Tables and general information

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DURAN Group is now DWK Life Sciences

Since the 1st June 2017, the companies DURAN Group, WHEATON Industries and KIMBLE Chase united under the new company name DWK Life Sciences. DWK Life Sciences is now a leading international manufacturer of premium laboratory products, packaging and storage solutions for a broad range of scientific and technical applications. The offer of DWK Life Sciences covers more than **25,000 laboratory products**, **which are manufactured at 12 locations** and marketed under the renowned brands **DURAN®, WHEATON®** and **KIMBLE®**. The leading global and field-tested range of laboratory products is supplemented by an innovative research and Life Science portfolio.

The material of glass

General properties

In comparison with other materials such as stainless steel or plastic, glass offers near-universal chemical resistance to water, saline solutions, acids, alkalis and other organic solvents. It is only affected by hydrofluoric acid and at increased temperatures by strong alkalis and concentrated phosphoric acids.
Glass is dimensionally stable and safe even at high temperatures and does not release harmful substances when heated. Glass also exhibits high transparency.
In the laboratory, various types of glass are used depending on application. These are chiefly soda-lime glass (AR®-glass) as well as various types of borosilicate glass.

Soda-lime glass has less chemical and thermal load capacity than borosilicate glass. Due to its high thermal expansion, soda-lime glass has a low thermal shock resistance and can incur stresses and crack when heated or cooled. Soda-lime glass is well suited to applications involving temporary chemical contact at room temperature as well as to disposable articles.

Borosilicate glass is to a large extent chemically inert and suitable for use up to very high temperatures. The various types of borosilicate glass mainly differ from one another in terms of their linear coefficient of expansion and hence their resistance to changes in temperature.
The most commonly used types of borosilicate glass are borosilicate glass 3.3 (DURAN®, SIMAX), borosilicate glass 4.9 (Fiolax®) and borosilicate glass 5.1.

The following factors are critical to the quality of laboratory glassware:

- The glassware and glass type
- The shape obtained during the production process
- Even distribution of wall thickness in all areas of the article (particularly in critical areas such as in the neck/shoulder area and at the transitions to the base). This ensures:
  - better mechanical stability
  - higher thermal shock resistance
  - freedom from stresses, which can cause the vessel to burst when heated

These quality characteristics not only increase safety for employees in the laboratory, but also extend the useful life of the laboratory glassware and protect valuable substances.

Comparison of DURAN® and soda-lime glass

Chemical properties:

	DURAN®	Soda-lime glass
Chemical composition	81 % SiO_2 13 % B_2O_3 4 % Na_2O/K_2O 2 % Al_2O_3 No added heavy metals	69 % SiO_2 1 % B_2O_3 3 % K_2O 4 % Al_2O_3 13 % Na_2O 2 % BaO 5 % CaO 3 % MgO
Hydrolytic resistance to DIN ISO 719	Class 1	Class 3
Acid resistance to DIN 12116	Class 1	Class 1
Alkali resistance to ISO 695	Class 2	Class 2

Physical properties:

Transformation temperature [°C]	525	
Coefficient of expansion α (20 to 300 °C) [10^{-6} K^{-1}]	3.3	9.1

Usage instructions:

Max. allowable usage temperatures	500 °C	approx. 100 °C
Maximum negative temperature	-70 °C	approx. 0 °C
Maximum temperature difference ΔT	100 K	30 K
Use in the microwave	Suitable	Unsuitable
Pressure and vacuum operation	Only products indicated as such are suitable for use under pressure/vacuum due to their geometry and wall thickness (e.g. suction bottles, dessicators, DURAN® pressure plus bottles)	Unsuitable
Cleaning in dishwashers	Suitable	Unsuitable

The **thermal shock resistance of glass** is dependent on the shape, wall thickness, surface characteristics and finish of the glassware used.

Rapid changes in temperature cause high temporary stress in the glass, meaning that rapid cooling processes are very dangerous, since in this case a thin outer layer of the glass is placed under tensile stress over the still hot inner core. Glass is much more susceptible to tensile stress than to compressive stress.

DURAN® is much more resistant to rapid changes in temperature than soda-lime glass due to its lower thermal expansion.

Carl Roth GmbH + Co. KG
Labware · Life Science · Chemicals
Schoemperlenstraße 3–5 · D-76185 Karlsruhe
Phone +49 721 5606-0 · Fax +49 721 5606-149
P.O.Box 100121
76231 Karlsruhe
info@carlroth.com
www.carlroth.com

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The special features of DURAN®
Very high chemical resistance, nearly inert behaviour, a high usage temperature, minimal thermal expansion and the resultant high resistance to thermal shock are its most significant properties. Excellent physical and chemical performance makes DURAN® the ideal material for use in the laboratory and for the manufacture of chemical apparatus used in large-scale industrial plants. It is also widely used on an industrial scale in all other application areas in which extreme heat resistance, thermal shock resistance, mechanical strength and exceptional chemical resistance are required. The properties of DURAN® meet the specifications of DIN ISO 3585. Compared to other types of borosilicate 3.3. glass, DURAN® is noted for its highly constant and technically reproducible quality.

Chemical properties
DURAN® glass is more chemically resistant that all other known materials. DURAN® borosilicate glass is highly resistant to water, acids, saline solutions, organic substances and halogens, such as chlorine or bromine. It also has good resistance to alkaline solutions. Only hydrofluoric acid, concentrated phosphoric acid and strong alkalis break down the glass surface (glass corrosion) at temperatures >100 °C. Their near-inert behaviour means that there are no interactions (e.g. ion exchange) between the medium and glass and it is thus possible to practically rule out any influence on the experiments.

Physical Properties:
Temperature stability under heating
The maximum permissible operating temperature for DURAN® is 500 °C. As it has a very low coefficient of linear expansion ($\alpha = 3.3 \times 10^{-6}\ K^{-1}$), a feature of DURAN® is its high thermal shock resistance up to $\Delta T = 100$ K. This is also dependent on the wall thickness and the geometry of the products.

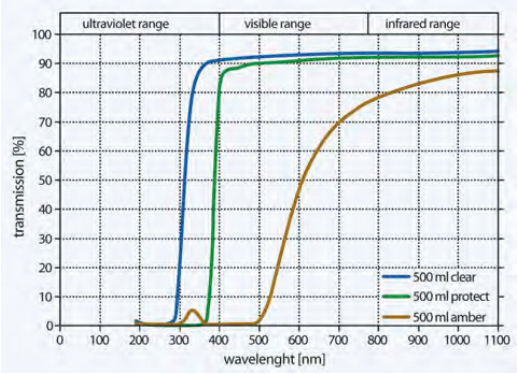
Temperature stability under freezing
DURAN® can be cooled down to the maximum possible negative temperature and is thus suitable for use with liquid nitrogen (approx. -196 °C). When doing so, bear in mind the product geometry and the properties of any additional components used (e.g. screw caps). In general, DURAN® products are recommended for use down to -70 °C.
When cooling down and thawing, care must be taken to ensure that the temperature difference does not exceed 100 K. In practice, therefore, it is recommended that they be cooled and heated gradually.
When freezing substances such as DURAN® bottles, the container should only be filled to max. 3/4 full and frozen at an angle of 45 °
(in order to enlarge the surface area).

Use in the microwave
DURAN® laboratory glassware is suitable for use in microwaves. This also applies to plastic coated DURAN® products.

Conformity with standards and guidelines
DURAN® is a neutral glass with high hydrolytic resistance and therefore belongs to glass type 1 according to the European Pharmacopoeia (EP, Section 3.2.1), the Japanese Pharmacopoeia (JP, Section 7.01), the United States Pharmacopeia (USP, Section: 660) and the National Formulary. In addition to being in conformity with the DIN ISO 3585 international standard, in which the properties of borosilicate glass 3.3 are defined, many items of DURAN® laboratory glassware meet the standards for glass laboratory equipment.

Environmental compatibility of DURAN® laboratory glassware
DURAN® laboratory glassware is manufactured from natural, mineral raw materials. Unlike other materials, laboratory glassware can be used for years if handled properly and therefore is superior to other materials in ecological terms.
Toxic substances cannot leach out. The production processes have been systematically optimised for maximum environmental compatibility during the production process.

Optical properties
In the spectral range from approx. 310 to 2200 nm the absorption of DURAN® clear glass is negligibly low. In photochemical processes the light transmission of DURAN® in the ultraviolet range is of particular importance. The transmissivity in the UV range indicates the ease with which photochemical reactions, such as chlorinations and sulfochlorinations, can be carried out. The chlorine molecule absorbs in the range from 280 to 400 nm and thus serves as a carrier of the radiation energy.



Amber colouring of DURAN® laboratory glassware
The amber colouring allows the storage of light-sensitive substances in DURAN® products. In the wavelength band between 300 and 500 nm, light transmission compared to DURAN® clear glass is <10 %. Accordingly, the amber DURAN® glass meets USP/EP/JP guidelines.
Since the amber diffusion ink is applied to the outside of the clear glass article by means of spray coating, the proven DURAN® properties inside the bottle remain unaffected; there is no contact or interaction between contents and amber coating.
The coating is then stove enamelled, and therefore is resistant to chemicals and cleaning in a dishwasher.

Safety instructions
DURAN® glassware is safe to use. The guidelines applicable for the use of special glass in laboratories in the country in question should always be observed. The following points should, however, always be observed:
- Before using DURAN® laboratory glassware, it should be checked to ensure that it is suitable for the intended purpose and that it will function properly.
- Faulty laboratory glassware can present a hazard (e. g. risk of cuts, burns, infection) which should not be underestimated. If appropriate repairs to any item cannot be carried out or cannot be justified on grounds of cost, it must be disposed of in the proper manner (as household waste or, depending on possible contamination, in accordance with the applicable guidelines; never as waste glass).
- Glassware should only be subjected to sudden changes in temperature taking into account a thermal shock resistance of ΔT=100K. This applies in particular to thick-walled glassware, such as suction bottles or dessicators.
- Make sure that apparatus stands firmly and is not subjected to stress by using appropriate support material.

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