SCHOTT

Specification Physical and chemical properties	**PCE - TKT** **B 270 Superwite**

B 270 Superwite D 0092

B 270 Superwite is a clear high transmission crown glass (modified soda-lime glass) available in form of sheets, optical rods, profiled rods and strips.

The subsequent properties are based primarily upon the measuring results of the very latest standards and measuring methods, which are defined in corresponding "Measuring and Test Procedures". SCHOTT DESAG retains the right to change the data in keeping with the latest technical standards. Non-toleranced numerical values are reference values of an average production quality.

Values marked with ◊ do not apply to the type of glass or no values are available.

Requirements deviating from these specifications must be defined in writing in a **customer agreement**.

Date of release: May 02, 00

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1. Optical properties

1.1 Refractive indices (20°C)

Pretreatment of samples
annealed at 40°C/h

* ± 0.0003 upon request

n_g	1.5341
$n_{F'}$	1.5297
n_F	1.5292
n_e	1.5251 ± 0.001*
n_d	1.5230
n_D	1.5229
$n_{C'}$	1.5207
n_C	1.5203

Further refractive indices in UV and IR (reference values): see annex

1.1.1 Abbe value

n_e	58.3 ± 0.6
n_d	58.5

1.2 Transmittance data

1.2.1 Spectral transmittance $t\ (l)$

1.2.1.1 $t\ (l)$ - curve

Plot of spectral transmittance $t\,(l)$ for

d = 2.0 mm und d = 15 mm (l = 280 nm - 650 nm): see annex

d = 2.0 mm und d = 15 mm (l = 280 nm - 2000 nm): see annex

1.2.1.2 $t\ (l)$ - individual values in %

see annex

1.2.1.3 Edge wavelength (d = 2.0 mm)

Edge wavelength $l_C\,(t = 0.46)$ in nm: 312

Solarization refer to 6.2

Additional data

$l_S\,(t = 0.05)$ in nm	294
$l_P\,(t = 0.85)$ in nm	340

1.2.2 Luminous transmittance t_v

1.2.2.1 Luminous transmittance as a function of thickness

thickness in mm	t_{vD65} in %	t_{vA} in %
2.0	91.7	91.7
4.0	91.6	91.6
15.0	91.0	91.0

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1.2.3	**Special transmittance values in % (*d* = 2.0 mm)**		
1.2.3.1	**UV - transmittance**	t_{UVA}	84
		t_{UVB}	19
1.2.3.2	**IR - transmittance**	t_A	92.5
1.2.3.3	**Radiant transmittance**	t_e	91.4
1.3	**Colour**		
1.3.1	**Visual evaluation**		disregard
1.3.2	**Colorimetry (*d* = 2.0 mm)**		
		D_{65} x	0.314
	Chromaticity coordinates (colour locus) are referred	y	0.332
	to the namend Standard Illuminant according to	A x	0.448
	CIE 2°-observer	y	0.408
1.3.3			disregard
1.3.4	**General colour rendering index R_a (*d* = 2.0 mm)**		100

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2. Thermal properties

2.1 Viscosities and corresponding temperatures

Designation	Viscosity log h in dPas	Temperature J in °C
Strain point	14.5	511
Annealing point	13.0	541
Softening point	7.6	724
Forming temperature	6.0	827
Forming temperature	5.0	915
Forming temperature	4.0	1033

2.2 Transformation temperature *Tg* in °C

533

2.3 Coefficient of thermal expansion a

2.3.1 Coefficient of mean linear thermal expansion a in 10^{-6} K^{-1} for the indicated temperature range (static measurement)

$a_{(20°C-300°C)}$	9.4
$a_{(20°C-200°C)}$	9.0
$a_{(20°C-100°C)}$	8.2

2.3.2 Coefficient of mean linear thermal expansion a in 10^{-6} K^{-1} for the indicated temperature range (dynamic measurement)

$a_{(20°C-100°C)}$	7.8
$a_{(20°C-150°C)}$	8.4
$a_{(20°C-200°C)}$	8.8
$a_{(20°C-250°C)}$	9.1
$a_{(20°C-300°C)}$	9.4
$a_{(20°C-350°C)}$	9.6
$a_{(20°C-400°C)}$	9.8
$a_{(20°C-450°C)}$	10.0
$a_{(20°C-500°C)}$	10.3

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2.3.3	**Coefficient of mean linear thermal expansion α in 10^{-6} K^{-1} for the mentioned temperature intervals (dynamic measurement)**		see annex
2.4	**Fuseability**		
	Stress-free fusion with suitable SCHOTT DESAG lower segments is possible.		
2.5	**Mean specific heat capacity c_p (20°C-100°C) in J/ (g·K)**		0.86
2.6	**Thermal conductivity λ in W/ (m·K) for the indicated temperatures**		
		ϑ = 24.5°C	0.92
		ϑ = 89°C	1.01
		ϑ = 127°C	1.08
		ϑ = 167°C	1.15
2.7	**Specific thermal stress σ in N/ (mm²·K)**		0.86

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3.	**Mechanical properties**	
3.1	**Density r in g/cm³**	2.55
3.2	**Stress optical coefficient *C* in 1.02 x 10^{-12} m²/N**	2.7
3.3	**Breaking strength**	
	Admissible value for the bending strength σ_{zul} of technically annealed glasses as calculation basis (air) in N/mm²	30
	A higher mechanical strength can be realized by chemical toughening according to the ion exchange procedure (refer to annex 3.3.1) or by thermal toughening.	
3.3.1	**Chemical toughening**	
	Processing temperature *J* in °C	420
	Processing time *t* in h	16
	Compressive stress *Ds* as birefringence in nm/cm	7200
	Penetration depth *Nz* up to neutral zone in µm	48
	Further information	see annex
3.3.2	**Thermal toughening**	
	Recommended minimum thickness *d* in mm for toughened safety glass for building purposes according to DIN 1249 T10 - 1990	4.0
3.4	**Young´s modulus *E* in kN/mm²**	71.5
3.5	**Poisson´s ratio** m	0.219
3.6	**Torsion modulus *G* in kN/mm²**	29.3
3.7	**Knoop hardness HK_{100}**	542

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4.	**Chemical properties**	
4.1	**Hydrolytic resistance acc. to DIN ISO 719**	
	Hydrolytic class	HGB 3
	Equivalent of alkali (Na_2O) per gram of glass grains in µg/g	170
4.2	**Acid resistance acc. to DIN 12 116**	
	Acid class	2
	Half surface weight loss after 6 hours in mg/dm²	1.4
4.3	**Alkali resistance acc. to DIN ISO 695**	
	Class	A 2
	Surface weight loss after 3 hours in mg/dm²	140
5.	**Electrical properties**	
5.1	**Dielectric constant (Permittivity) e_r at 1 MHz**	7.0
5.2	**Dissipation factor tan d bei 1 MHz**	$30 \cdot 10^{-4}$
5.3	**Electric volume resistivity r_D in $\Omega \cdot$ cm** **at the specified temperatures**	
5.3.1	**r_D for alternating current 50 Hz and 3 kHz**	
	J = 1260°C	10.2
	J = 1386°C	6.8
5.3.2	**r_D for direct current**	
	J = 250°C	10^9
	J = 350°C	$1.6 \cdot 10^7$
	J = 400°C	$2 \cdot 10^6$
5.4	**Temperature t_{k100} in °C for a specific electric volume resistivity of 10^8 $\Omega \cdot$ cm**	301

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6. Other properties

6.1 Lead equivalent in mm Pb at 15 mm glass thickness for X-rays

Voltage 50 kV/0.16 mm Cu total filtering	0.24
Voltage 80 kV/0.16 mm Cu total filtering	0.32
Voltage 110 kV/0.40 mm Cu total filtering	0.33
Voltage 150 kV/0.70 mm Cu total filtering	0.27

Measuring and Test Procedures

For X-radiation (constant voltage) the lead equivalent is defined by the total filtering specified in the table (refer also to DIN 6845).
The exposed area has a diameter of 50 mm. The absorption of radiation in the sample piece is compared to lead absorbers of such a thickness that the same attenuation of the dose performance is reached in both cases.
As detector, a scintillation dosimeter (scintillator 44 mm diameter, 15 mm height) is used.
The measuring inaccuracy is ± 0.03 mm.

6.2 Solarization

Shifting of the edge wavelength λ_C (t = 0.46) after UV-radiation in the direction of longer wavelength	$\Delta \lambda_C$ in nm	2

Measuring and Test Procedures

The sample will be irradiated with a UV - F 400 floodlamp.
The irradiation time amounts to 7h; the distance between floodlamp and samplefastening is 14 cm.

7. Annex (diagrams, curves)

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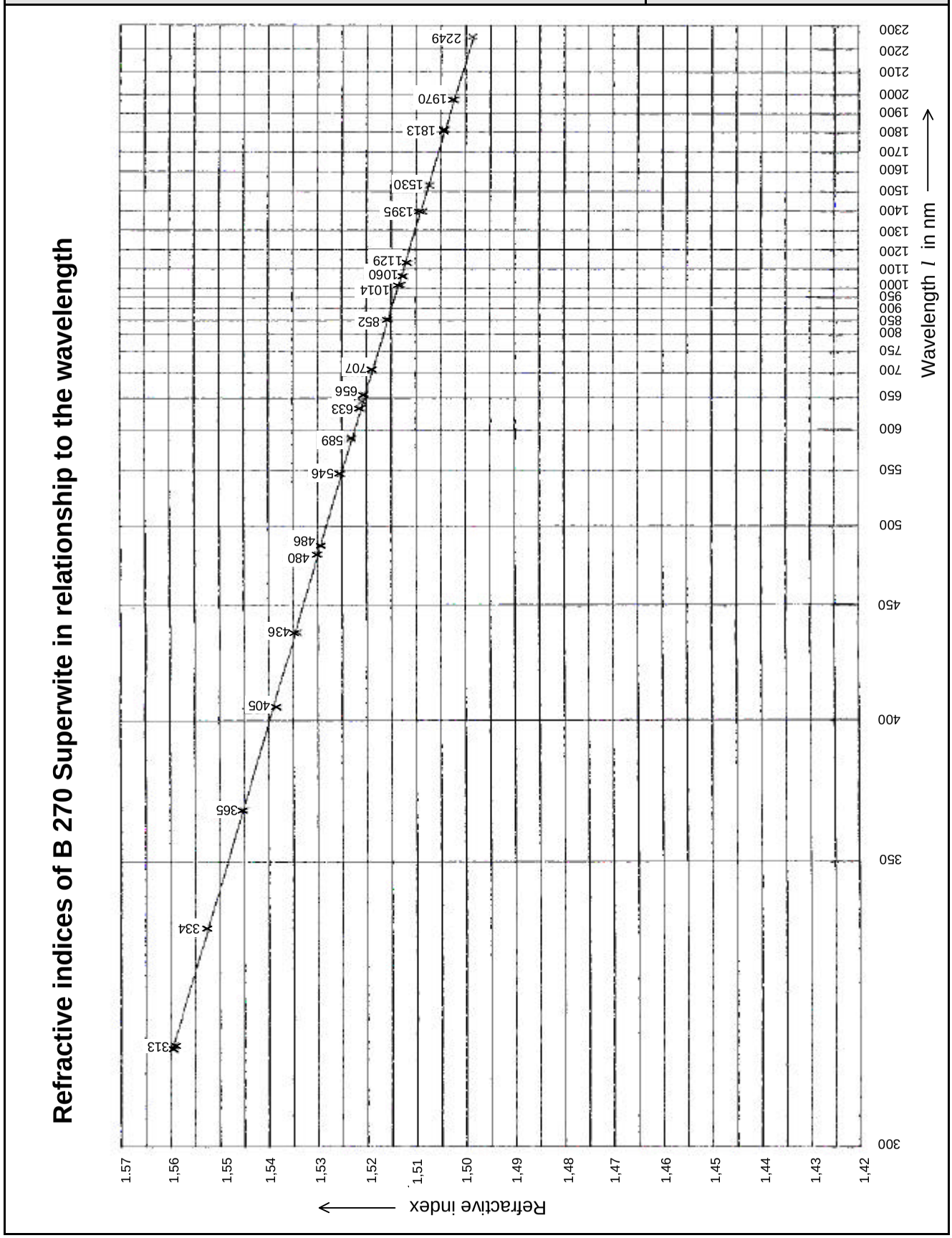

Annex 1.2.1.1

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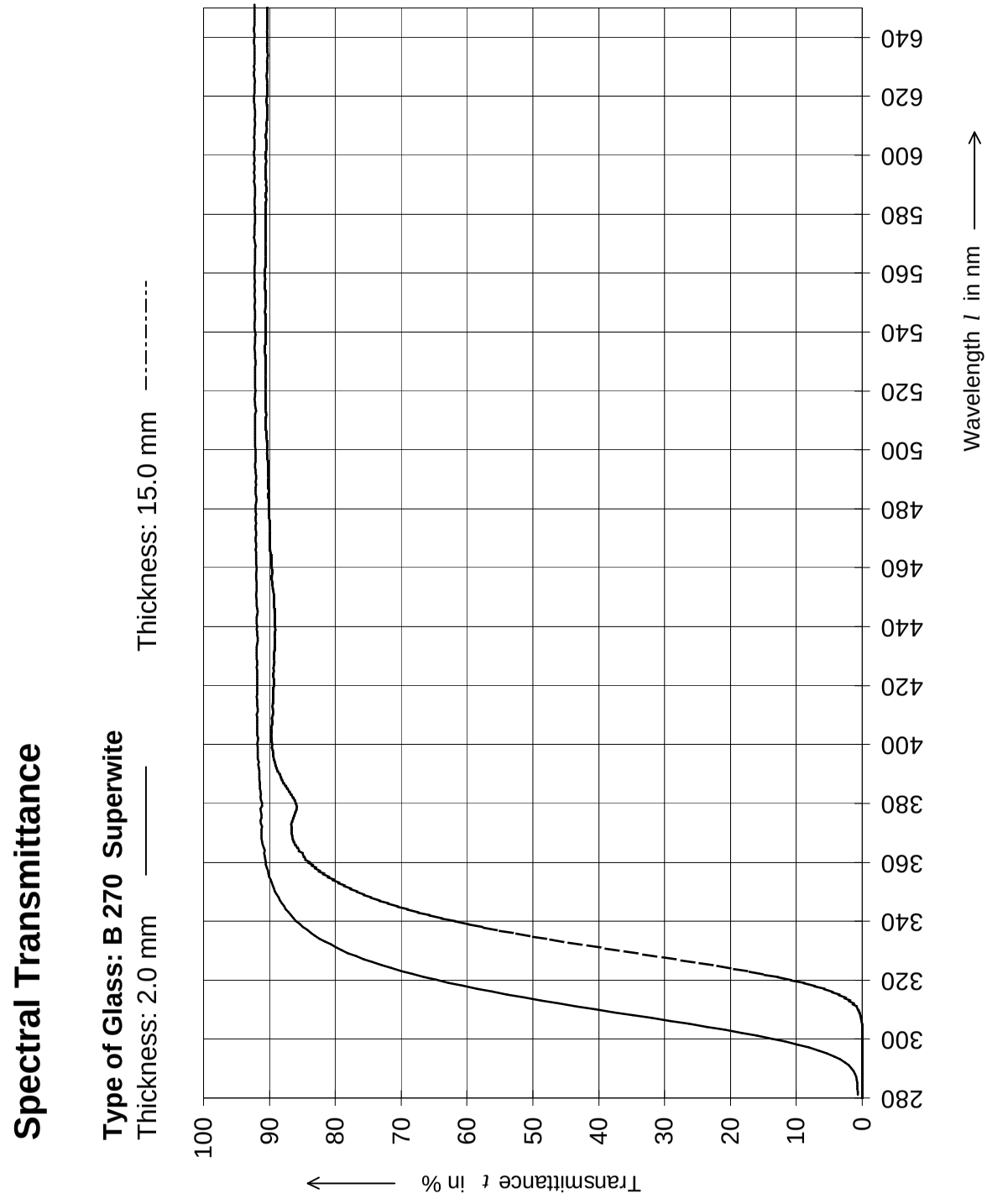

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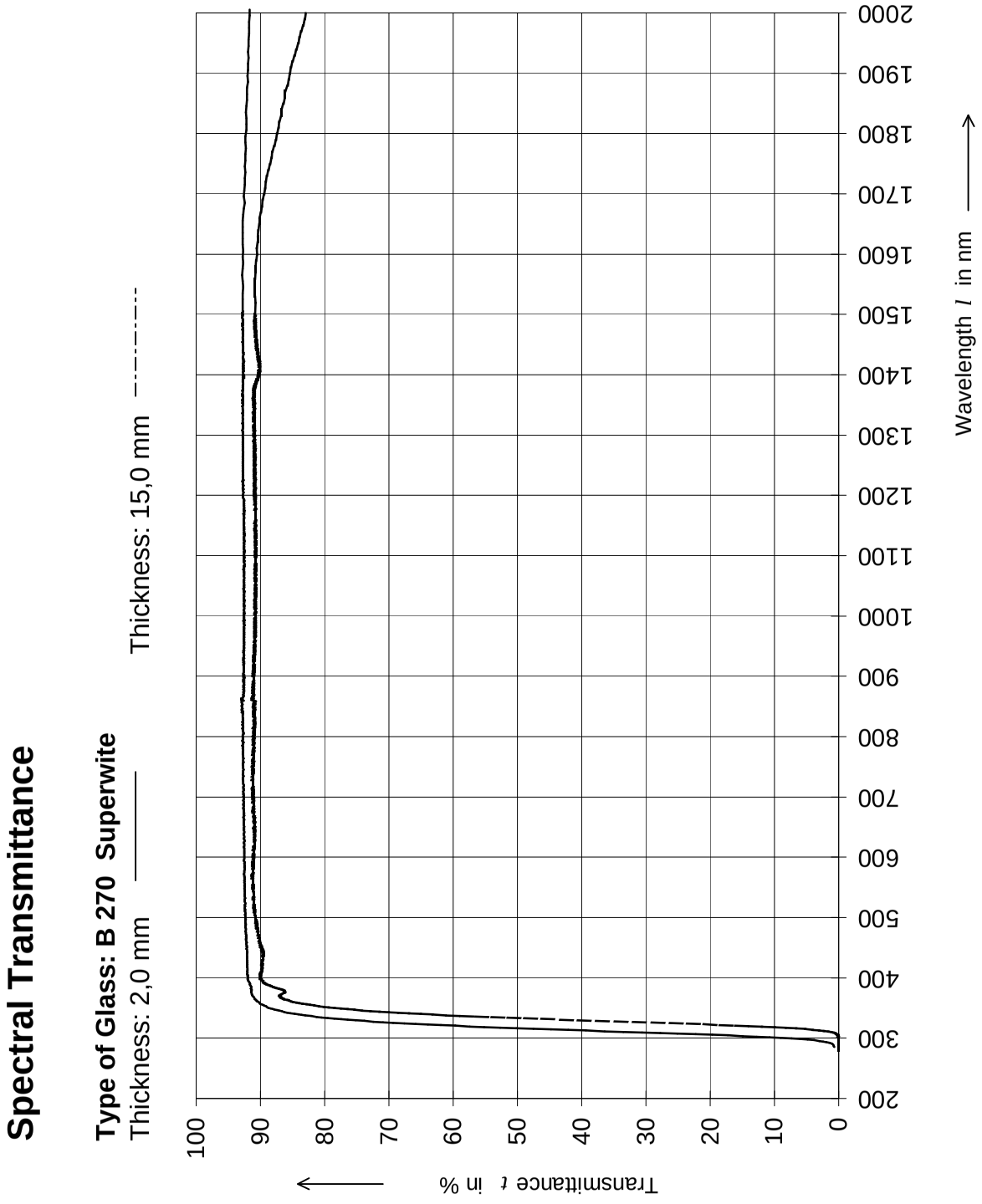

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Spectral transmittance $t\ (l)$ in % for the named thickness

	thickness in mm													
l in nm	1	2	3	4	5	6	7	8	9	10	15	20	25	30
300	35.1	13.5	5.2	2.0	0.8	0.3	0.1	0.0	0.0	0.0				
310	60.0	39.6	26.1	17.2	11.4	7.5	4.9	3.3	2.2	1.4				
320	76.0	63.4	52.9	44.1	36.8	30.7	25.6	21.4	17.8	14.9	10.9	5.4	2.6	1.3
330	84.2	77.8	71.8	66.3	61.3	56.6	52,3	48.3	44.6	41.2	34.6	25.0	18.1	13.1
340	88.0	84.9	81.9	79.0	76.3	73.6	71.0	68.5	66.1	63.8	59.6	51.8	44.9	39.0
350	89.8	88.4	87.1	85.7	84.4	83.1	81.8	80.6	79.3	78.1	75.1	70.4	65.9	61.8
360	90.6	89.9	89.2	88.5	87.9	87.2	86.5	85.9	85.2	84.6	83.0	80.4	77.8	75.4
370	90.8	90.4	89.9	89.4	89.0	88.5	88.0	87.6	87.1	86.7	85.6	83.8	82.0	80.3
380	90.9	90.4	90.0	89.5	89.1	88.6	88.1	87.7	87.2	86.8	85.4	83.6	81.7	79.9
390	91.2	91.0	90.7	90.5	90.3	90.1	89.9	89.7	89.5	89.2	88.6	87.7	86.8	85.9
400	91.3	91.2	91.0	90.9	90.7	90.6	90.5	90.3	90.2	90.0	89.5	88.9	88.2	87.6
410	91.3	91.2	91.1	91.0	90.8	90.7	90.6	90.4	90.3	90.2	89.7	89.1	88.5	87.9
420	91.4	91.2	91.1	91.0	90.8	90.7	90.6	90.4	90.3	90.2	89.6	88.9	88.3	87.7
430	91.4	91.2	91.1	91.0	90.8	90.7	90.6	90.4	90.3	90.2	89.4	88.8	88.1	87.4
440	91.4	91.3	91.1	91.0	90.8	90.7	90.6	90.4	90.3	90.1	89.5	88.8	88.1	87.4
450	91.4	91.3	91.2	91.1	90.9	90.8	90.7	90.5	90.4	90.3	89.7	89.1	88.5	87.9
460	91.5	91.4	91.3	91.2	91.1	91.0	90.9	90.8	90.7	90.6	90.0	89.5	89.0	88.5
470	91.5	91.4	91.4	91.3	91.2	91.1	91.0	90.9	90.8	90.8	90.3	89.9	89.4	89.0
480	91.6	91.5	91.4	91.3	91.3	91.2	91.1	91.1	91.0	90.9	90.5	90.1	89.8	89.4
490	91.6	91.5	91.5	91.4	91.4	91.3	91.2	91.2	91.1	91.1	90.8	90.5	90.2	89.9
500	91.6	91.6	91.5	91.5	91.4	91.4	91.4	91.3	91.3	91.2	90.9	90.6	90.4	90.1
510	91.6	91.6	91.5	91.5	91.4	91.4	91.4	91.3	91.3	91.2	90.9	90.7	90.4	90.2
520	91.7	91.6	91.6	91.5	91.5	91.4	91.4	91.3	91.3	91.2	91.1	90.9	90.7	90.5
530	91.7	91.6	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.4	91.2	91.0	90.8	90.6
540	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	91.2	91.0	90.9	90.7
550	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	91.2	91.0	90.9	90.7
560	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	91.2	91.0	90.8	90.6
570	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	91.2	91.0	90.8	90.6
580	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	91.1	90.9	90.6	90.4
590	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	91.0	90.8	90.5	90.3
600	91.7	91.7	91.6	91.6	91.5	91.5	91.5	91.4	91.4	91.3	90.9	90.7	90.4	90.1
610	91.7	91.7	91.6	91.5	91.5	91.4	91.3	91.3	91.2	91.1	90.9	90.6	90.3	90.0
620	91.7	91.7	91.6	91.5	91.5	91.4	91.3	91.3	91.2	91.1	90.8	90.4	90.0	89.7
630	91.8	91.7	91.6	91.5	91.5	91.4	91.3	91.3	91.2	91.1	90.7	90.3	90.0	89.6
640	91.7	91.7	91.6	91.5	91.4	91.3	91.2	91.1	91.0	90.9	90.6	90.2	89.8	89.4
650	91.7	91.7	91.6	91.5	91.4	91.3	91.2	91.1	91.0	90.9	90.6	90.2	89.8	89.4
660	91.8	91.7	91.6	91.5	91.5	91.4	91.3	91.3	91.2	91.1	90.7	90.3	89.9	89.5
670	91.8	91.7	91.6	91.6	91.5	91.4	91.3	91.2	91.2	91.1	90.7	90.3	90.0	89.6
680	91.8	91.7	91.6	91.6	91.5	91.4	91.3	91.2	91.2	91.1	90.7	90.3	90.0	89.6
690	91.8	91.7	91.6	91.6	91.5	91.4	91.3	91.2	91.2	91.1	90.8	90.4	90.1	89.7
700	91.8	91.7	91.6	91.6	91.5	91.4	91.3	91.2	91.2	91.1	90.8	90.4	90.1	89.7
710	91.8	91.7	91.6	91.6	91.5	91.4	91.3	91.2	91.2	91.1	90.8	90.4	90.1	89.7
720	91.8	91.7	91.6	91.6	91.5	91.4	91.3	91.2	91.2	91.1	90.8	90.4	90.1	89.7
730	91.8	91.8	91.7	91.6	91.6	91.5	91.4	91.4	91.3	91.2	90.8	90.4	90.1	89.7
740	91.8	91.8	91.7	91.6	91.6	91.5	91.4	91.4	91.3	91.2	90.8	90.4	90.1	89.7
750	91.8	91.8	91.7	91.6	91.6	91.5	91.4	91.4	91.3	91.2	90.8	90.4	90.1	89.7
760	91.8	91.8	91.7	91.6	91.6	91.5	91.4	91.4	91.3	91.2	90.8	90.4	90.1	89.7
770	91.8	91.8	91.7	91.6	91.6	91.5	91.4	91.4	91.3	91.2	90.8	90.4	90.0	89.6
780	91.8	91.7	91.7	91.6	91.5	91.4	91.3	91.2	91.1	91.1	90.7	90.3	89.9	89.5
790	91.9	91.8	91.7	91.6	91.6	91.5	91.4	91.4	91.3	91.2	90.7	90.2	89.8	89.4
800	91.8	91.8	91.7	91.6	91.5	91.4	91.3	91.2	91.1	91.0	90.6	90.2	89.7	89.3

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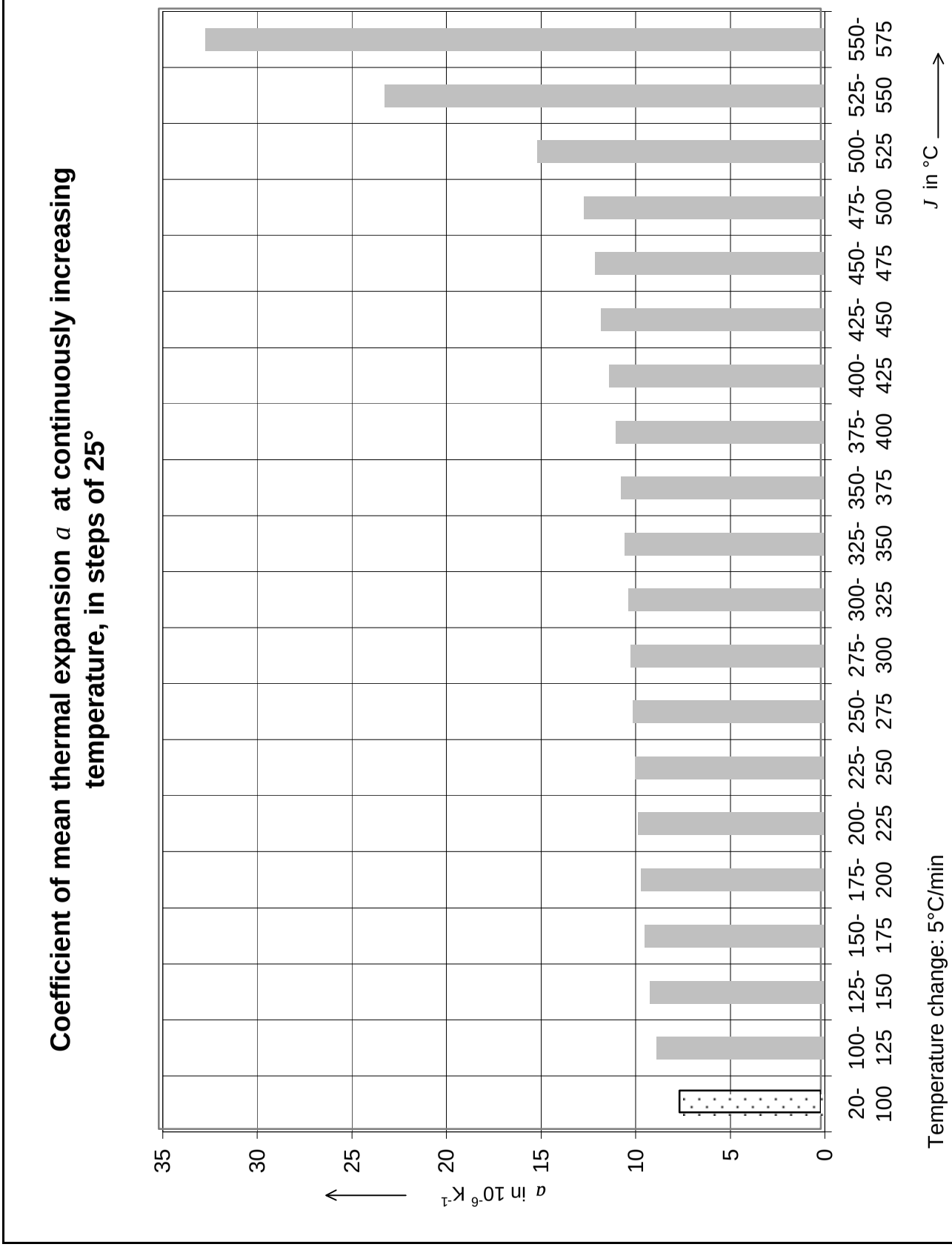

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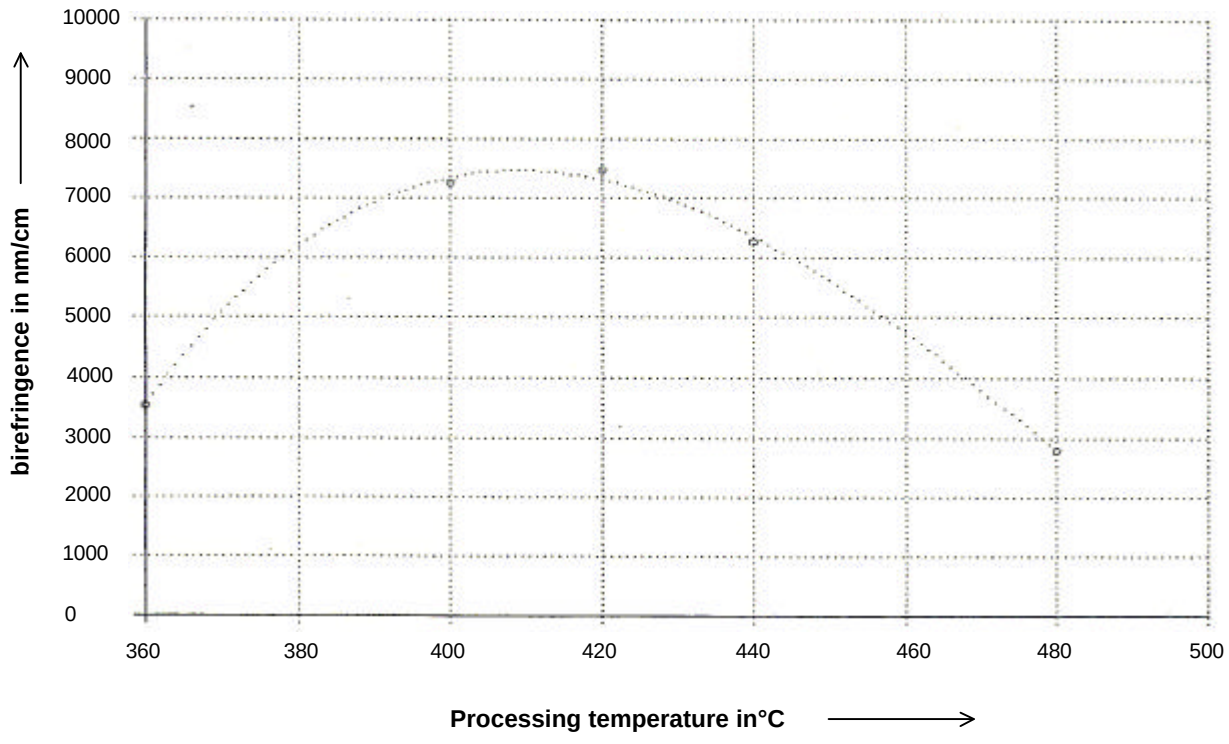
Chemical toughening parameter

Glass and chemical toughening parameters		
Transformation temperature	°C	533
Glass thickness	mm	3
Processing time	h	16
Processing temperature	°C	420
Salt bath (* weight percentages)	KNO_3 in % *	99.5
	SiO_2 x H_2O in % *	0.5

Chemical toughening results *		
Penetration depth	µm	48
Birefringence	nm/cm	7200

* measured across at a sample piece ground down to 0.3 mm ± 0.05 mm

Ball drop test acc. FDA	% failed	not carried out
Ball drop test acc. DIN	% failed	not carried out



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