TECHNOORG
L I N D A

UniMill

Fully automated ion beam thinning system for TEM/XTEM sample preparation

- Fast thinning and gentle polishing/cleaning with the same instrument
- Fully automated ion source setup and ion mill operation
- Widest range of ion energies: from 100 eV to 16 keV using ultra high-energy and low-energy noble gas ion sources
- Optional liquid nitrogen cooling

The new UniMill (code IV7) model of Technoorg ion mills has been designed for extremely rapid preparation of high-quality TEM/XTEM samples with unsurpassed high thinning rate. The design of the instrument enables both rapid milling with the ultra high-energy noble gas ion source followed by final polishing and cleaning with the patented low-energy ion gun.

APPLICATION

The UniMill is recommended to users developing new materials or new sample preparation methods and due to its extreme milling rate, it is also recommended for studying materials of very low sputtering rate, such as diamond, sapphire, etc. Its exclusive capability of producing damage- and artifact-free samples by low-energy ion bombardment provides unique opportunity to study real nanostructures in synthesized and natural materials in all fields of technical sciences and materials research.

STATE-OF-THE-ART ION SOURCES

The UniMill includes two independently controlled ion sources: one high- or ultra high-energy ion gun and one low-energy ion gun.

High-energy and ultra high-energy ion sources

Technoorg's ultra high-energy ion source provides the highest milling energy in the market. The ion gun operating up to 16 keV is especially designed for TEM sample preparation for materials of very low milling rate.

Low-energy ion source

The exceptional construction of the ion source allows to reach high beam current densities in the whole operating range. The beam of extremely low-energy noble gas ions eliminates the surface damage and ion beam induced amorphization.

Ion source control

All ion gun parameters including accelerating voltage and beam current are controlled automatically by a digital feedback loop, but they can always be changed manually during the sample preparation process. The initial values of the ion source parameters are set either automatically or manually and are continuously monitored and displayed by the computer.

AUTOMATED OPERATION

The UniMill model of Technoorg ion mills is provided with full computer control utilizing an easy-to-use graphical interface. All milling parameters including the electrode voltages, working gas flow, sample motion/tilt and further parameters of process timing and perforation detection can be stored or pre-programmed in arbitrary number of steps. This fully automated feature of the UniMill allows to produce high-quality samples with minimum user intervention.

ONLINE MONITORING AND SUPPORT

The UniMill is supplied with a software extension for online technical support, which enables instant error detection and problem elimination via the Internet.

LIQUID NITROGEN COOLING

This feature reduces excessive sample heating during the ion bombardment. Thus, heat-sensitive materials can be prepared without destabilization of internal structures. Automated and manual liquid nitrogen cooling options are available.

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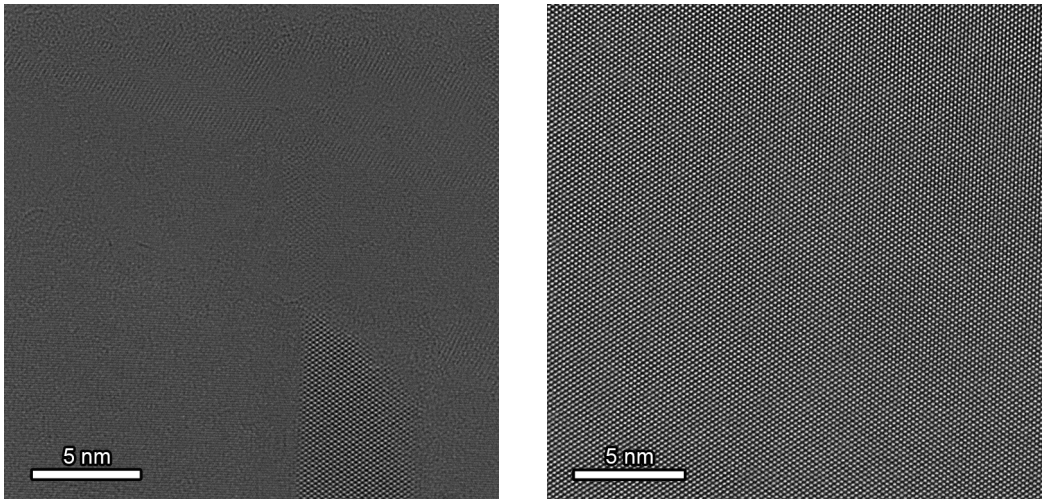

Diamond sample after high-energy perforation (left) and after low-energy cleaning (right). While the high-energy ion source enabled rapid perforation, it also caused damage to the sample due to the high energy of the Ar ions. Subsequently, using the low-energy ion source, all the damaged layers were successfully removed, revealing the pristine lattice of the diamond.

SPECIFICATIONS

ION SOURCES

Ultra high-energy ion source (optional):
- Ion energy: up to 16 keV, continuously adjustable
- Beam current: up to 500 μA
- Broad ion beam diameter: 1.5-2 mm (FWHM)

High-energy ion source (standard configuration):
- Ion energy: up to 10 keV, continuously adjustable
- Beam current: up to 300 μA
- Broad ion beam diameter: 1.5-2 mm (FWHM)

Low-energy ion source:
- Ion energy: 100 eV-2 keV, continuously adjustable
- Beam current: up to 80 μA
- Beam diameter: 1.8-2.3 mm (FWHM)

SPECIMEN STAGE

- Milling angle: 0°-40°, electronically adjustable in 0.1° increments
- Computer controlled in-plane specimen movement:
  - rotation in 360°
  - oscillation from ±10° to ±120° in 10° steps
- Remarkable thickness range of the accepted TEM samples (30 - 200 μm)

IMAGING SYSTEM

- CMOS camera image for full visual control and milling supervision/termination
- High-resolution color CMOS camera
- Manual zoom video lens of 30-360× magnification range

COMPUTER CONTROL

- Built-in industrial grade PC
- Easy-to-use graphical interface and image analysis module
- User independent ion source setup including gas flow regulation
- Pre-programmed milling recipes for automatic setting of mechanical and electronic milling parameters (manual adjustment is also possible)
- Automated sample loading
- Automatic termination: by timer or optical termination of the milling process supported by an image analysis module detecting the sample perforation or monitoring the evolution of surface topography

GAS SUPPLY SYSTEM

- 99.999% purity argon gas of 1.3-1.7 bar absolute pressure
- High precision working gas flow control

VACUUM SYSTEM

- Pfeiffer vacuum system with oil-free diaphragm and turbomolecular pumps equipped with compact, full-range Pirani/Penning vacuum gauge

POWER REQUIREMENTS

- 100-120 V / 10 A / 50-60 Hz or
- 220-240 V / 5 A / 50-60 Hz

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