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Glass Capillaries

Quality glass, superior prices for microinjection/microelectrodes

Features

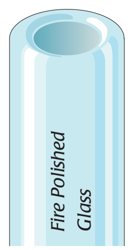
- Quality borosilicate glass capillaries
- Large variety available, including fire polished, filaments, thin wall, specialty glass and multi-barrel

Benefits

- Superior pricing
- Most glass orders ship within 48 hours

Applications

- Microinjection
- Electrophysiology
- Patch clamp
- Fluid Handling



FIre Polishing

Fire-Polished glass capillaries are easier to insert into microelectrode holders without damaging the gasket. More importantly, fire-polished glass won't scratch the chloridized wire used in a recording electrode. Fire-polishing does not affect the glass's mechanical or electrical properties.

Making Uniform, Reproducable Microelectrodes

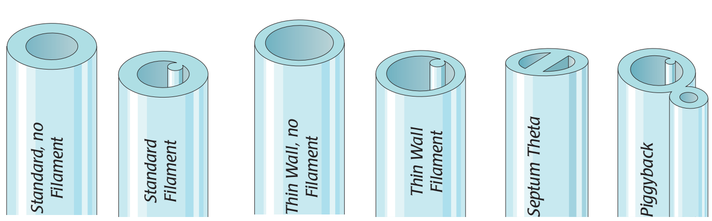
Borosilicate glass capillaries: Close dimensional tolerances assure microelectrode uniformity and reproducibility. Capillaries are available in 1, 2, 3, 5 and 7-barrel configurations, complete range of single barrel thin-wall sizes and a variety of special configurations. Capillaries with filaments contain a solid filament fused to the inner wall, which speeds filling of electrodes. Capillaries with or without inner filaments are available for making microelectrodes in a wide range of diameters.

Filament Glass Capillaries

Single Barrel standard wall thickness capillaries are offered either with or without inner filaments for quick filling in a variety of lengths and diameters.

Thin Wall Glass Capillaries

Thin Wall single barrel capillaries are offered both with or without inner filaments.



Choosing Patch Clamp Glass

To select the best patch clamp glass for your experiments, we have evaluated available glass types in terms of the four properties most crucial to successful patch clamp studies:

The **softening temperature** determines how easily each glass type can be pulled to the desired shape and the extent to which it can be heat polished. Glass with a high softening temperature is difficult to pull and causes unnecessary wear on the heating element of the puller. This makes it very hard to make electrodes that are reproducible and of consistent quality. Patch clamp glass with a low softening temperature is preferred; however, higher softening temperature glass is stronger.

Electrical properties determine how much noise the glass is likely to produce in recording situations. The lower the product of dielectric constant times the loss factor, the smaller the equivalent noise current the glass will produce (Rae and Levis, Methods in Enzymology, 207, p67, 1992). Patch clamp glass with good electrical properties is critical especially in single-channel recording.

Sealability: It is not clear what factors determine the sealing ability of the patch to the glass. Almost any glass can form a gigohm seal under the right conditions. Different glass types vary, however, in how easily they form a seal. It is important to select a patch clamp glass that seals easily. Good fire polish is critical for seal.

Leachable components: Substances leached from glass can alter channel behavior. Since different channels are sensitive to different glass components, it is best to record one type of channel with several different kinds of pipette glass to eliminate any artifact due to the glass.

WPI offers capillary tubing made from two glass types widely used in constructing patch clamp electrodes. The significant characteristics of each are as follows:

PG52151-4, PG52152-4 and PG52165-4 are prepared from Schott #8250 glass (equivalent to Corning #7052), one of the most widely used patch clamping glasses. This is a specially formulated borosilicate glass with a softening temperature that is 110°C lower than regular borosilicate glass (Corning 7740, or Pyrex). It has excellent sealing properties for most cells. Electrical properties are also very good.

PG10150-4 and PG10165-4 are composed of Corning #0010 glass, a high lead content (22% PbO) glass. Its thermal and electrical performance is between the Schott #8250 and Corning #8161 glasses described above. It is much more economical than Corning #8161 glass. It has been found that this glass causes much less alteration in channel behavior than Corning #8161 and Schott #8250 glass (Furman and Tanaka, *Biophys. J.* 53, p287, 1988).

Patch clamp capillaries do not have microfilaments

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Physical Properties of WPI Glass Capillaries

The physical properties of glass depend upon the chemical composition of the glass, as well as how the glass was manufactured. Glass has no set melting point, but four temperatures are of primary importance when discussing glass production.

Working Point is the temperature that the glass is soft enough to work. At this temperature, the glass viscosity is 10^4 poises.

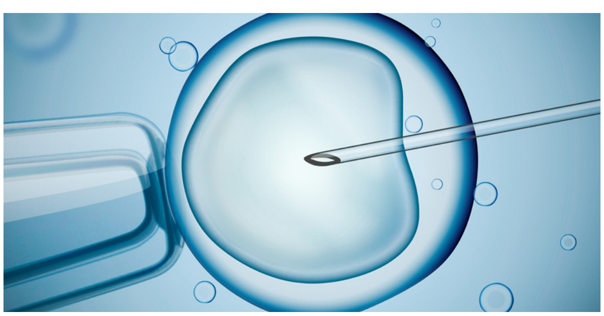
Softening Point - At this temperature, glass deforms easily, even by forces of gravity. The glass viscosity is $10^{7.6}$ poises.

Annealing Point - When glass reaches the annealing point and remains for a few minutes, many of the internal stresses of the glass formation are obviated. During the annealing process, the glass is heated to the annealing temperature and then allowed to cool at a controlled rate. Glass that is not annealed is prone to crack or shatter with minor temperature fluctuations or mechanical shocks.

Strain Point - When glass temperature remains at the strain point for several hours, the internal stresses are relieved. Stresses that remain in the glass after maintaining the strain point for a few hours are permanent.

WPI sells glass from multiple suppliers. In the tables below, we detail some of common glass specifications.

	Duran® Schott 8250	Duran® Schott 0010	Duran® Schott 8330	Corning 7800	Kimble N51A
WPI Usage	Pulled Glass PG-52151, PG-52165 Patch clamp glass capillaries	Patch clamp glass capillaries	WPI thin wall glass capillaries Pre-pulled micropettes with TW in the part no.	Multi-barrel capillaries Septum theta Piggyback capillaries Glass rods	Single barrel glass tubing (p/n 1Bxxxx)
Density ρ	2.28 g/cm³		2.23 ± 0.02 g/cm³	2.33 g/cm³	2.33 g/cm³
Working Point - 10^4 dPa·s	1055°C		1260 ± 20°C		1140°C
Softening Point - $10^{7.6}$ dPa·s	720°C	625°C	820 ± 10°C	789°C	785°C
Annealing Point - 10^{13} dPa·s	500°C		560 ± 10°C	565°C	570°C
Strain Point	490°C		510°C	517°C	530°C
Relative dielectric constant tan δ at 1 MHz and 25 °C	4.9	6.7	4.6 10^{-4} 37 10^{-4}		
Thermal expansion (0–300°C)	5.0×10^{-6} /K		33×10^{-7} cm/cm/°C	55×10^{-7} cm/cm/°C	55×10^{-7} cm/cm/°C
Young's Modulus	64×10^3 N/mm²		6.4×10^3 kg/mm²	7.2×10^3 kg/mm²	10.4×10^6 PSI
Poisson's Ratio	0.21		0.20		
Dielectric Constant	4.9		4.6		5.8
Loss Factor 1 MHz 25°C	22×10^{-4}		2.6%		4.9%
Refractive Index	1.487		1.473 mm²/N	1.490 mm²/N	1.490 mm²/N
Temperature Limits				460°C (extreme service) 200°C (normal service)	
Max. Thermal Shock				115°C	
Visible Light Transmission 2 mm thickness					91%
Specific Heat 25–175°C					0.204 g. cals/g. deg.
Thermal Conductivity	1.2 W/m/K (at 90°C)				0.0026 cals/cm/cm²/sec/°C



Corning 7800 glass is a type I, class B borosilicate glass that conforms to federal specification DD-G54lb and ASTM E-438. This glass has the following composition:

	Corning 7800	Duran® Schott 8330
SiO_2	73%	81.0%
B_2O_3	10%	13%
Na_2O	2%	~2.0%
Al_2O_3	7%	2.0%
K_2O	2%	~2.0%
BaO	<0.1%	
CaO	0.7%	

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USA: International Trade Center, 175 Sarasota Center Boulevard, Sarasota FL 34240-9258 USA
Tel: (941) 371-1003 • **Fax:** (941) 377-5428 • **E-mail:** wpi@wpiinc.com • **Internet:** www.wpiinc.com

UK: 1 Hunting Gate, Hitchin, Hertfordshire SG4 0TJ England • Tel: 44 (0)1462 424700 • E-mail: wpiuk@wpi-europe.com
Germany: Zossener Str. 55, 10961 Berlin, Germany • Tel: 030-6188845 • Fax: 030-6188670 • E-mail: wpide@wpi-europe.com
China & Hong Kong: Rm 25e, No8 Donfang Rd., Pudong District, Shanghai 200120 PRC • Tel: +86 688 85517 • E-mail: ChinaSales@china.wpiinc.com
Brazil: Conselheiro Nabias, 756 sala2611, Santos-Sao Paulo 11045-002 Brazil • E-mail: info@brazil.wpiinc.com