radleys
accelerating chemistry

Technical Bulletin

Date	TB No.	Radleys Contact	Revision No.
19 December 2014	TB 101	support@radleys.com	1

Glass Technical Data

Radleys has been manufacturing scientific glassware and laboratory equipment for over 45 years and its customers include leading blue-chip industrial and academic research facilities around the world.

Radleys uses only the highest quality glass and associated materials for production. All glass is inspected before manufacture for evidence of stones, scratches or imperfections. After manufacture, all glassware is annealed to remove any stresses and inspected using a polarised light viewer to ensure it is stress-free.

Radleys uses only borosilicate glass 3.3, as specified in ISO 3585. In most instances we use SCHOTT DURAN® borosilicate glass, details of which are shown below.

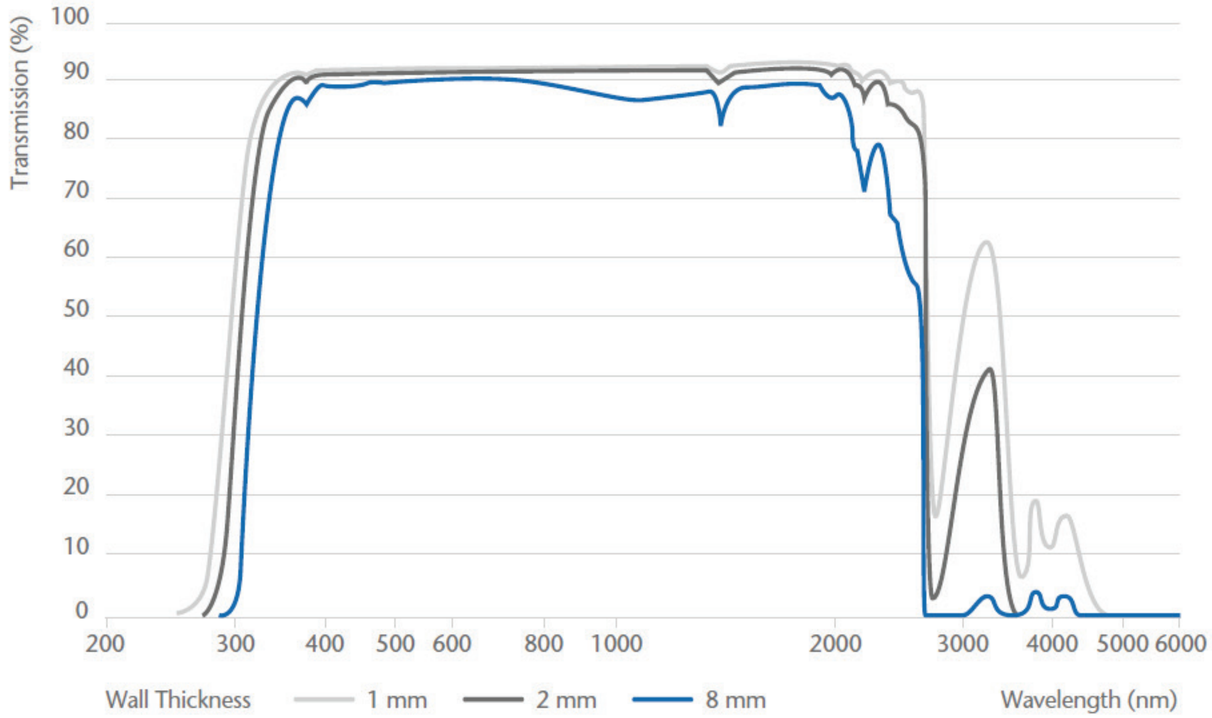
DURAN® borosilicate glass 3.3

Physical Properties		
Coefficient of mean linear thermal expansion α (20 °C; 300 °C) acc. to DIN ISO 7991		$3.3 \cdot 10^{-6}$ K^{-1}
Transformation temperature T_g		525 °C
Temperature of the glass at viscosity η in dPa · s:	10^{13} (annealing point) $10^{7.6}$ (softening point) 10^{4} (working point)	560 °C 825 °C 1260 °C
Density ρ at 25 °C		2.23 g · cm^{-3}
Modulus of elasticity E (Young's modulus)		$63 \cdot 10^{3}$ N · mm^{-2}
Poisson's ratio μ		0.20
Thermal Conductivity λ_w at 90 °C		1.2 W · m^{-1} · K^{-1}
Temperature for the specific electrical resistance of 10^{8} Ω · cm (DIN 52 326) $t_{k\,100}$		250 °C
Logarithm of the electric volume resistivity (Ω · cm)	at 250 °C at 350 °C	8 6.5
Dielectric properties (1 MHz, 25 °C)	Dielectric constant (permittivity) ε Dielectric loss factor (dissipation factor) tan δ	4.6 $37 \cdot 10^{-4}$
Refractive index (λ = 587.6 nm) n_d		1.473
Stress-optical coefficient (DIN 52 314) K		$4.0 \cdot 10^{-6}$ mm^{2} · N^{-1}

Chemical Composition			
SiO_2	B_2O_3	$Na_2O + K_2O$	Al_2O_3
81	13	4	2

main components in approx. weight %

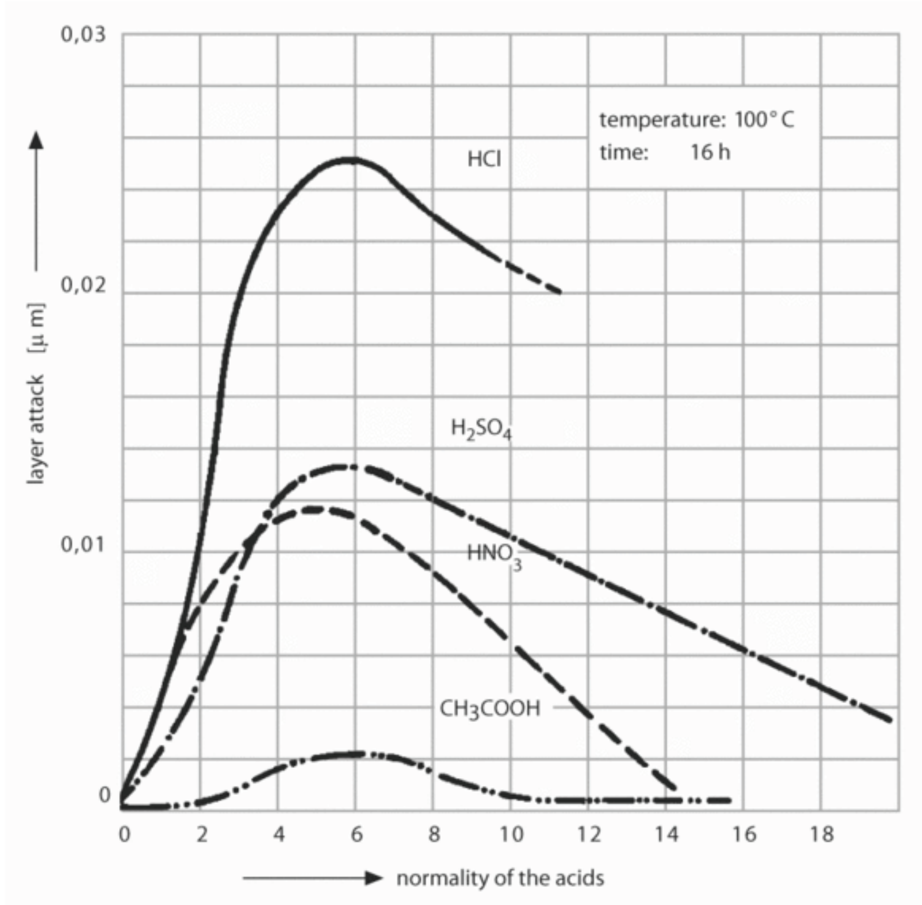
Transmission



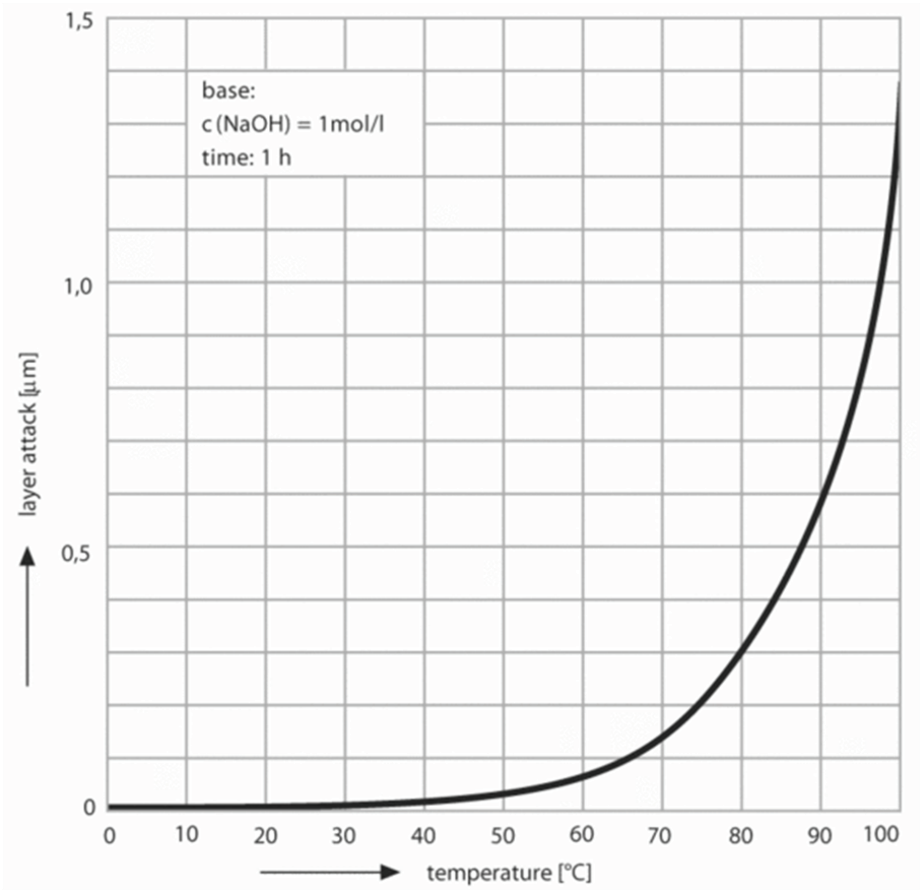
Chemical resistance

DURAN® borosilicate glass 3.3 has exceptional overall chemical resistance. It is highly resistant to water, salt solutions, most acids, halogens (chlorine, bromine and iodine) and organic substances. It has reasonable alkali resistance. Hydrofluoric acid, concentrated phosphoric acid and strong alkaline solutions can attack the glass surface; the extent will depend on the temperature and concentration.

Chemical Resistance	
Hydrolytic Class (DIN ISO 719)	HGB 1
Acid Class (DIN 12116)	Class S 1
Alkali Class (DIN ISO 695)	Class A 2



Acid attack on DURAN® as a function of acid concentration



Alkali attack on DURAN® as a function of temperature

Additional chemical resistance data is available on request.

Safe delta T (ΔT) – jacketed reaction vessels

To limit the potential stress (and therefore the risk of vessel breakage) that can be caused by a large difference between the jacket temperature and the contents temperature, the delta T (ΔT – the difference between the two temperatures in K, equivalent to °C) should be limited to our recommended 50 K or °C.

With current Huber thermoregulators with Pilot ONE controllers, you can adjust this by Menu → Protection Options → Delta T Limiter → type 50 in 'New value' field → tap 'Ok' to confirm. In the previous Nuevo controllers the delta T limiter can be found in the 'Limits' menu, and in older Unistat controllers it is program 18.

Important note
This control can only be achieved if the contents temperature is being monitored. If the internal temperature is not being monitored (if the vessel is empty, for instance) then great care should be taken to cool or heat the vessel in a controlled, gradual way to prevent thermal shock (e.g. by use of a ramp function).