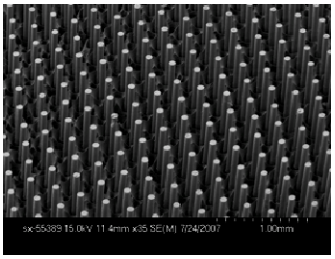
Microwire Arrays

Nondrawable Wire Arrays Using Glass Drawing

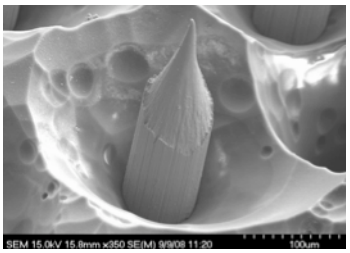
Researchers at the Department of Energy's Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, have developed a method of forming refractory wire arrays using a glass drawing process. This process uses a modified "Taylor wire drawing" technique to glass coat nondrawable wire (i.e., high melting-point wire). This produces glass coated wire fibers. These fibers are then bundled together and fused into a solid rod. The rod is cut into wafers with a diamond saw. After etching away part of the glass matrix, the wire array becomes fully exposed.

The size of the wafer is only limited by how much fiber is bundled before fusion. Because the wire is not actually being drawn, its final diameter is the same as the diameter of the original wire spool. The images to the right show wires with diameters of 75 microns. Wires with diameters as small as 5 micron are commercially available to be used with this method. The obvious application for these arrays is as electrodes. Since the wires extend all the way through the wafer, energizing or sensing the electrode is accomplished by simply connecting to it via the back plane. We have created arrays of both tungsten and platinum wires because of tungsten's wide use as a field emission electrode and platinum's wide use as a medical (implant) electrode.

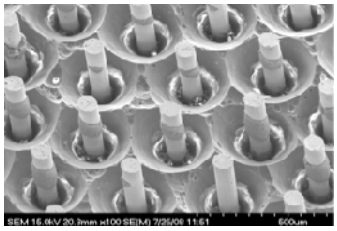
For use as field emitters, the tungsten wires require sharpening. This is done by first etching away part of the outer glass. The tungsten wires are then sharpened by an electrochemical etching method. Finally, the glass matrix is once again etched back to fully expose the sharpened electrodes.



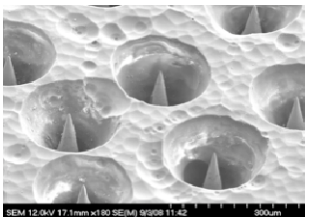
Tungsten wire array in a glass matrix.



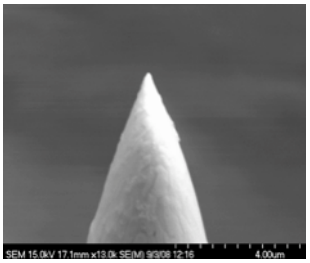
Exposed and sharpened tungsten wire.



Exposed tungsten wires after glass etching.



Electrochemically etched tungsten wires after glass etching.



Etched wire close-up.

Sponsors: ORNL Laboratory Directed Research and Development and Maturation Funds.

Features:

- Uniform arrays of refractory metal wire in glass matrixes.
- These arrays can be used in electronic applications and/or medical applications.
- Wire detection or activation via the back plane greatly enhances connectivity.
- Arrays can be fabricated with various size wires and pitches.

Contact Information:
Panos G. Datskos
Group Leader
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6054
Phone: 865-574-6205
Fax: 865-574-9407
(datskospg@ornl.gov)

MSSE

OAK RIDGE National Laboratory

www.ornl.gov