

TenuPol-5



Automatic electrolytic thinning of specimens for transmission electron microscopy



Unique advantages and technologies

Scan function

Determination of correct polishing voltage through built-in scan function

Built-in database

With 18 Struers and up to 200 user methods

Automatic shut-off

Thinning process stopped automatically through infra-red light when hole appears

Pre-thinning

Large samples can be pre-thinned electrolytically to avoid mechanical deformation

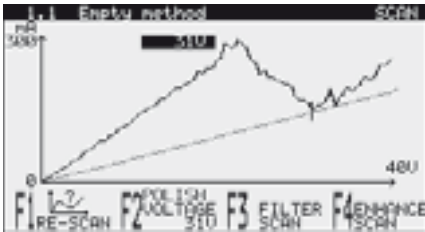
Simultaneous thinning

Thinning from both sides to avoid damaged structures.

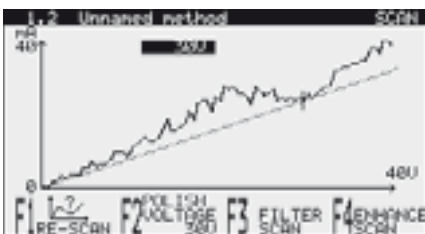
With TenuPol-5 a perforated specimen for transmission electron microscopy can be made from a sample of 3 or 2.3 mm dia. in just a few minutes.

The specimen is polished from both sides simultaneously, thus providing a structure with a minimum of deformation. When the perforation appears, the polishing can automatically be stopped by the infrared detector system, and the specimen is ready for the TEM examination. No special operator training is required.

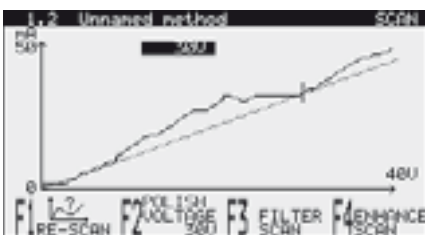
Also electrolytical pre-thinning or blanking can easily be carried out.



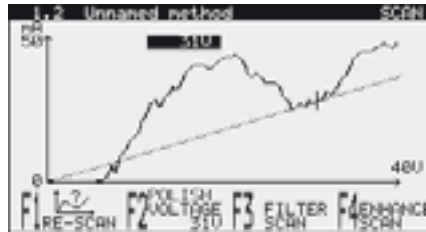
Determination of polishing voltage through built-in scan function
TenuPol-5 is equipped with a unique scanning function. After placing a specimen in the holder, a pre-defined voltage range is scanned to determine the current density curve. This curve is used to define the correct polishing voltage for the thinning process. Instead of time consuming trial and error testing of parameters it is now easy to find the correct settings after a single scan of a new sample material.



As not all materials display such an easy to analyse current density curve as shown before, both filter and enhance functions are included with the TenuPol-5.



After filtering the current density curve might look like that, and the correct polishing value is easy to define.



After an additional enhancement the definition might be even easier.

STRESS METHODS			
Material	Stainl. steel	alumn	Alu
Low C-steel	0.1mm	0.05	*
Low C-steel	0.2mm	0.05	*
Low C-steel	0.3mm	0.05	*
Inpax 45HRC	0.1mm	0.05	*
Inpax 45HRC	0.2mm	0.05	*
Inpax 45HRC	0.3mm	0.05	*
Titanium	0.1mm	0.05	*
Titanium	0.2mm	0.05	*

Built-in database with 18 Struers and up to 200 user methods

10 methods for the final thinning and 8 methods for pre-thinning of various materials are included with TenuPol-5. A whole range of materials can thus be prepared immediately, without any lengthy and time consuming trials. These methods can also be used as starting point for the development of methods for other materials. 200 user-defined methods can be saved in 20 groups in the database of TenuPol-5.

ELECTROLYTE		ELECT. METHOD	
Electrolyte	1	RU	
Voltage	2	50.00	
Temperature	reconn: 1	+15°C	(-5.0°C)
Polishing time	1	No Limit	
Light stop value	1	Auto	
Graphic time scale	1	Auto	
Flow mode	1	Single flow	
Pump flow rate	12		

Automatic shut-off

The very small perforations required for the following examination in the TEM are very difficult to control visually. TenuPol-5 is therefore equipped with an IR-detector system. The infrared light from the transmitter passes

through the jet nozzle to the sample. As soon as a hole appears in the centre of the specimen, the light hits the photocell on the other side and the process is shut off in accordance with the pre-set light stop value. As the IR-detector system is insensitive to white light, errors are eliminated. When pre-thinning or "punching" specimens, the automatic shut-off system using infrared light cannot be used. Then a preparation time is set instead.

Pre-thinning

To avoid deformations of the finished sample the basic material with a diameter of 12-21 mm is pre-thinned to a thickness of less than 0.5 mm in an area of up to 10 mm dia. This procedure is carried out by means of a special specimen holder.

Electrolytic "punching"

Mechanical punching to produce samples small enough for electrolytical thinning is bound to introduce deformations in the sample material. With TenuPol-5 several 3 mm (or 2.3 mm) specimens at a time can be "punched" electrolytically from the foil material, without introducing any deformation at all.

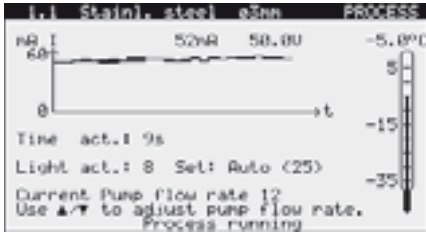
Chemical thinning

TenuPol-5 is made of corrosion-resistant materials. This allows for chemical polishing with most chemicals. TenuPol-5 can be used with perchloric acid and other highly corrosive electrolytes.

Design

TenuPol-5 consists of two separate units, the control unit and the polishing or thinning unit.

The polishing unit with the electrolyte pump, electronic thermometer and exchangeable specimen holder



The control unit

Both the power supply and the programming and monitoring functions are incorporated in the control unit. The unit is operated on the touch pad and on the backlit graphic display all parameters are presented. Upon pressing the Start button, the display changes, and the ongoing process can be monitored. Parameters like current, electrolyte temperature and elapsed thinning time are displayed. Both the display of parameters before and the display of actual values after process start provide an exceptional amount of immediately usable information. Deviations from one process to the next can be detected straightaway, and necessary measures can be taken. Required changing of electrolyte can be detected before changes of the polishing result will be noticed.

The polishing/thinning unit

The design as a separate unit makes it possible to place the polishing/thin-

ning unit away from the control unit. If required the polishing unit can be set up in a fume cabinet while the control unit is set up outside. TenuPol-5 comprises 2 electrolyte reservoirs, an insulated one for use with the built-in cooling coil and an uninsulated one for cooling the electrolyte, e.g. by placing the reservoir in an ice bath.

Specimen holders

The TenuPol-5 standard equipment includes a specimen holder for 3 mm specimens. A 2.3 mm specimen holder and a sample holder with an opening of 10 mm dia. are also available. The holders are made of reinforced Teflon and consist of two main parts. The holders are easily opened and closed, allowing simple mounting and fast cleaning. One of the two parts carries the platinum conductor. When the closed holder is mounted in the polishing cell, electrical connection to the polishing

circuit is automatically established. No extra plug or cable is necessary. The other part has a sliding diaphragm which allows the mounting of samples with any thickness less than 0.5 mm. The 3 mm and 2.3 mm specimen holders are normally used for final thinning (perforation), and the holder with a 10 mm diaphragm for pre-thinning and electrolytic "punching".

Jet holders

The standard set of jet holders has a 1 mm jet bore for use with the 3 and 2.3 mm specimen holders.

A set of jet holders with a 2.5 mm jet bore for use with the holder with a 10 mm opening is also available.

PC-Interface

With this interface TenuPol-5 can be operated from a PC. The scans can be transferred into a spread sheet and compared and saved. This allows for the comparison of the behaviour of different materials or tracking the ageing of electrolytes. It is also possible to save different methodscreens as bitmaps.



A specimen holder for 3 mm samples for final thinning, with 10 mm dia. hole for pre-thinning or electrolytic punching and a set of jet holders. The platinum connector and the sliding specimen fixture can be seen.

Technical data

Control unit

Mains voltage:	Single-phase, 100-120/220-240V, 50-60 Hz.
Power consumption:	220-240V / 1.50A 110-120V / 3.15A
Output:	0-100V / 0-2A

Dimensions

Width:	385 mm
Depth:	350 mm
Height:	160 mm
Weight:	17 kg

Polishing unit

Sizes of original specimen:	12-21 mm dia., max. 1 mm thick 3 mm dia., max. 0.5 mm thick 2.3 mm dia., max. 0.5 mm thick
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Dimensions

Width:	270 mm
Depth:	180 mm
Height:	276 mm
Weight:	3.8 kg

Specifications

TenuPol-5 control unit, with electronic thermometer and adapter for the connection of (TENPO)

TenuPol polishing unit, with specimen holder for 3 mm dia. specimens (TETRI), sets of jets (TETOR), pump, cooling coil, insulated PVC container, non-insulated PVC-container and built-in photo cell

Connection print for data transfer between TenuPol-5 and a PC

Specimen holder for 3 mm dia. specimens

Specimen holder for 2.3 mm dia. specimens

Specimen holder, 10 mm diaphragm for pre-thinning

Set of jets, 1 mm bore

Set of jets, 2.5 mm bore for use with (TETMA)

Tape Kit for electrolytic "punching"

Code

TENFI

TENPO

LEGPC

TETRI

TETTO

TETMA

TETOR

TETET

TENKI

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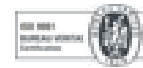
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