Electrochemical preparation of nanotips

Automated etching device ARMIN

ISI CAS Institute of Scientific Instruments The Czech Academy of Sciences

APPLICATIONS

The fully automated etching device enables end-users to easily create ultra-sharp nanotips of diameters lower than 50 nanometers on a single- or poly-crystalline wires.

Main features

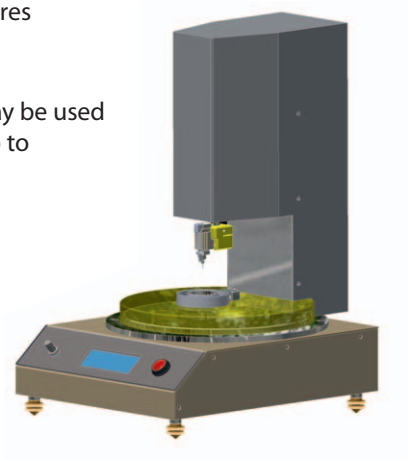
- Fully automated compact solution offering high reproducibility
- Storage memory for various etching procedures

Extended etching options

- Single-crystalline or poly-crystalline wires may be used
- Variability of wire diameters used (0.1 mm up to 0.35 mm)
- Customized tip shape

Examples of use

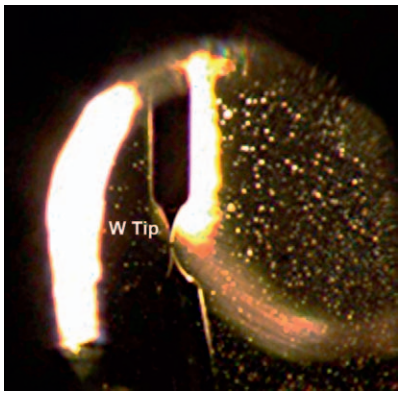
- Scanning Tunneling Microscopy (STM) probes
- Nanomanipulators (FIB and SEM)
- Field Emission (FE) cathodes

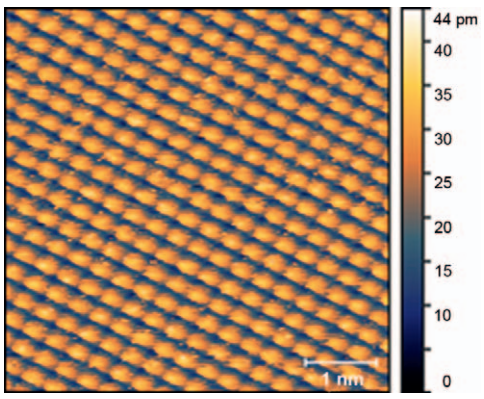


CASE STUDY 1

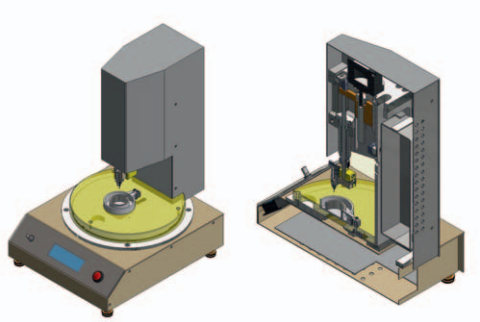
Scanning Tunneling Microscopy (STM) Probe

The STM tips were formed from 0.3 mm tungsten wire. The image below (left) shows the scanning probe above the planar surface of the silver, showed in better detail (right).

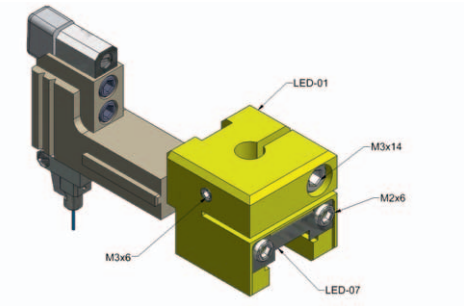




Institute of Scientific Instruments
of the CAS, v.v.i.
The Czech Academy of Sciencesc
Královopolská 147, 612 64 Brno,
The Czech Republic
www.isibrno.cz

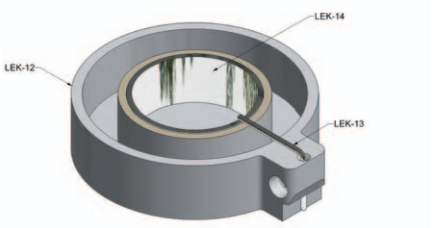


Advanced mechanical construction containing digital and analogue parts for real-time process control and measurement.



Plug-in adaptor containing special clamp holding etched wire. Can be easily removed or switched for another.

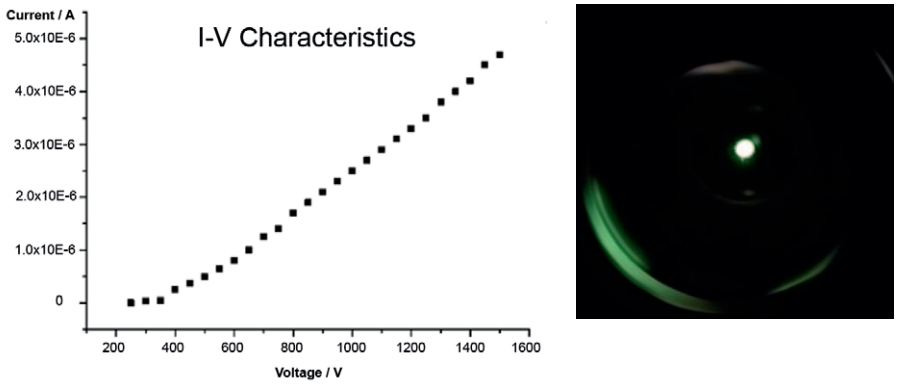
Plug-in plastic cylinder serving as an electrolyte tank. Can be easily removed or switched for another.



CASE STUDY 2

Cold Field Emission Cathode

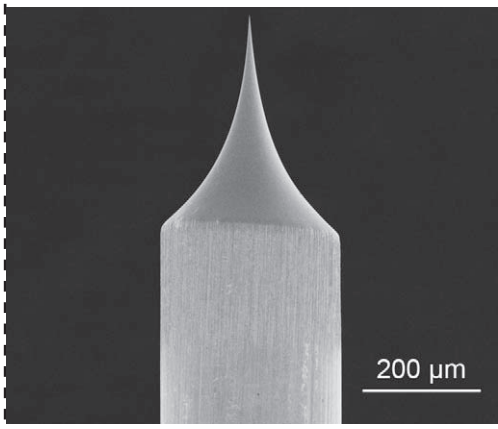
Sharp tips with low apex radius are important for cathodes based on field emission (FE) of electrons. The need for them arose in the early days of electron microscopy, especially in connection with field emission microscopy (FEM). Nowadays, the ultra-sharp tips with diameters lower than 100 nm are mostly used for electron guns with cathodes operating at a room temperature. This kind of free electron source has proven to have the highest source brightness accompanied with the lowest energy spread compared to common ZrO/W emitters.



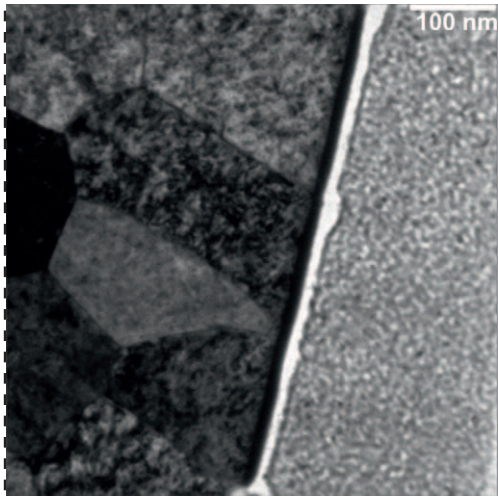
An I-V plot representing the current-voltage behavior of the clean tungsten tip (left) along with the emission pattern (right) measured in diode configuration with YAG scintillator showing beam profile.

WHAT YOU WILL BENEFIT FROM

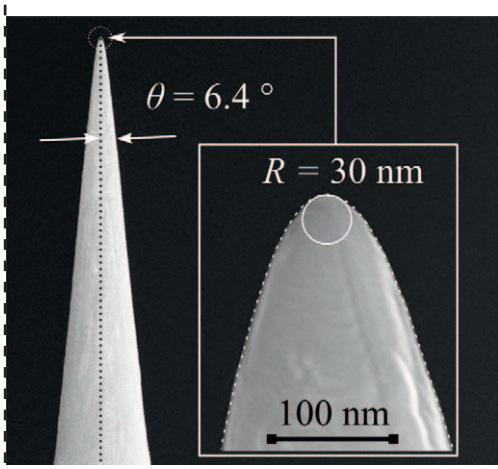
- More than 20 years de sign experience.
- Short production cycle.
- From science through R&D, to final product.
- Design labs using high-tech prototype production technology.



The macroscopic view of the example nanotip, made of a polycrystalline W.



Section of the polycrystalline tungsten tip showing crystalline structure and the surface oxide layer created during the etching. The layer thickness is approximately from 10 to15 nanometers.



The detailed view of the example nanotip, made of a polycrystalline 0.3 tungsten wire using the preprogrammed two-step method.