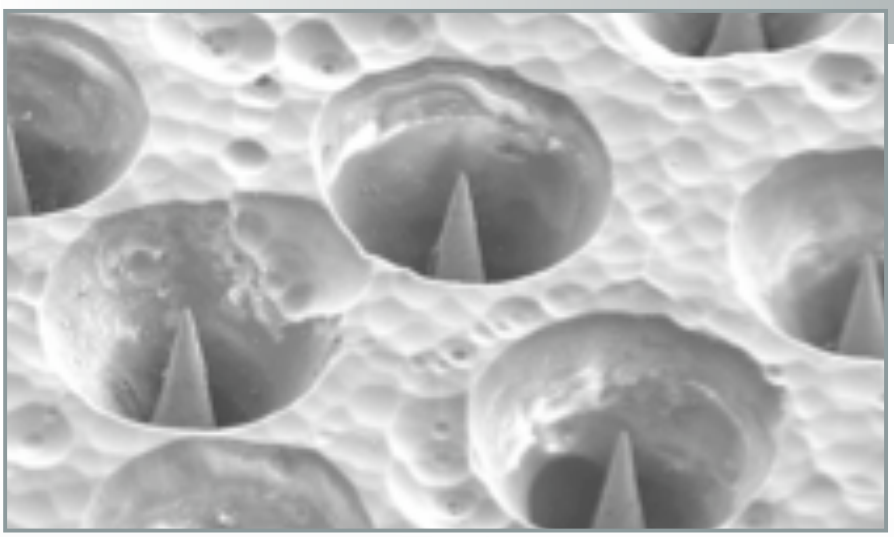
Glass Drawing for Wire Arrays

UT-B ID 200902224



Technology Summary

Refractory metals are extraordinarily resistant to heat and wear. They all share a melting point above 2000°C and are hard at room temperature. The high melting points make powder metallurgy the method of choice for fabricating components of refractory metal, such as wire arrays.

Researchers at ORNL have developed a method of forming refractory wire arrays using a glass drawing process. They use a modified "Taylor wire drawing" technique to glass coat nondrawable wire (i.e., wire that has a high melting point), producing 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 limited only by how much fiber is bundled prior to fusion. Since the wire is not actually being drawn, its final diameter is the same as the diameter of the original wire on the spool. Wires with diameters as small as 5 microns can be used in this process.

An important application for these arrays is in making electrodes. Since the wires extend all the way through the wafer, energizing or sensing the electrode is accomplished by connecting to it via the back plane. The researchers 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 electrical-chemical etching method. Then once again, the glass matrix is etched back to fully expose the sharpened electrodes.

Advantages

The invention and application feature uniform arrays of extraordinarily heat resistant refractory metal wire, configured in a glass matrix. Besides high heat resistivity, the wires are highly resistant to wear. Connectivity is greatly enhanced by detecting or activating the wire through the back plane. Arrays can be fabricated with various sizes of wires and pitches.

Applications

These arrays can be used to make electrodes, in electronic applications and medical applications.

Patent

Application in preparation

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