

PELCO Dimpler

AG83050



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The PELCO® Dimpler[™] provides Automated Precision Thinning of Specimens for TEM Analysis, for deprocessing and failure analysis, and similar applications where targeted fine polishing is required. It is a precision electro-mechanical metallographic lapping in-strument that will continuously monitor and control dimpling parameters and accurately terminate at a preset specimen thickness. This electronic and mechanical integration has added repeatability and reliability to the dimpling process, as well as automation.

Active monitoring of the Z-position, feedback-controlled damping, and automated controls for determining termination of processing work together to provide repeatable, reliable results in sample preparation.

Z Position

The Z position is continuously monitored via a non-contact sensor. The digital display indicates the dimple depth in microns and is updated once every revolution. This negates any errors due to tool run out, especially significant when using padded polishing tools. The termination depth can be set using the Z-position, allowing processing to stop when a specified depth of material is removed.





Unit 7, M11 Business Link Parsonage Lane, Stansted Essex, UK CM24 8GF t: +44 (0)1279 215 506 f: +44 (0)1279 813 105 e: sales@agarscientific.com w: agarscientific.com

Termination

Process termination can be determined using the built-in timer, or by the Z Position. When using Z Position termination, the timer counts up to measure the total time elapsed until the Z Position is reached. This is useful for creating process recipes for various sample types. Four factors improve the overall stability during processing, and the termination accuracy:

- 1. Non-Contact Position Sensor
- 2. Tool Phase Sensor
- 3. No external measuring device
- 4. Magnetically coupled arm damping

The Non-Contact Position Sensor measures the location of the fulcrum arm which corresponds precisely to the thickness of the specimen. This sensor has an accuracy of better than one micron. Since it is non-contacting there are no detrimental effects on the action of the fulcrum arm. The reaction time of the sensor is fast enough to terminate the dimpling process the first time the Tool Phase Sensor indicates that the Z termination set point has been reached. Specimen thickness is measured directly on the PELCO Dimpler with the tool surface as the measuring point. The dimple depth and the Z termination set point are measured with the same reference. This prevents any measurement error from being translated directly to a termination error.

Damping

Damping of the arm is accomplished by using position information from the Non-Contact Position Sensor, processing it and feeding it back to the arm motor, which controls the up/down force of the arm. The position sensor and the processing circuit is fast enough to actively dampen any vibration the arm may experience. Since the damping force is magnetically coupled to the arm there is no mechanical play in the system, allowing damping response on the sub-micrometre level. Damping is adjustable from zero damping to stiff damping.

Damping offers three significant attributes:

- 1. Vibrations that can crack thin specimens are greatly reduced.
- 2. Keeps tools round, negating excess impacts, providing more accurate Z position control.
- 3. Tool gently contacts the specimen when the arm is lowered.





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Automated Controls

Automated features make the dimpling process more repeatable and easy to use. Tools are raised and lowered at the touch of a button; dimpling force, damping force, fine balance, and Z offset (termination point) all are set from the front panel.

Once dimpling has begun no monitoring is necessary. After the initial specimen thickness has been measured, the specimen is mounted and the user simply selects a dimple depth and begins dimpling. The precise Z position of the tool/surface interface is continuously displayed while dimpling with any tool. When the selected dimple depth is reached the PELCO Dimpler controls will automatically raise the arm then stop the tool rotation, specimen rotation, and clock timer.

Working Interface

The working interface for the unpadded tools shows very high stability in terms of the ΔZ reading (change in the offset value), with any deviation usually the result of tilt in the mounted sample. Research has indicated that for padded tools, the working diameter is within the nap of the pad. In this case, the ΔZ between the working interface and the specimen is a function of dimpling load (force set point), tool speed, damping, and pad compliance. After the dimpling load, tool speed, and damping are selected, the working diameter will stabilise at the working interface of the pad. This working interface is monitored on the Z display and used as a reference location from which a specimen is to be dimpled further.

Specimen Mounting

Different mounts are available depending on the size and type of sample. TEM specimens are generally mounted on optically smooth sapphire flats. The low thermal mass of the flat reduces mounting and dismounting times and the smooth surface allows the dimpled specimens to be easily removed. The hardness of sapphire limits damage if specimens are accidentally perforated due to operator error. The retainer ring which secures the sapphire flat also serves as a slurry reservoir. This platen set is used with the traditional Dimpler tools. For larger specimens for surface analysis or delayering a separate, shorter magnetic base and platen set is used with larger diameter tools. These were developed for delayering and deprocessing.

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Tools

The standard dimpling tools include flatting and dimpling tools, in both unpadded versions for faster material removal and padded versions for polishing. Tools are made from 316 Stainless steel. Flatting tools such as Tools Ii and 2i, and the Large Area Tools have a flat profile while Dimpling Tools such as 3i and 4i have a radiused profile to produce a pronounced dimple. The flatting tools will still produce a dimple with the lowest point at the centre of rotation, but it will have a much shallower height differential across the dimple.

A variety of padded and unpadded tools are available to meet many dimple polishing process requirements. The AG83031 standard tool set for 3mm samples contains 6 tools, part numbers AG83010, AG83016, AG83015, AG83012, AG83013, and AG83014. Available tools and specimen mounts are shown below.



Standard Base, Platen, Ring and Sapphire Flat, for use with Standard Tools

Standard Base, Adjustable Platen, Ring and Sapphire Flat, for use with Standard Tools

AG83027 Standard Platen Set





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Tools (continued)







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Dimpler & Tools Specifications

Z Offset	Accuracy	1 Micron
	Range	2000 microns
Z Termination Accuracy	Tools 1i / 3i	<± 1 micron
	Tools 2i / 4i	<± 2 microns
Tool Force	Range	1 - 200 grams
		1 gram steps
Balance	Sensitivity	1 gram
	Range	50 grams
Tool Speed	100 - 600 RPM	
Specimen Platen Speed	10 RPM	
Tool Shaft	0.5 micron TIR	
	Tools 1i / 3i	<± 1 micron TIR
	Tools 2i / 4i	<± 2 microns TIR
Platen Surface	< 0.5 micron TIR	
Dimensions	Length	68.6cm
	Width	35.6cm
	Height	33cm
	Weight	32kg
Electrical	Universal AC Input: 100-240 VAC, 50/60Hz	

AG83050 PELCO Video Alignment Microscope (VAM)



The PELCO® Video Alignment Microscope is an essential accessory for the PELCO Dimpler, particularly for deprocessing/delayering and site-specific polishing applications. It allows easy targeting of an area of interest, and precise control of the position, size, and shape of the bottom of the dimple or thin area of the specimen. It is particularly useful for selective surface polishing and delayering applications, where the low point and planarity of the polished area must be controlled to reveal the feature of interest. The VAM consists of a microscope optical system with a TFT display, a post corresponding precisely to the base mount on the PELCO® Dimpler™ that is aligned to the optic axis of the microscope, a reticule to allow precise targeting of a particular area using the adjustable base, and an X-Y stage for precision alignment to the area of interest.

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PELCO Dimpler & Acessories Ordering Information

AG83050	PELCO® Video Alignment Microscope
AG84000	PELCO® Dimpler™ precision specimen thinning and polishing
AG83031	Standard Tool Set for 3mm Samples
AG83027	Standard Platen Set (with through-hole)
AG83032	Adjustable Platen Set
AG83002	Standard Platen (with through-hole)
AG83004	Adjustable Platen, Fits PELCO® 15000 Lapping Fixture
AG83007	Magnetic Base for Large Area Tool
AG83003	Slurry Retainer Ring for Standard and Adjustable Platens
AG83001	Sapphire Flat
AG83040	Platen for Large Area Tools
AG83008	Magnetic Base for Standard and Adjustable Platen
AG83010	Tool li, Flatting
AG83015	Tool 4iM, Dimpling, Padded (low nap rayon)
AG83012	Tool 3i, Dimpling
AG83016	Tool 4iT Dimpling, padded, nonwoven
AG83013	Tool 2iM padded, low nap rayon
AG83014	Tool 2iT, padded, nonwoven
AG83011	Large Area, Tool li, 0.125" width
AG83039	Large Area Tool, Padded, 0.125" width
AG83036	Large Area Tool, 0.25" width
AG83044	Large Area Tool, padded, 0.25" width
AG83038	Large Area Tool, Counterbored 2 sides, 0.25" width
AG83045	Large Area Tool, Counterbored 2 sides, Padded, 0.25" width
AG83046	Large Area Tool, Counterbored 1 side, Padded, 0.25" width
AG83037	Large Area Tool, 0.5" width
AG83047	Large Area Tool, Padded, 0.5" width
AG83064	Repadding Strips for li Tools
AG83061	Repadding Strips for 1/8" Large Area Tools,
AG83062	Repadding Strips for 1/4" Large Area Tools
AG83063	Repadding Strips for 1/2" Large Area Tools
AG83060	Repadding Roller Tool Kit

