MODEL 170

Ultrasonic Disk Cutter

Quickly cut TEM specimens from hard, brittle materials without mechanical or thermal damage

FISCHIONE INSTRUMENTS

MODEL **170**

Ultrasonic Disk Cutter

Creates disk, cylindrical, and rectangular specimens.

- **Minimal mechanical and thermal damage**
- **Specimen is always parallel to the cutting axis**
- **Disk specimens from materials as thin as 10 µm**
- **Rods up to 10 mm long**
- **Rectangular wafers for transmission electron microscopy cross-section (XTEM) specimens**
- **10 µm resolution depth indicator**
- **Automatic termination**
- **Precise sample positioning**
- **Optional microscope attachment**

CUT TEM OR XTEM SPECIMENS

Ultrasonic disk cutting is a proven method for producing specimens for transmission electron microscopy (TEM) from hard, brittle materials such as ceramics, semiconductors, and geological substances.

Ultrasonic cutting action

The Model 170 Ultrasonic Disk Cutter uses the excitation of lead zirconate titanate (PZT) crystals oscillating at a frequency of 26 kHz to effect cutting tool movement. The cutting medium is an abrasive slurry of either boron nitride or silicon carbide.

Tool motion is optimized to cut at the maximum rate while minimizing mechanical- and thermal-induced specimen damage.

A dial indicator with a resolution of 10 µm accurately displays the cutting depth of the tool.

Constant-force stage

During the cutting process, the specimen stage applies constant force to advance the material parallel to the cutting tool to produce specimens with a consistent diameter. It also allows rods to be cored from bulk samples in just a few minutes. Rods up to 10 mm in length can be readily cored for subsequent cutting into 3 mm specimen disks.

A rare earth magnetic coupling rigidly holds the specimen container to the stage to prevent damage that can occur if the specimen is allowed to move laterally in relation to the cutting tool.

The resulting specimen is essentially free of both edge and surface damage.

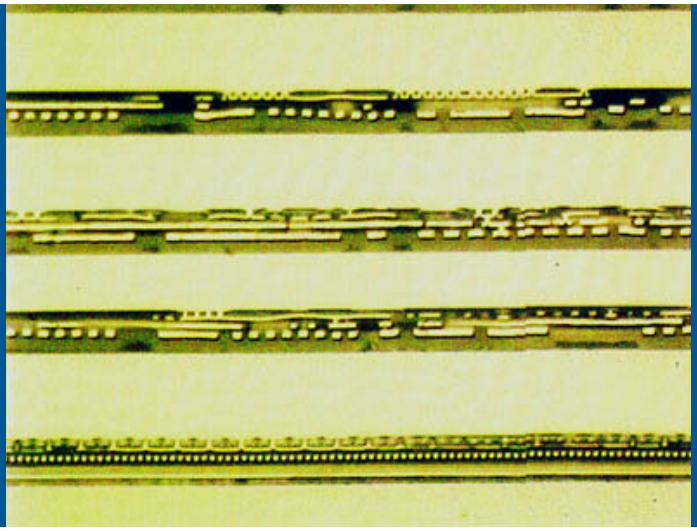
Autotermination

The Model 170 uses an electrical continuity detector for determining when the cutting process is complete.

The sample material is glued onto an aluminum specimen plate using a low-melting point polymer. Two thumbscrews rigidly attach the specimen plate to the specimen container, maintaining electrical continuity between the container and stage.

The cutting tool and ultrasonic transducer assembly are maintained at ground potential. A +0.8 VDC signal is placed on the specimen stage. When contact is made between the tool and the specimen plate, continuity is sensed and the process is automatically terminated. An override switch gives the user the option of continuing cutting even after continuity is sensed.

When cutting conductive material, a specimen plate with an insulating layer on its surface is used to isolate the specimen from the termination signal.



Optical image of an XTEM specimen consisting of multiple individual sections of a microelectronic material. Produced by ultrasonic disk cutting and mechanical grinding.

Optional microscope attachment

A microscope attachment helps locate the specific area of interest in the bulk material, an important aspect of producing a 3 mm disk. The microscope is rigidly attached to the ultrasonic cutting head and is easily rotated into place to observe and position the specimen. A simple alignment procedure adjusts the microscope's position in relation to the cutting tool.

Once the region of the material to be cored is established in the field of view, the ultrasonic cutting head is rotated back into position for cutting. A precision mechanism establishes the angular positioning of the microscope and ultrasonic cutting head with a repeatability of better than 10 µm.

Optional microscope attachment is used to position the sample.

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Document Number PB170 Revision 02 12/2014