



Novel applications for the P-2000 micropipette puller

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The Sutter Instrument P-2000 micropipette puller was originally designed to allow the use of quartz glass in the well-established applications of micropipette techniques, such as intracellular or patch type recordings from neurons and microinjection into animal and plant cells. In order to work with quartz glass the P-2000 uses a CO₂ laser as the heat source. The power of the laser output is servo-controlled, and this allows the P-2000 to also work with glasses that have a lower melting point.

The ability to work with quartz and fused silica has allowed the development of new applications for this type of device outside the traditional range of micropipette techniques. Along with the known advantages of quartz in terms of mechanical, electrical and optical properties, we found that quartz (or fused silica) could produce pipettes with smaller tips than had ever been made with the traditional glasses for micropipettes.

There was immediate interest in using our system to pull fiber optic tapers for the new field of Near-Field Optical Scanning Microscopy (NSOM). We designed a very of the P-2000 specifically tailored for use with small diameter glass such as 125 micron optical fibers, and this version was termed the P-2000/F. Typical fiber tips are pulled to the desired size within the range of 40 to 100 nm. It is possible to pull much smaller tips, but these are generally not workable for NSOM.

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10 micron ID tip pulled with HPLC tubing on P-2000/F

In addition to NSOM the P-2000/F has been used for research involving fiber optic sensors and fiber optic coupling.

The P-2000/F was a natural choice for the new field of nanospray mass spectrometry. The small diameter fused silica tubes used for HPLC were easily turned into nozzles for nanospray with the P-2000/F. In this case tip sizes needed to be much larger (2 to 15 microns) but the flexibility of the P-2000 and its microprocessor control made this just a matter of properly selecting a few program values.

The P-2000 has also been used to form electrodes for new applications by drawing the glass (typically quartz) with a small fiber or wire of a different material inside. Carbon fibers inside quartz have been used for voltammetry and Platinum wires inside quartz have been used to make ultramicroelectrodes (UME) for techniques such as scanning electrochemical microscopy (SECM).

It is difficult to guess what new applications may arise for the P-2000. It is clearly the instrument of choice when there is a requirement to draw glass to nanometer tip sizes, or whenever glass rods or tubes need to be tapered to tips that are in the range of nanometers to tens of microns.

Tip pulled from 125 micron fused silica optical fiber with a P-2000/F. 50 nm tip size after subtracting 20 nm for the gold coating.

