The Future Made Clear

OHARA

VAD-BASED ANHYDROUS SYNTHETIC FUSED SILICA

SK-1310

SK-1310 Fused Silica

SK-1310 is the anhydrous synthetic fused silica among the SK-1300 series products of VAD-based synthetic fused silica. In addition to the high reliability of heat resistance, mechanical strength, and chemical resistance maintained by SK-1300, photolytic absorption is not generated to the infrared area of 2.73 μm, because it doesn't contain hydrogenous radicals. SK-1310 products are fully renovated materials with the maximum transmission applicable to the entire ultraviolet, visible and infrared areas. The physical and chemical characteristics are prominent similar to the SK-1300 products in a broad range of applications in advanced technological industries such as semiconductors and optics.

1. Optical fibers
2. Optical elements for ultraviolet and infrared lenses or windows
3. All types of cells for ultraviolet or infrared transmission of entire areas of spectrophotometer
4. Electrical-discharge lamp tubing

		Element	Analytical Value	Element	Analytical Value
Typical Impurity Analysis	ppb	Al	<10	Co	<10
		Fe	<10	Ni	<10
		Ti	<10	P	<10
		Ca	<10	B	<10
		Mg	<10	Na	<10
		Mn	<10	K	<10
		Cr	<10	Li	<10
		Cu	<10	Zr	<10
	ppm	OH	<1	Cl	<2000

	Solution	Treatment Temperatures (°C)	Hours (H)	Weight Loss (mg/cm^2)
Chemical Resistance	H_2O	95	45	0.0001~0.0002
	1/100 N HNO_3	115	24	0.005~0.01
	5% NaOH	100	10	1.30

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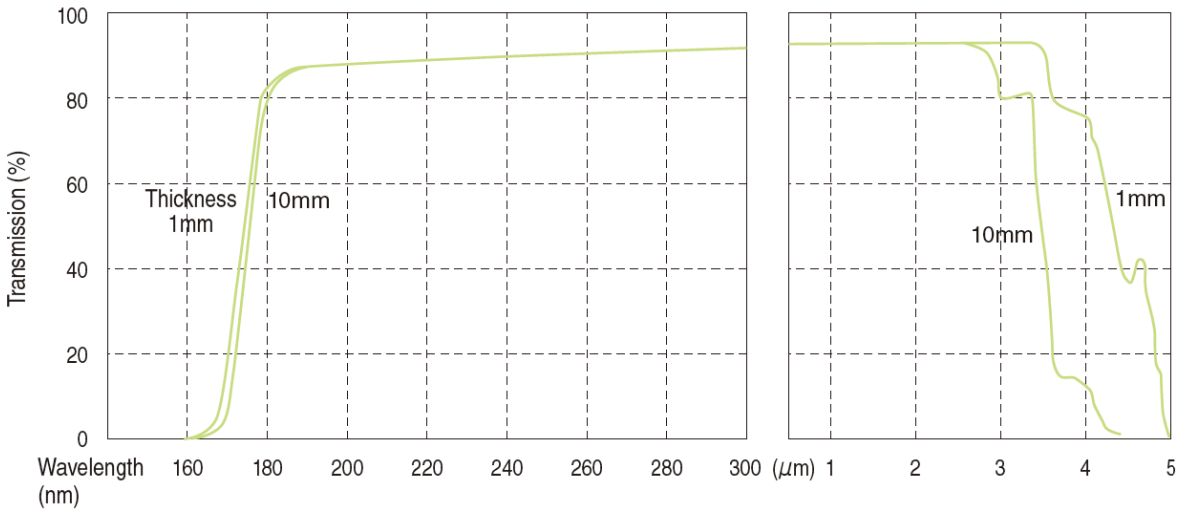
Transmission



Refractive Index

Wavelength (nm, in air)	25°C in air	20°C in air	20-5°C in air Wavelength (nm, in air)	1×10−6／°C dn/dT
365.015 (i)	1.47475	1.47469	365.015 (i)	11.5
404.656 (h)	1.46982	1.46977	404.656 (h)	11.0
435.835 (g)	1.46689	1.46684	435.835 (g)	10.7
486.133 (F)	1.46333	1.46328	486.133 (F)	10.5
546.075 (e)	1.46028	1.46023	546.075 (e)	10.2
587.562 (d)	1.45866	1.45861	587.562 (d)	10.2
656.273 (C)	1.45657	1.45652	656.273 (C)	10.2
Measuring accuracy	±5×10⁻⁶		Measuring accuracy	±0.6×10⁻⁶

Optical Qualities

Item	Grade
Bubbles	0～0.03mm²/100cm³
Striae	Grade A in one direction (As per Mil-G-174)
Birefrengence (Strain)	20nm/cm and under

Physical Properties

Item	Unit	Value	Item	Unit	Value
Density	g/cm³	2.2	Coefficient of thermal expansion	1/K	5.5×10⁻⁷
Young's module	GPa	72.5			
Torsional rigidity	GPa	31.4	Softening point	℃	1600
Poisson's ratio		0.17	Annealing point	℃	1160
Compression strength	GPa	1.1	Strain point	℃	1060
Bending strength	MPa	69			
Tensile strength	MPa	55	Specific heat (25℃)	kJ/kg·K	0.74
Vickers hardness	GPa	8.8～10.1	Thermal conductivity ratio (25℃)	W/m·K	1.3
Knoop hardness	GPa	6.4～7.0	Thermal conductivity ratio (100℃)	W/m·K	1.4

SK-1310
Glass Data Sheet

Code(d) **459678**
Code(e) **460677**

Refractive Index	n_d	**1.45866**	Abbe Number	v_d	**67.8**	Dispersion	n_F-n_C **0.00676**
		1.458663			67.85		0.006760
Refractive Index	n_e	1.460277	Abbe Number	v_e	67.71	Dispersion	$n_{F'}$-$n_{C'}$ 0.006798

Refractive Indicies(at 25℃,Air,1013hPa)		
λ(μm)		
n_{2325}	2.32542	1.43320
n_{1970}	1.97009	1.43876
n_{1530}	1.52958	1.44449
n_{1129}	1.12864	1.44908
n_t	1.01398	1.45045
n_s	0.85211	1.45267
$n_{A'}$	0.76819	1.45409
n_r	0.70652	1.45535
n_C	0.65627	1.45657
$n_{C'}$	0.64385	1.45690
n_{He-Ne}	0.63280	1.45722
n_D	0.58929	1.45860
n_d	0.58756	1.45866
n_e	0.54607	1.46028
n_F	0.48613	1.46333
$n_{F'}$	0.47999	1.46370
n_{He-Cd}	0.44157	1.46642
n_g	0.435835	1.46689
n_h	0.404656	1.46982
n_i	0.365015	1.47475
n_{KrF}*	**0.248500**	**1.50849**
n_{ArF}*	**0.193300**	**1.56051**

Deviation of Relative Dispersions Δθfrom "Normal"	
$\Delta\theta_{C,t}$	0.0400
$\Delta\theta_{C,A'}$	0.0082
$\Delta\theta_{g,d}$	-0.0063
$\Delta\theta_{g,F}$	-0.0040
$\Delta\theta_{i,g}$	0.0048

Constants of Dispersion Formula	
A_1	7.50110530E-01
A_2	3.54568578E-01
A_3	9.18389018E-01
B_1	4.97286260E-03
B_2	1.42109021E-02
B_3	1.00468940E+02

Other Properties	
Bubble Quality Group	1
Specific Gravity	2.20
Remarks	

Partial Dispersions	
n_C-nt	0.006118
n_C-$n_{A'}$	0.002476
n_d-n_C	0.002097
n_e-n_C	0.003711
n_g-n_d	0.008230
n_g-n_F	0.003567
n_h-n_g	0.002927
n_i-n_g	0.007853
n_C-n_t	0.006456
n_e-$n_{C'}$	0.003373
$n_{F'}$-n_e	0.003425
n_i-$n_{F'}$	0.011044

Thermal Properties		
Strain Point StP (°C)		1060
Annealing Point AP (°C)		1160
Softening Point SP (°C)		1600
Expansion Coefficients	(+0~+200°C)	5.5
α (10-7/°C)	(+100~+300°C)	-
Thermal Conductivity k (W/m•K)		1.3
Specific heat capacity c (J/kg•K)		736
Thermal diffusivity ($10^{-7}m^2/s$)		8.04

Mechanical Properties		
Young's Modulus E ($10^8N/m^2$)	725	
Rigidity Modulus G ($10^8N/m^2$)	310	
Poisson's Ratio σ	0.17	
Knoop Hardness Hk[Class]	660	7
Abrasion Aa	-	
Photoelastic Constant β (nm/cm/10^5Pa)		3.5

Chemical Properties	
Water Resistance(Powder) Group RW(P)	1
Acid Resistance(Powder) Group RA(P)	1
Weathering Resistance(Surface) Group W(S)	-
Acid Resistance(Surface) Group SR	1
Phosphate Resistance PR	-

Electrical Properties	
Dielectric constant ε	4.0
Dielectric tangent tanδ	0.0004
Volume resistivity(Ω•cm)	>1E+16

Impurities	
OH content (ppm)	<1
Cl content (ppm)	<2000

Temperature Coefficients of Refractive Index							
Range of Temperature (°C)	dn/dt relative (10-6/℃)						
	t	C'	He-Ne	D	e	F'	g
-40~0	-	-	-	-	-	-	-
0~20	-	-	-	-	-	-	-
20~25	9.7	10.1	10.0	10.1	10.2	10.5	10.7
20~40	-	-	-	-	-	-	-
40~60	-	-	-	-	-	-	-

Relative Partial Dispersions	
$\theta_{C,t}$	0.905
$\theta_{C,A'}$	0.3663
$\theta_{d,C}$	0.3102
$\theta_{e,C}$	0.549
$\theta_{g,d}$	1.2175
$\theta_{g,F}$	0.5277
$\theta_{h,g}$	0.433
$\theta_{i,g}$	1.1617
$\theta'_{C',t}$	0.9497
$\theta'_{e,C'}$	0.4962
$\theta'_{F',e}$	0.5038
$\theta'_{i,F}$	1.6246

Coloring			
λ_{80}	~180	λ_5	~180
λ_{70}	~180		

~180:Less than 180nm

Internal Transmittance	
λ(nm)	τ10mm
172*	**0.662**
193*	**0.991**
248*	**0.999~**
250	0.999~
260	0.999~
270	0.999~
280	0.999~
290	0.999~
300	0.999~
320	0.999~
340	0.999~
360	0.999~
365*	**0.999~**
380	0.999~
400	0.999~
450	0.999~
500	0.999~
550	0.999~
587*	**0.999~**
600	0.999~
650	0.999~
700	0.999~
800	0.999~
900	0.999~
1000	0.999~
1129*	**0.999~**
1200	0.999~
1400	0.999~
1530*	**0.999~**
1600	0.999~
1800	0.999~
1970*	**0.999~**
2000	0.999~
2326*	**0.998**
2400	0.995
2500	0.992

0.999~:better than 0.999

***Precision Measurements**

Rev.F DATE 2018/10/24