

# LVEM 5

Low Voltage Benchtop Electron Microscope  
Nanoscale from Your Benchtop



# INTRODUCING THE LVEM 5



## High Contrast Nanoscale Imaging

- Unmatched contrast of biologic and light material samples
- Image resolution as good as 1.2 nm
- Meaningful results without the need for heavy metal staining
- Versatility of having TEM, SEM and STEM imaging modes in one unit

## Unique Benchtop Design

- The world's only benchtop TEM microscope
- Exceptional space-saving design
- Installs easily wherever imaging is needed most
- No special facility requirements needed (such as cooling, special power or an anti-vibration isolation)

## Simplified Workflow

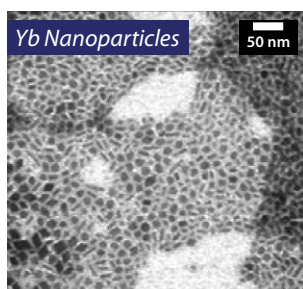
- Easy to learn and operate
- User-friendly software interface and intuitive controls
- Quick sample exchange allows for high throughput imaging
- Image the same area of interest in TEM and SEM with high contrast



# YOUR WAY TO ELECTRON MICROSCOPY

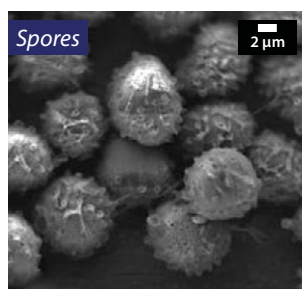


The LVEM 5 seamlessly combines 4 different imaging functionalities into one benchtop instrument, so samples no longer need to be displaced from one microscope to another. Furthermore, switching between imaging modes is easy, with the click of a button the same area of interest of a sample can be imaged in TEM, SEM and STEM modes.



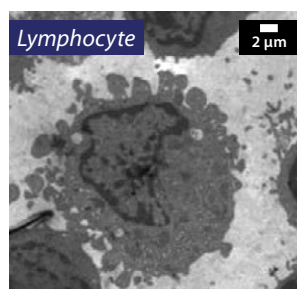
## TEM Mode

LVEM 5 microscopes can be equipped with either a CCD or Scientific CMOS camera for Transmission Electron Microscopy imaging of nanoparticles and thin sections.



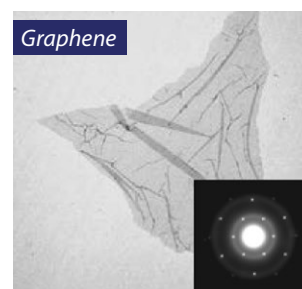
## SEM Mode

A Backscatter Electron (BSE) detector offers a stereoscopic view of the sample. With the click of a button SEM mode is easily accessed to view the same area of interest for topographical information.



## STEM Mode

Scanning Transmission Electron Microscopy is made possible with an added STEM detector. This mode allows for transmission images to be obtained from denser materials.

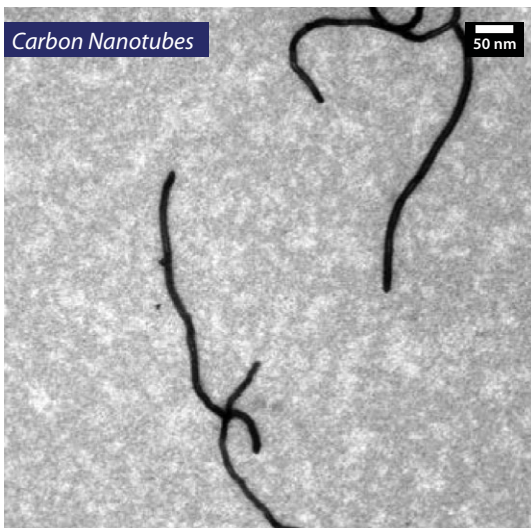
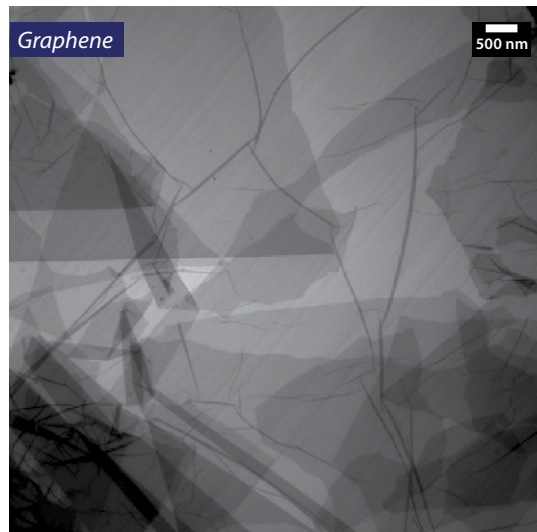
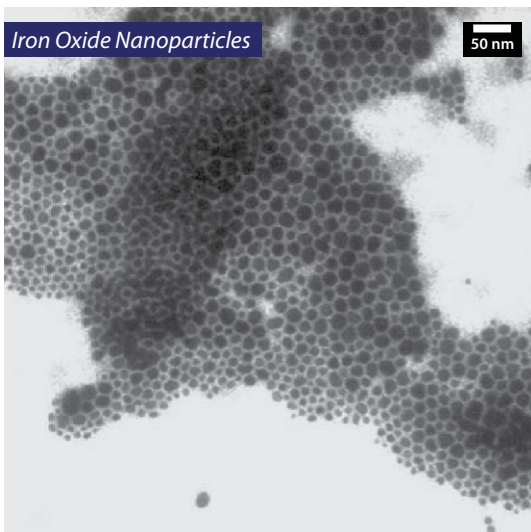


## ED Mode

Electron Diffraction provides structural characterization of crystalline materials.

# MATERIAL SCIENCE APPLICATIONS

The LVEM 5 has established itself as a valued asset to materials science research laboratories, providing the ability to rapidly obtain nanoscale images directly from the benchtop. High contrast and high resolution images of nano-structured materials provide meaningful sample data that can be used for complete morphological characterization and size distribution analysis, while phase composition and crystal structure can also be studied. With unmatched imaging resolution from a benchtop electron microscope, the LVEM 5 provides image data that would otherwise require a visit to a core facility and the use of a much larger and more complicated instrument. The LVEM 5 brings nanoscale to your benchtop.



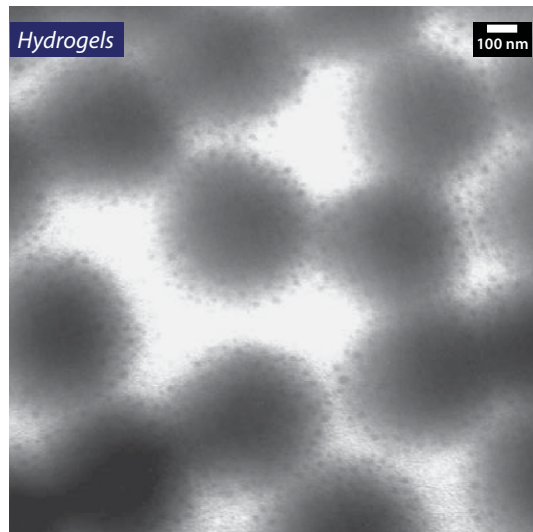
# LIFE SCIENCES APPLICATIONS

Conventional Transmission Electron Microscopes struggle to provide adequate contrast of organic materials, requiring the use of heavy metal staining to provide contrast. The LVEM 5 has overcome this limitation by means of its unique 5kV electron source, and is capable of providing high contrast of organic and other soft materials. These slower moving electrons interact more readily with organic materials, producing unmatched image contrast. Eliminating the need for stains provides for simplified sample preparation protocols and imaging of samples in their natural, unstained state.



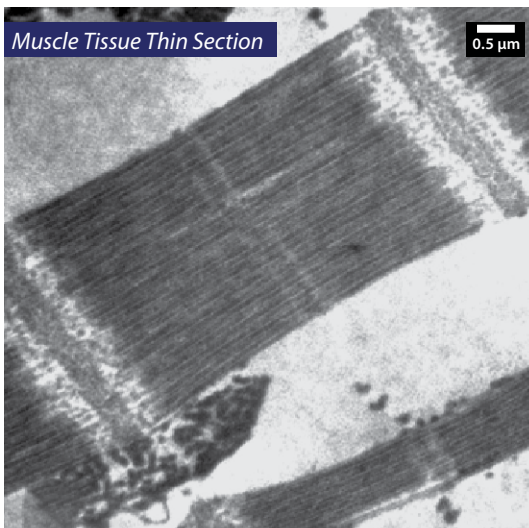
## Viruses

Study viruses such as adenovirus, rotavirus and tobacco mosaic virus, either in their natural state or with staining, a capability unique to LVEM.



## Biologic Nanoparticles

Characterize essential morphological properties of protein-based, DNA-based, hybrid and synthetic particles with confidence.



## Thin Sections

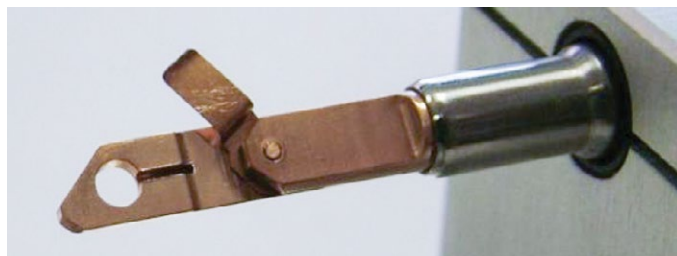
Clearly image biologic tissue thin sections such as brain, heart and kidney tissue without the necessity to stain.



# SPECIALIZED SAMPLE HOLDERS

## AFM Tip Holder

The LVEM5 electron microscope can be used in combination with the optional AFM tip holder to image most AFM tips. This is a rapid technique for obtaining detailed information on the quality and design of your AFM tips.

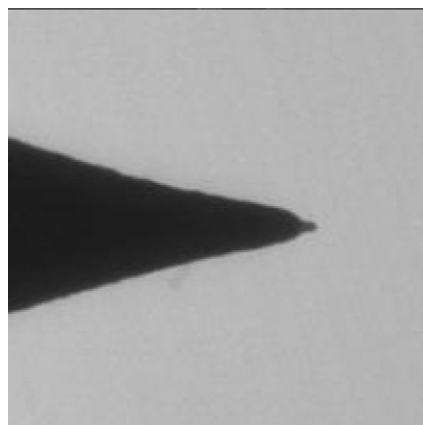
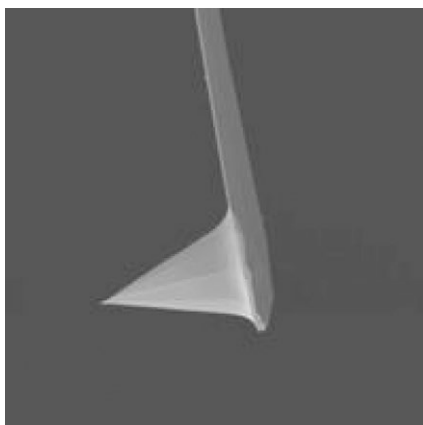
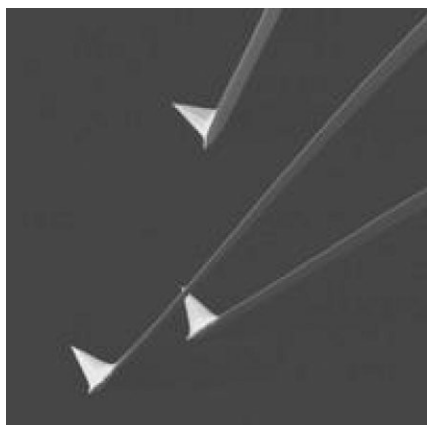


Atomic Force Microscopy (AFM) relies on a cantilever with a sharp tip (probe) that is used to scan the surface of a sample. AFM tips generally have a radius of curvature of around a few nanometers.

When the tip approaches the sample surface, forces between the tip and the sample lead to a deflection of the cantilever. The nature of the AFM probe determines the forces that will be measured, as well as the microscope's final sensitivity. Therefore probe quality is a primary concern.

Tip shape and sharpness can easily be measured in both TEM and SEM modes. This versatility, paired with rapid sample exchange, is a strong advantage for quality assurance inspection associated with the production of AFM probes.

Custom AFM tips, such as chemically and biologically coated AFM tips, or AFM tips with particle attachments, such as nanoparticles or ligands, can be effortlessly imaged. Additionally, the low voltage imaging provided by the LVEM5 allows for significantly higher contrast of any soft materials (polymers, biologic materials) used to functionalize AFM tips.



# SPECIALIZED SAMPLE HOLDERS

## Tilt Holder

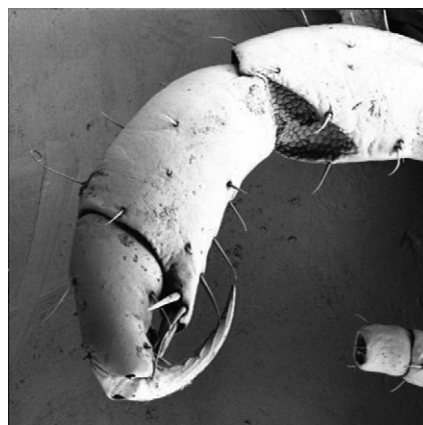
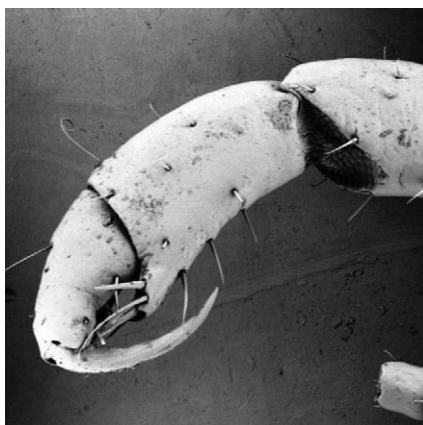
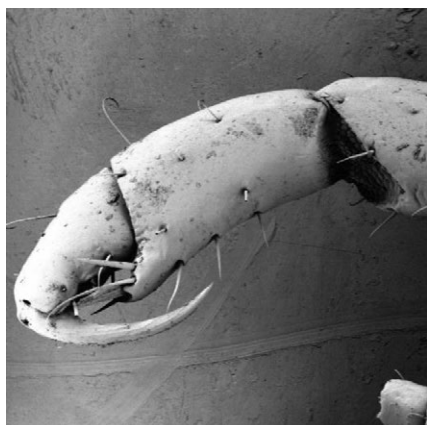
The LVEM 5 transmission electron microscope mode can be used in combination with the optional tilt holder to perform Electron Tomography. This is a technique for obtaining detailed 3D structures from 2D images. In the process, a beam of electrons is passed through the sample at incremental degrees of rotation around the center of the target sample. This information is collected and used to assemble a three dimensional image of the target.

Additionally, the LVEM 5 scanning electron microscope mode can be used in combination with the optional tilt holder to perform photogrammetry. This technique involves extraction of 3D geometry information from 2D images taken from a sample held at different angles relative to the BSE detector.

The Tilt Holder for the LVEM 5 allows analysis of various sample types from different points of view, thus enabling reconstruction of a 3D image of the sample.

## Key Specifications

- $\pm 22.5^\circ$  of tilt
- Compatible with TEM, SEM and STEM modes



# KEY TECHNICAL FEATURES



## Benchtop Design

### A small footprint in the lab

The LVEM 5 is a benchtop instrument 90% smaller than classical TEMs. Designed to be installed in individual labs, the LVEM 5 can be placed wherever imaging is routinely needed.



## No Special Facilities

### Installs almost anywhere

As a result of its small footprint and novel column architecture, the LVEM 5 does not require a dedicated room, anti-vibration isolation, special power supply or cooling of any kind, thereby simplifying the instrument's installation.



## Permanent Magnet Lenses

### No cooling required

The LVEM 5 and LVEM 25 are the only TEMs using permanent magnet lenses. This unique factor allows for the miniature architecture and eliminates any cooling requirements.



## Field Emission Gun

### High contrast electron source

A 5kV Schottky type FEG with very high brightness and spatial coherency allows for strong interactions between the emitted electrons and the samples. This is what provides the LVEM 5 with uniquely high contrast.



## Controls & Software

### Complete imaging control

The LVEM 5 comes with intuitive software for microscope operations and imaging. User operations are facilitated with simple adjustments for illumination, magnification and image optimization. The included PC and monitor allow for on-screen measurements and statistics, as well as live histogram correction and FFT.



## Manipulator

### Precise sample area selection

The LVEM 5 employs a motorized stage with joystick control for intuitive sample movement. Joystick sensitivity is dynamic, providing quick motion for low magnification sample screening and fine precision for high magnification imaging.



## Ultra-High Vacuum Pumps

### Clean column, clean imaging

A maintenance free turbomolecular pump provides rapid evacuation of the airlock system and the silent and vibration free ion getter pumps produce an ultra-high vacuum imaging environment, free from contamination.

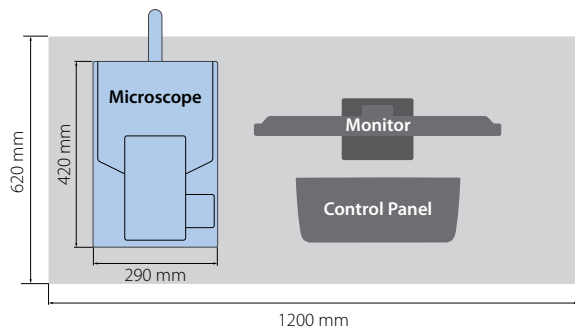


# SPECIFICATIONS

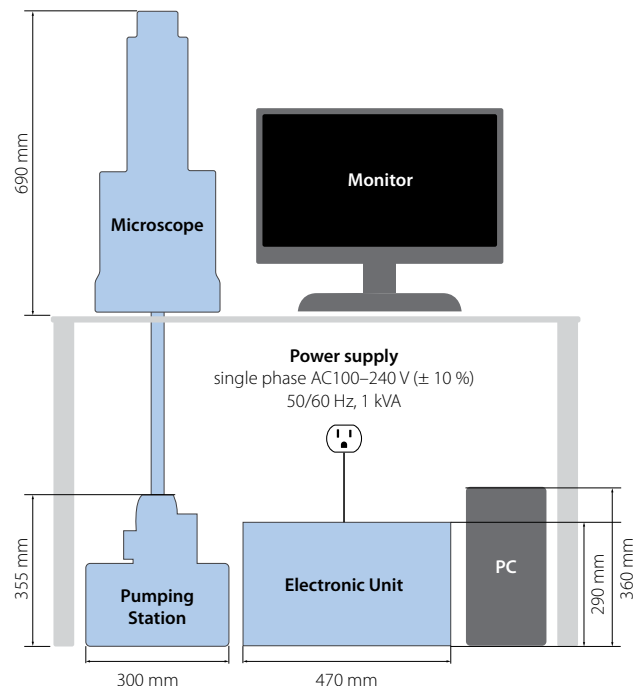
OPERATION		
Nominal accelerating voltage	5 kV	
Electron gun	Schottky field emission gun	
Specimen size	standard Ø 3.05 mm TEM grids	
Specimen movement	x, y: ± 1 mm	z: ± 0.3 mm
Tilt holder	± 22°	
Specimen exchange time	approx. 3 min	
IMAGING MODES		
BASIC TEM MODEL		
Projection lens	electrostatic single lens	
Resolving power	2.0 nm	
Total magnification	2,200 – 230,000x	
TEM BOOST MODEL		
Projection lens	electrostatic double lens	
Resolving power	1.2 nm	
Total magnification	1,400 – 700,000x	
ELECTRON DIFFRACTION		
Minimum probe size	100 nm	
Camera	CCD	sCMOS
Camera length (binning 1x1)	2,100 pixels	2,390 pixels
Camera constant (binning 1x1)	36.3 nm pixels	41.3 nm pixels
STEM		
Resolving power	2.0 nm	
Maximum magnification	250,000x	
Maximum field of view	25 × 25 µm	
SEM (BSE DETECTOR)		
Resolving power	4,0 nm	
Maximum magnification	100,000x	
Maximum field of view	200 × 200 µm	
SCAN IMAGE CAPTURE		
up to 2,048 × 2,048 pxls / 8 bits		

TEM IMAGE CAPTURE		
	TEM Basic model	TEM Boost model
Camera	CCD	sCMOS
Sensor size	2,048 × 2,048 pixels	2,560 × 2,160 pixels
Digitalization	12-bits	16-bits
VACUUM		
AIRLOCK SYSTEM		
Diaphragm and turbomolecular pump		10 <sup>-5</sup> mbar
OBJECT SPACE		
Ion getter pump		10 <sup>-7</sup> mbar
ELECTRON GUN		
Ion getter pump		10 <sup>-9</sup> mbar
POWER CONSUMPTION		
Standby mode	40 VA	
Operation consumption		300 VA
Maximum consumption		810 VA
DIMENSIONS AND WEIGHT		
MICROSCOPE UNIT		
Weight	25 kg	
Dimensions (w × d × h)		296 × 440 × 690 mm
AIRLOCK PUMPING STATION		
Weight	17 kg	
Dimensions (w × d × h)		300 × 300 × 355 mm
ELECTRONICS UNIT		
Weight	19 kg	
Dimensions (w × d × h)		470 × 270 × 290 mm
MAINS CONNECTION		
Voltage/frequency	100–240 V / 50–60Hz	
INSTALLATION BENEFITS		
No cooling water needed		
Only single phase plug needed		

## Installation Layout



Recommended table size: 1200 × 700 mm  
Withstand load: 75 kg or more



# CONTACTS

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## LVEM Distribution

### Europe

DELONG INSTRUMENTS a.s.  
[www.delong.cz](http://www.delong.cz)

**Czech & Slovak Republic**  
Pragolab s. r. o.  
[www.pragolab.cz](http://www.pragolab.cz)

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[imagescience.hu](http://imagescience.hu)

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[www.m-s.it](http://www.m-s.it)

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**Spain and Portugal**  
Jasco Analitica Spain  
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### World

DeLong America  
[delongamerica.com](http://delongamerica.com)

LVEMs are supported globally by sales and service offices in local markets. Please contact us directly for any questions you have or to be referred to your local distributor.

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