGLAS-XA (H-grade)	Acrylic sheet	Lead glass	Plate glass
55%	Maximum charge(V) Half life of decay(sec)	1480 12	1200 ∞	1590 ∞	1490 10
	Maximum charge(V) Half life of decay(sec)	1120 2	1200 ∞	1570 ∞	1360 7
75%	Maximum charge(V) Half life of decay(sec)	1480 12	1200 ∞	1590 ∞	1490 10
	Maximum charge(V) Half life of decay(sec)	1120 2	1200 ∞	1570 ∞	1360 7

10 Radiation-resistance :

KYOWAGLAS-XA has high radiation-resistance. Little deterioration of physical properties and discoloration were observed after 1×10^5 R exposure.

Retention of physical properties after exposure

Grade	H-grade			S-grade		
	Exposure(R)	1×10^4	5×10^4	1×10^5	1×10^4	5×10^4
Flexural strength	100	105	105	103	102	104
Flexural modulus	99	103	104	102	101	102
Izod impact strength	98	97	93	97	101	107

Co-60 γ -rays, 150R/hr. Unexposed condition is indicated in 100

Discoloration after exposure

Material	Thickness (mm)	Exposure (R)	L *1	ΔE *2
KYOWAGLAS-XA, H-grade	7	0	90.8	—
		1×10^4	90.8	1.0
		1×10^5	90.1	1.3
Lead glass	5	0	93.3	—
		1×10^4	90.7	4.2
		1×10^5	75.5	24.9
Plate glass	5	0	94.1	—
		1×10^4	93.1	1.2
		1×10^5	85.4	10.5

Co-60 γ -rays, 150R/hr

*1...Hunter's lightness. *2...Hunter's color difference

11 Chemical-resistance :

KYOWAGLAS-XA is resolved or dissolved by strong sulfuric acid or acetic acid, and attacked by strong acid or alkali on surface. But KYOWAGLAS-XA is not attacked by water, isopropyl alcohol and such aliphatic hydrocarbon as hexane, and not resolved by such solvent of acrylic resin as toluene, acetone and chloroform.