

# 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

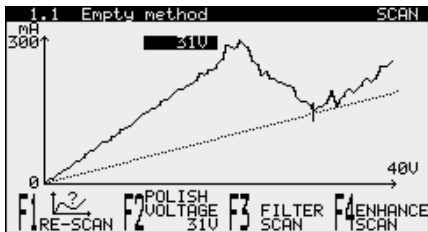
### Simultaneous thinning

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.

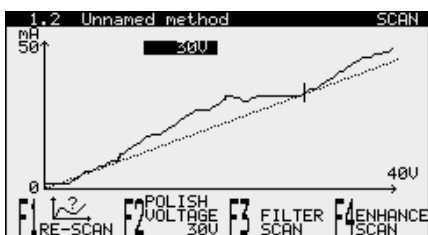
Also electrolytical pre-thinning or blanking can easily be carried out.



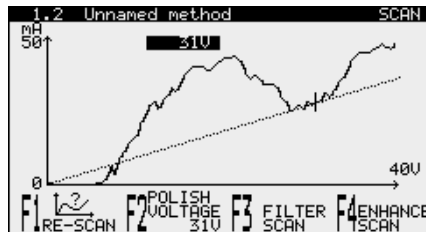
**Determination of polishing voltage through built-in scan function**  
TenuPol-5 is equipped with a unique scanning function. After placing a specimen in the holder, a pre-defined voltage range is scanned to determine the current density curve. This curve is used to define the correct polishing voltage 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.

STRUERS METHODS			
1	Stainl. steel	ø10mm	A8 0
	Stainl. steel	ø3mm	A8 0 *
	Low C-steel	ø10mm	A2 0 *
	Low C-steel	ø3mm	A2 0 *
	Impax 45HRC	ø10mm	A2 0 *
	Impax 45HRC	ø3mm	A2 0 *
	Impax 45HRC	ø3mm	A2 0 *
	Titanium	ø10mm	A3 0 *
	Titanium	ø3mm	A3 0 *

### 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.

1.1 Stainl. steel ø3mm EDIT METHOD	
Electrolyte :	A8
Voltage :	50.0V
Temperature recomm. :	+15°C (-5.0°C)
Polishing time :	No Limit
Light stop value :	Auto
Graphic time scale :	Auto
Flow mode :	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.

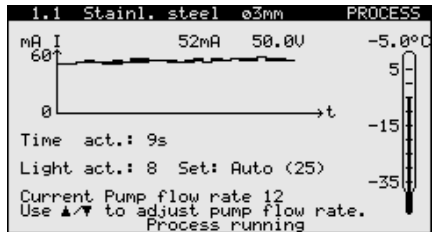
### Chemical thinning

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.



*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
-----------------------------	--

**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 (04086001)

**Code**

05396133

TenuPol polishing unit, with specimen holder for 3 mm dia. specimens (04086901), sets of jets (04086904), pump, cooling coil, insulated PVC container, non-insulated PVC-container and built-in photo cell

04086001

Specimen holder for 3 mm dia. specimens

04086901

Specimen holder for 2.3 mm dia. specimens

04086902

Specimen holder, 10 mm diaphragm for pre-thinning

04086903

Set of jets, 1 mm bore

04086904

Set of jets, 2.5 mm bore for use with (04086903)

04086905

Tape Kit for electrolytic "punching"

40900041

**Struers ApS**

Pederstrupvej 84  
 DK-2750 Ballerup, Denmark  
 Phone +45 44 600 800  
 Fax +45 44 600 801  
 struers@struers.dk  
 www.struers.com

**AUSTRALIAN & NEW ZEALAND**

**Struers Australia**  
 27 Mayneview Street  
 Milton QLD 4064  
 Australia  
 Phone +61 7 3512 9600  
 Fax +61 7 3369 8200  
 info.au@struers.dk

**BELGIUM (Wallonie)**

**Struers S.A.S.**  
 370, rue du Marché Rollay  
 F- 94507 Champigny  
 sur Marne Cedex  
 Téléphone +33 1 5509 1430  
 Télécopie +33 1 5509 1449  
 struers@struers.fr

**BELGIUM (Flanders)**

**Struers GmbH Nederland**  
 Zomerdijk 34 A  
 3143 CT Maassluis  
 Telefoon +31 (10) 599 7209  
 Fax +31 (10) 5997201  
 netherlands@struers.de

**CANADA**

**Struers Ltd.**  
 7275 West Credit Avenue  
 Mississauga, Ontario L5N 5M9  
 Phone +1 905-814-8855  
 Fax +1 905-814-1440  
 info@struers.com

**CHINA**

**Struers Ltd.**  
 No. 1696 Zhang Heng Road  
 Zhang Jiang Hi-Tech Park  
 Shanghai 201203, P.R. China  
 Phone +86 (21) 6035 3900  
 Fax +86 (21) 6035 3999  
 struers@struers.cn

**CZECH REPUBLIC & SLOVAKIA**

**Struers GmbH Organiza ni složka**  
 v deckotechnický park  
 P ílejská 1920,  
 CZ-252 63 Roztoky u Prahy  
 Phone +420 233 312 625  
 Fax +420 233 312 640  
 czechrepublic@struers.de  
 slovakia@struers.de

**GERMANY**

**Struers GmbH**  
 Carl-Friedrich-Benz-Straße 5  
 D- 47877 Willich  
 Telefon +49 (0) 2154 486-0  
 Fax +49 (0) 2154 486-222  
 verkauf@struers.de

**FRANCE**

**Struers S.A.S.**  
 370, rue du Marché Rollay  
 F-94507 Champigny  
 sur Marne Cedex  
 Téléphone +33 1 5509 1430  
 Télécopie +33 1 5509 1449  
 struers@struers.fr

**HUNGARY**

**Struers GmbH**  
 Magyarországi Fióktelep  
 Tatai ut 53  
 2821 Gyermely  
 Phone +36 (34) 880546  
 Fax +36 (34) 880547  
 hungary@struers.de

**IRELAND**

**Struers Ltd.**  
 Unit 11 Evolution@ AMP  
 Whittle Way, Catcliffe  
 Rotherham S60 5BL  
 Tel. +44 0845 604 6664  
 Fax +44 0845 604 6651  
 info@struers.co.uk

**ITALY**

**Struers Italia**  
 Via Monte Grappa 80/4  
 20020 Arese (MI)  
 Tel. +39-02/38236281  
 Fax +39-02/38236274  
 struers.it@struers.it

**JAPAN**

**Marumoto Struers K.K.**  
 Takanawa Muse Bldg. 1F  
 3-14-13 Higashi-Gotanda,  
 Shinagawa  
 Tokyo  
 141-0022 Japan  
 Phone +81 3 5488 6207  
 Fax +81 3 5488 6237  
 struers@struers.co.jp

**NETHERLANDS**

**Struers GmbH Nederland**  
 Zomerdijk 34 A  
 3143 CT Maassluis  
 Telefoon +31 (10) 599 7209  
 Fax +31 (10) 5997201  
 netherlands@struers.de

**NORWAY**

**Struers ApS, Norge**  
 Sjøskogenveien 44C  
 1407 Vinterbro  
 Telefon +47 970 94 285  
 info@struers.no

**AUSTRIA**

**Struers GmbH**  
 Zweigniederlassung Österreich  
 Betriebsgebiet Puch Nord 8  
 5412 Puch  
 Telefon +43 6245 70567  
 Fax +43 6245 70567-78  
 austria@struers.de

**POLAND**

**Struers Sp. z o.o.**  
 Oddział w Polsce  
 ul. Jasnogórska 44  
 31-358 Kraków  
 Phone +48 12 661 20 60  
 Fax +48 12 626 01 46  
 poland@struers.de

**ROMANIA**

**Struers GmbH, Sucursala Bucuresti**  
 Str. Preciziei nr. 6R  
 062203 sector 6, Bucuresti  
 Phone +40 (31) 101 9548  
 Fax +40 (31) 101 9549  
 romania@struers.de

**SWITZERLAND**

**Struers GmbH**  
 Zweigniederlassung Schweiz  
 Weissenbrunnenstraße 41  
 CH-8903 Birmensdorf  
 Telefon +41 44 777 63 07  
 Fax +41 44 777 63 09  
 switzerland@struers.de

**SINGAPORE**

**Struers Singapore**  
 627A Aljunied Road,  
 #07-08 BizTech Centre  
 Singapore 389842  
 Phone +65 6299 2268  
 Fax +65 6299 2661  
 struers.sg@struers.dk

**SPAIN**

**Struers España**  
 Camino Cerro de los Gamos 1  
 Building 1 - Pozuelo de Alarcón  
 CP 28224 Madrid  
 Teléfono +34 917 901 204  
 Fax +34 917 901 112  
 struers.es@struers.es

**FINLAND**

**Struers ApS, Suomi**  
 Hietalahdenranta 13  
 00180 Helsinki  
 Puhelin +358 (0)207 919 430  
 Faksi +358 (0)207 919 431  
 finland@struers.fi

**SWEDEN**

**Struers Sverige**  
 Box 20038  
 161 02 Bromma  
 Telefon +46 (0)8 447 53 90  
 Telefax +46 (0)8 447 53 99  
 info@struers.se

**UNITED KINGDOM**

**Struers Ltd.**  
 Unit 11 Evolution @ AMP  
 Whittle Way, Catcliffe  
 Rotherham S60 5BL  
 Tel. +44 0845 604 6664  
 Fax +44 0845 604 6651  
 info@struers.co.uk

**USA**

**Struers Inc.**  
 24766 Detroit Road  
 Westlake, OH 44145-1598  
 Phone +1 440 871 0071  
 Fax +1 440 871 8188  
 info@struers.com

*Struers' equipment is in conformity with the provisions of the applicable International Directives and their appurtenant Standards. (Please contact your local supplier for details).*

*Struers' products are subject to constant product development. Therefore, we reserve ourselves the right to introduce changes in our products without notice.*