



DEBEN

A WORLD LEADING DESIGNER AND MANUFACTURER
OF ACCESSORY PRODUCTS FOR MICROSCOPY AND
COMPUTED TOMOGRAPHY (CT) SYSTEMS

DEBEN:





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TENSILE & COMPRESSION STAGES

Microtest stages - In-situ SEM, EBSD, AFM, XRD, Raman, Optical, Fluorescence, Benchtop

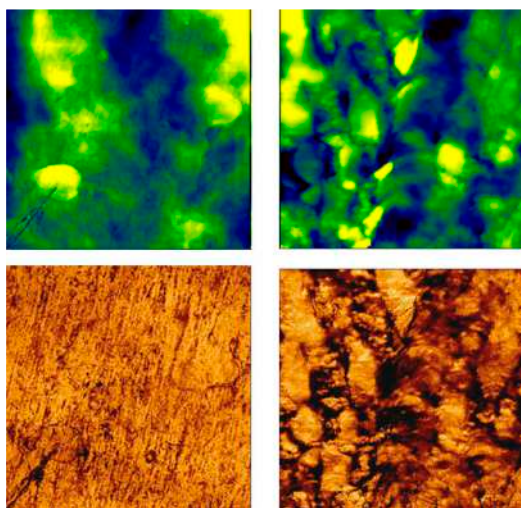
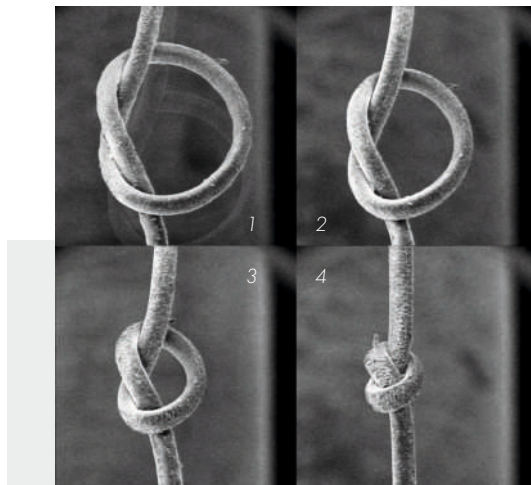
Deben tensile and compression stages are specifically designed to compliment a variety of in-situ imaging techniques and provide insight into physical changes to a structure.

In addition, utilising in-situ tensile testing with optional heating and cooling allows new insights into material properties.

One Application Scientist describes our tensile stage: "The tensile stage from Deben is a robust device which is as easy to use as the desktop SEM. It can be loaded into the SEM just like any other sample holder. There is no need to install or prepare any parts inside the SEM which really shortens the time to image."

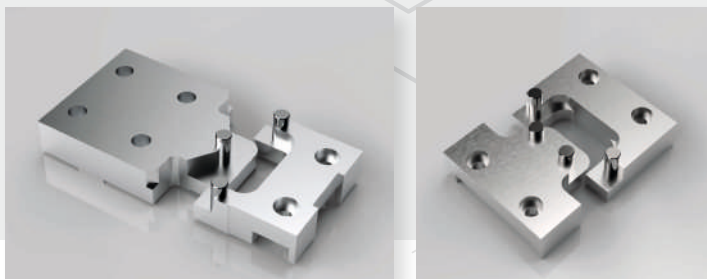
The tensile stage can be used outside the SEM under an optical microscope and inside the SEM when a higher magnification and better depth of focus is required. This bridges the gap between the light and electron microscopy worlds and allows for correlative microscopy techniques.

MT1000: Hair sample under tension in a desktop SEM



Deben MT200 stage: Paraffin film both before and after stretching in AFM

A Nanoscience AFM team decided on the Deben MT200, "firstly, it allows us to work simultaneously with our tip-scanning AFM and simultaneous top view observation. Secondly, the bi-directional stretching operation means the centre region of the sample will stay in position related to the optical axes and the adjusted AFM cantilever. We also find the height and overall size of the stretching stage allows us to mount it on our base stage providing the flexibility either as a stand-alone system or to use on top of an optical microscope body."



• Optional 3 & 4 point bending clamps for MT stages

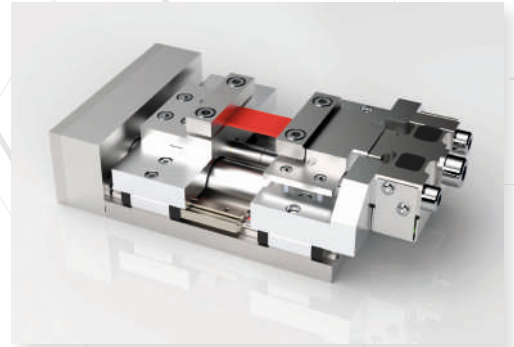


Deben Microtest 200N tensile and compression stage in an AFM system

Tensile & Compression Stages

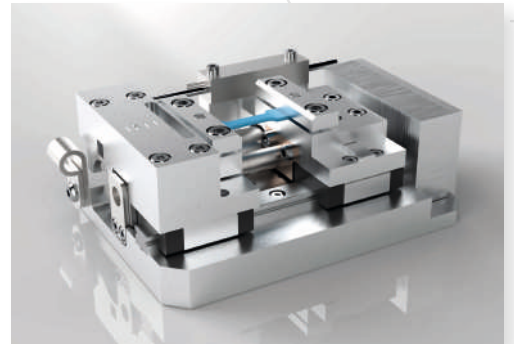
MT200

- 200N tensile and compression testing stage with precision slides and symmetrical stainless-steel leadscrew
- 200N loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 300nm resolution
- Standard speed range: 0.1mm/min. to 1.50mm/min.
- Travel: 10mm, standard gauge length: 10-20mm
- Maximum sample size: 50mm x 15mm x 10mm (L, W, H)
- Approx dimensions: 131mm x 62mm x 31mm (L, W, H)
- Weight: 500g approx.
- MICROTEST™ software control



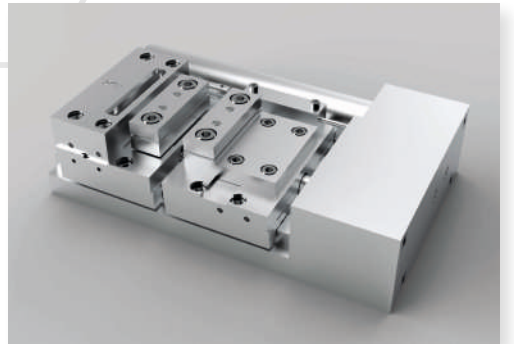
MT1000

- 1kN tensile and compression testing stage with precision slides and symmetrical stainless-steel leadscrew
- 1kN loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 3 μ m resolution
- Standard speed range: 0.2mm/min. to 2.0mm/min.
- Travel: 10mm, standard gauge length: 10-20mm
- Maximum sample size: (tensile) 30mm x 15mm x 10mm (L, W, H)
- Maximum dimensions: 89mm x 60mm x 28mm (L, W, H)
- Weight: 500g approx.
- MICROTEST™ software control



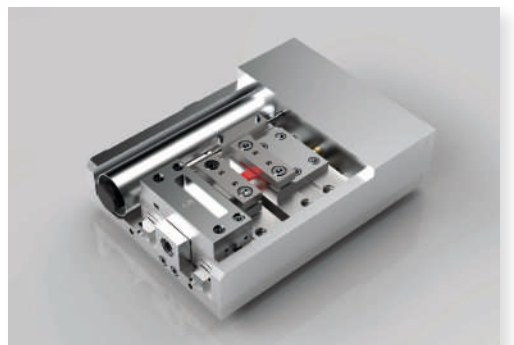
MT2000

- 2kN tensile and compression stage with precision slides and symmetrical stainless-steel leadscrew
- 2kN loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 3 μ m resolution
- Standard speed range: 0.03mm/min. to 0.5mm/min.
- Travel: 10mm, standard gauge length: 10-20mm
- Maximum sample size: (tensile) 50mm x 15mm x 10mm (L, W, H)
- Maximum dimensions: 136mm x 83mm x 37mm (L, W, H)
- Weight: 1.8kg approx.
- MICROTEST™ software control



MT5000

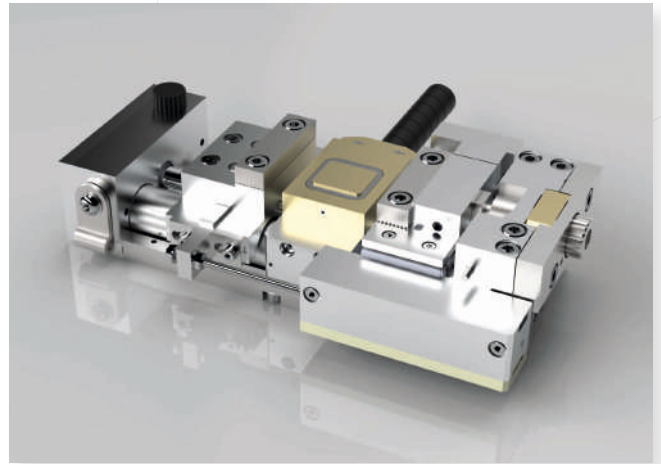
- Single leadscrew horizontally mounted tensile and compression testing stage
- Precision slides with symmetrical stainless-steel leadscrew
- 5kN loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, resolution 3 μ m
- Standard speed range 0.005mm/min. to 0.4mm/min.
- Travel: 10mm, standard gauge length: 10 – 20mm
- Maximum sample size: 67mm x 20mm x 10mm (L, W, H)
- Approx dimensions: 146mm x 108mm x 39mm (L, W, H)
- Weight: 2.5kg approx.
- MICROTEST™ software control



Variable Temperature Tensile and Compression Stages

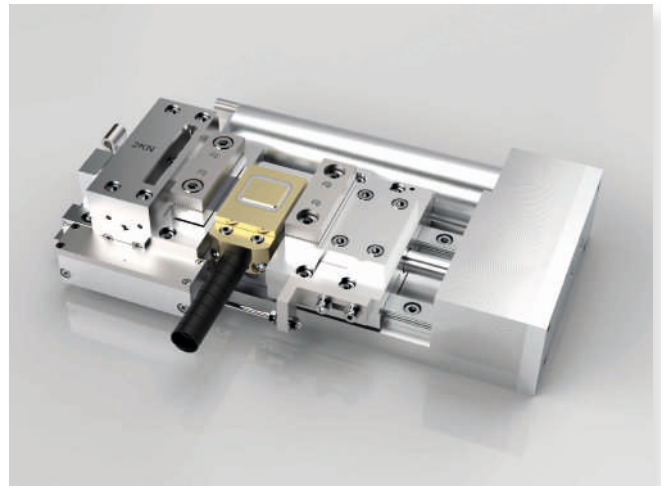
MT200VT

- Extended MT200 to incorporate Peltier substage
- 200N loadcell, linearity $\pm 1\%$ of full-scale range
- Extensometer for position readout, 300nm resolution
- Travel: 20mm, standard gauge length: 30mm – 50mm
- Temperature range: -20°C to $+160^{\circ}\text{C}$
- Dimensions: 131.5mm x 63.5mm x 36mm (L, W, H)
- Weight: 600g approx.
- MICROTTEST™ software control



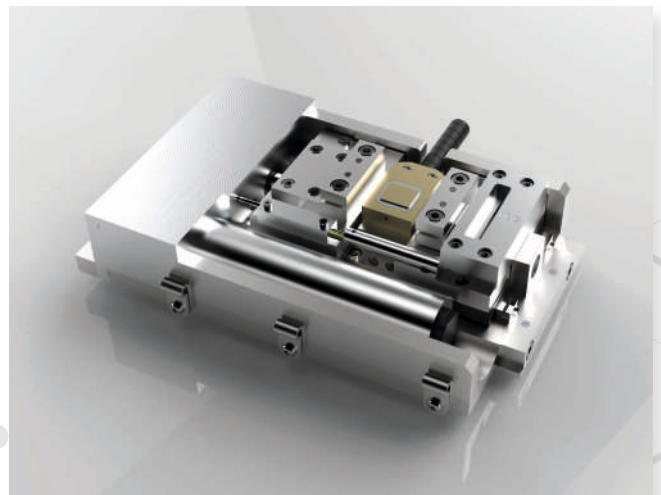
MT2000VT

- Extended MT2000 to incorporate Peltier substage
- 2kN loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1% static resolution 0.05% of full-scale range
- Extensometer for position readout, 3 μm resolution
- Standard speed range: 0.03mm/min. to 0.5mm/min.
- Travel: 10mm, standard gauge length: 30mm – 40mm
- Temperature range: -20°C to $+160^{\circ}\text{C}$
- Maximum sample size: (tensile) 50mm x 15mm x 10mm (L, W, H)
- Maximum dimensions: 176mm x 97mm x 37mm (L, W, H)
- Weight: 2kg approx.
- MICROTTEST™ software control



MT5000VT

- Extended MT5000 to incorporate Peltier sub-stage
- 5kN loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1% static resolution 0.05% of full-scale range
- Travel: 10mm, standard gauge length: 30mm – 40mm
- Temperature range: -20°C to $+160^{\circ}\text{C}$
- Dimensions: 166mm x 108mm x 39mm (L, W, H)
- Weight: 2.7kg approx.
- MICROTTEST™ software control

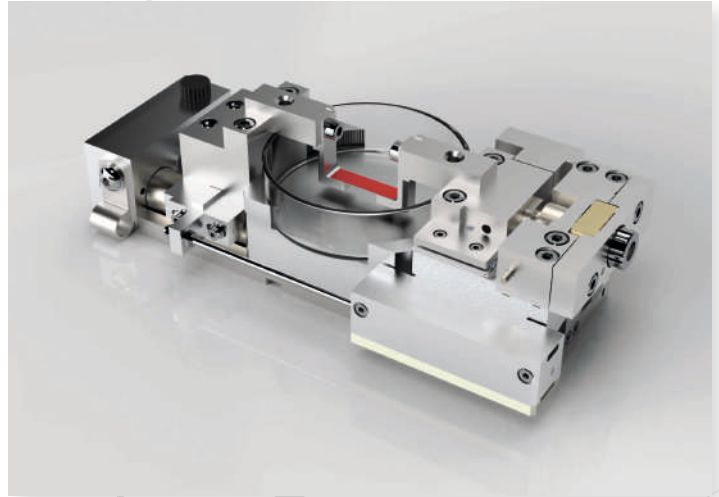




Tensile and Compression Stages for Life Sciences

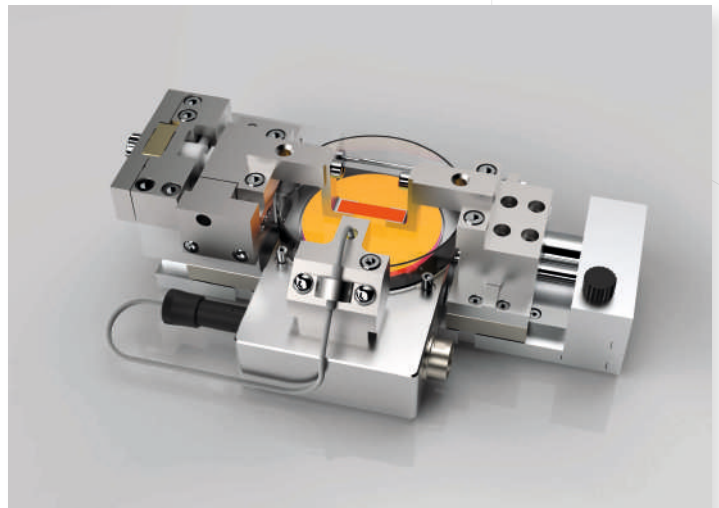
MT200P

- 200N tensile and compression testing stage with precision slides and symmetrical stainless-steel leadscrew
- 200N loadcell, linearity $\pm 1\%$ of full-scale range
- Extensometer for position readout, $3\mu\text{m}$ resolution
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Standard speed range: 0.1 mm/min. to 1.50 mm/min.
- Travel: 20mm, standard gauge length: 30-50mm
- Maximum sample size: 50mm x 15mm x 10mm (L, W, H)
- Approx dimensions: 131mm x 62mm x 31mm (L, W, H)
- Weight: 570g approx.
- MICROTEST™ software control



MT200PH

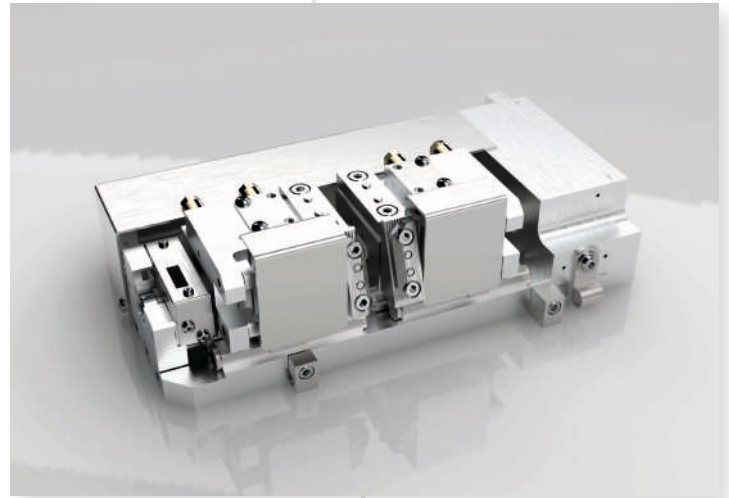
- 200N tensile and compression testing stage with precision slides and symmetrical stainless-steel leadscrew
- 200N loadcell, linearity $\pm 1\%$ of full-scale range
- Extensometer for position readout, $3\mu\text{m}$ resolution
- Heater module with temperature range from ambient to $+60^\circ\text{C}$
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Standard speed range: 0.1 mm/min. to 1.50 mm/min.
- Travel: 20mm, standard gauge length: 30-50mm
- Maximum sample size: 50mm x 15mm x 10mm (L, W, H)
- Approx dimensions: 131mm x 62mm x 31mm (L, W, H)
- Weight: 910g approx.
- MICROTEST™ software control



EBSD Tensile and Compression Stages

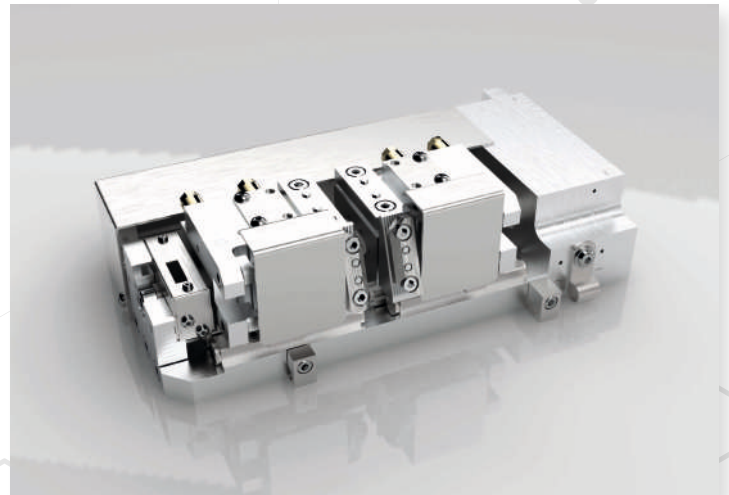
MT2000ER

- Single leadscrew horizontally mounted tensile and compression testing stage
- Precision slides with stainless-steel leadscrew
- 2kN tensile to 2kN compression (continuous)
- 2kN loadcell, linearity $\pm 1\%$ of full-scale range
- Force resolution better than 0.01% FS
- Extensometer for position readout, resolution 100nm
- Standard speed range 0.02mm/min. to 0.2mm/min.
- Maximum travel: 10mm (10 to 20mm between jaws)
- Flat samples (horizontal and 70° tilted position)
- EBSD sample dimensions:
 - Gauge length 10-20mm, sample clamping length 8mm each end, max. width 26mm
- Horizontal sample dimensions:
 - Gauge length 10-20mm, sample clamping length 12mm each end, max. width 36mm
- Approx dimensions: 181mm x 86mm x 52mm (L, W, H)
- Weight: 3.1kg approx.
- DEBEN TEST SUITE™ software control



MT2000EH

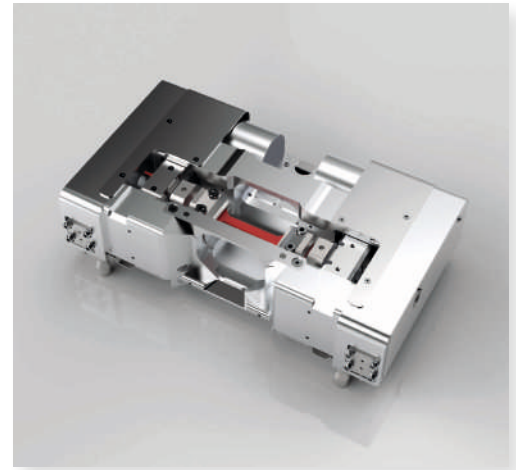
- Single leadscrew horizontally mounted tensile and compression testing stage
- Precision slides with stainless-steel leadscrew
- 2kN tensile to 2kN compression (continuous)
- 2kN loadcell, linearity $\pm 1\%$ of full-scale range
- Force resolution better than 0.01% FS
- Extensometer for position readout, resolution 100nm
- Standard speed range 0.02mm/min. to 0.2mm/min.
- Maximum travel: 10mm (10 to 20mm between jaws)
- Flat samples (horizontal and 70° tilted position)
- Heated jaws for EBSD position (70°):
 - 600°C max. jaw temperature in vacuum
 - Water cooled (including chiller)
 - Standalone heating controller
- EBSD sample dimensions:
 - Gauge length 10-20mm, sample clamping length 8mm each end, max. width 26mm
- Horizontal sample dimensions:
 - Gauge length 10-20mm, sample clamping length 12mm each end, max. width 36mm
- Approx dimensions: 181mm x 86mm x 52mm (L, W, H)
- Weight: 3.3kg approx.
- DEBEN TEST SUITE™ software control





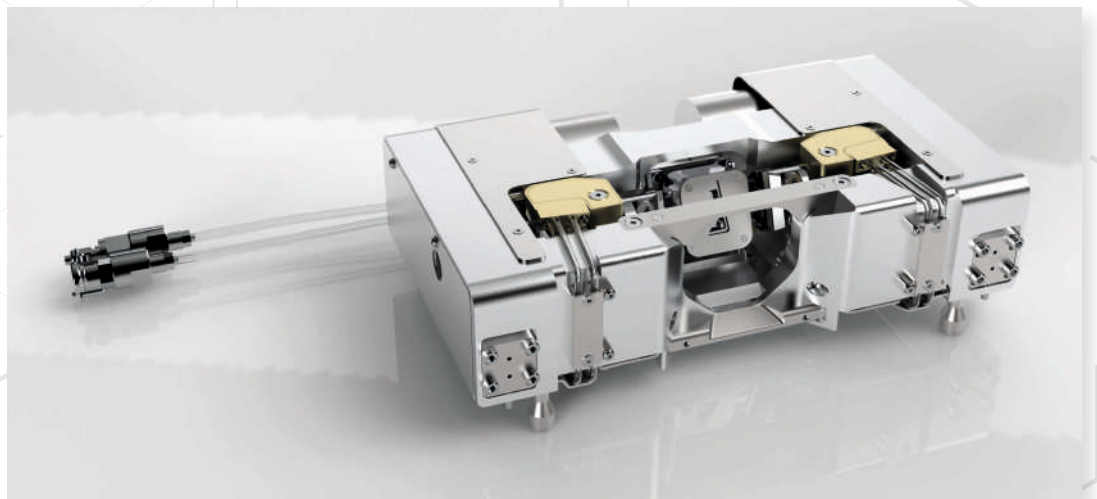
MT5000ER

- Horizontally mounted dual-motor tensile and compression testing stage
- 5kN tensile to 5kN compression (Continuous)
- 5kN loadcell, linearity $\pm 0.5\%$ of full-scale range
- Force resolution better than 0.01% FS
- Dual optical extensometers for position readout, resolution 100nm
- Motor speed (per jaw): 0.55 $\mu\text{m/s}$ - 15 $\mu\text{m/s}$ (0.033mm/min. – 0.9mm/min.)
- Motor speed (combined): 1.1 $\mu\text{m/s}$ - 30 $\mu\text{m/s}$ (0.067mm/min. – 1.8mm/min.)
- Maximum travel: 20mm (30 to 50mm between jaws)
- Dual motor allows independent or dual jaw movement
- User Exchangeable Flat Sample Jaws and 70° tilt EBSD Jaws
- EBSD 70° jaw position has clear line of sight to SEM lens and EBSD detector with no shadowing
- EBSD and Horizontal sample dimensions:
 - Gauge length 30-50mm, sample clamping length 10mm each end, maximum width 5mm
- Dimensions: 225mm x 132mm x 66mm (L, W, H)
- Weight: 3kg approx.
- DEBEN TEST SUITE™ software control



MT5000EH

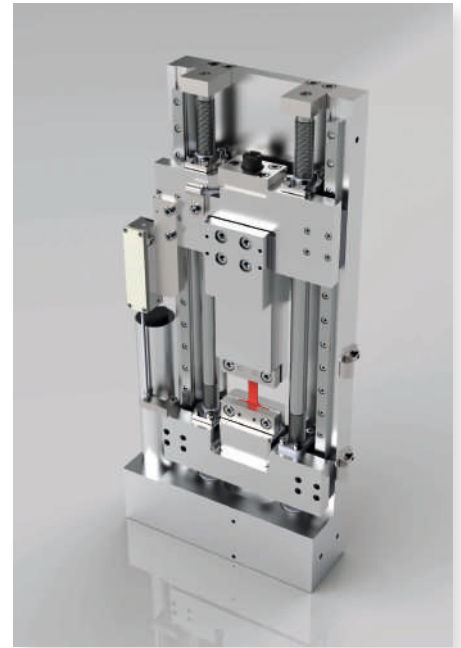
- Horizontally mounted dual-motor tensile and compression testing stage
- 5kN tensile to 5kN compression (Continuous)
- 5kN loadcell, linearity $\pm 0.5\%$ of full-scale range
- Force resolution better than 0.01% FS
- Dual optical extensometers for position readout, resolution 100nm
- Motor speed (per jaw): 0.55 $\mu\text{m/s}$ - 15 $\mu\text{m/s}$ (0.033mm/min. – 0.9mm/min.)
- Motor speed (combined): 1.1 $\mu\text{m/s}$ - 30 $\mu\text{m/s}$ (0.067mm/min. – 1.8mm/min.)
- Maximum travel: 20mm (30 to 50mm between jaws)
- Dual motor allows independent or dual jaw movement
- Maximum heater temperature 1000°C:
 - Water cooled (including chiller)
 - Standalone heating controller
- User Exchangeable Flat Sample Jaws and 70° tilt EBSD Jaws
- EBSD 70° jaw position has clear line of sight to SEM lens and EBSD detector with no shadowing
- EBSD and Horizontal sample dimensions:
 - Gauge length 30-50mm, sample clamping length 10mm each end, maximum width 5mm
- Dimensions: 225mm x 132mm x 66mm (L, W, H)
- Weight: 3.3kg approx.
- DEBEN TEST SUITE™ software control



Transmission Tensile and Compression Stages

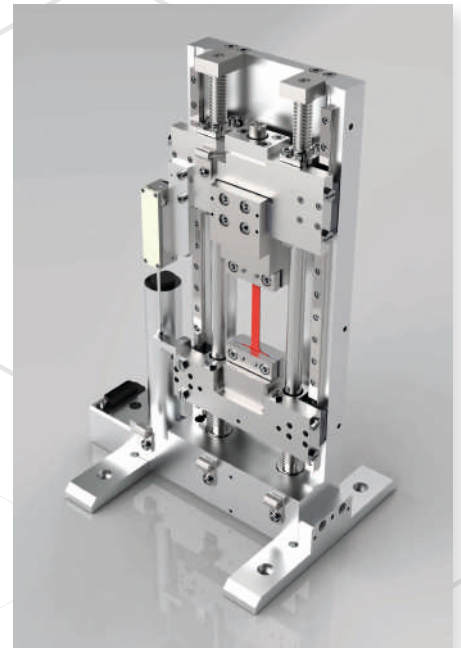
MT2000DL

- Horizontally or vertically mounted stage with void in rear for transmission observation
- Precision slides with dual symmetrical stainless-steel leadscrews
- 2kN loadcell, linearity $\pm 1\%$ of working range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 300nm resolution
- 20mm linear extensometer for position readout
- Maximum travel 20mm, standard gauge length 20mm – 40mm between jaws
- Maximum sample size 50mm x 15mm x 10mm (L, W, H)
- Maximum Dimensions: 321mm x 162mm x 43mm (L, W, H)
- Weight: 6.4kg approx.
- MICROTEST™ software control



MT5000DL

- Horizontally or vertically mounted stage with void in rear for transmission observation
- Tensile and compression testing; compression platen supplied
- Precision slides with dual symmetrical stainless-steel leadscrews.
- 5kN loadcell, linearity $\pm 1\%$ of working range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 300nm resolution
- Linear extensometer for position readout
- Standard speed range of 0.1mm/min. to 1.0mm/min.
- Max. travel 20mm (50-70mm between jaws) {other range can be specified}
- Dimensions: 173mm x 43mm x 316mm (L, W, H)
- Weight: 6.6kg approx.
- MICROTEST™ software control

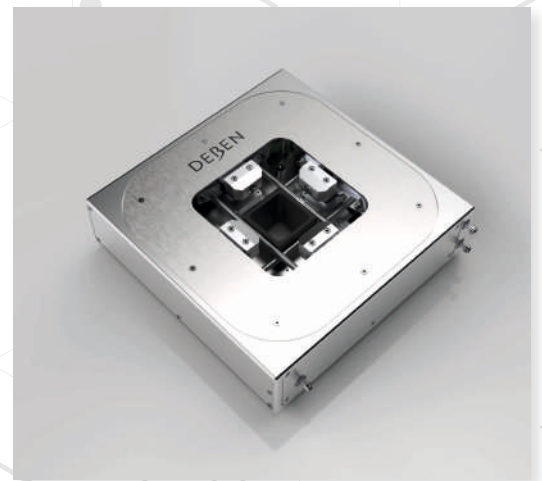


Multi-Axial Tensile and Compression Stages

MT200BA

The bi-axial tensile stage can be used to stretch sheet materials in two perpendicular directions simultaneously. Ideal for Benchtop, SEM, Optical, XCT and Synchrotron use, the MT200BA is used in materials science and solid mechanics to study the mechanical properties of materials like textiles, polymers, metal sheets, and biological soft tissues.

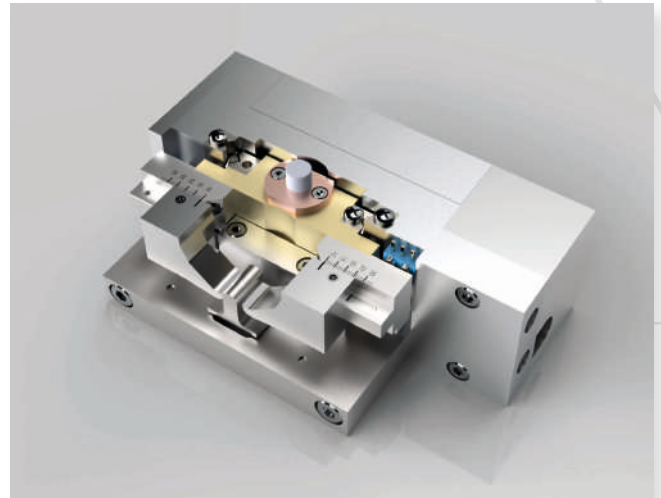
- Tensile and compression testing
- Line of sight for transmission samples
- 200N loadcell, linearity $\pm 1\%$ of full-scale range
- Travel: 30mm, standard gauge length: 20mm – 50mm
- Stationary centre for a 30x30mm sample
- Dimensions: 170mm x 170mm x 41mm
- Weight: 1.9kg approx.
- MICROTEST™ software control



Vertical Bending Stages

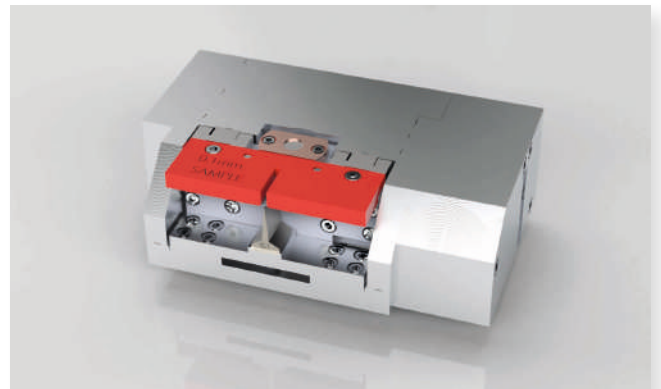
MT300VB

- Three-point bending inverted for microscopy with four point bending adaptor included
- Precision slides with stainless steel leadscrew
- Sliding sample clamps allowing stroke width to be set between 10mm and 30mm
- 300N loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 3 μ m resolution
- Standard speed range of 0.2mm/min. to 2mm/min.
- Maximum sample size 50mm x 10mm x 10mm (L, W, H)
- Displacement 10mm
- Approximate dimensions: 100mm x 61 mm x 43.8mm (L, W, H)
- Weight: 560g approx.
- MICROTEST™ software control



MT2000VB

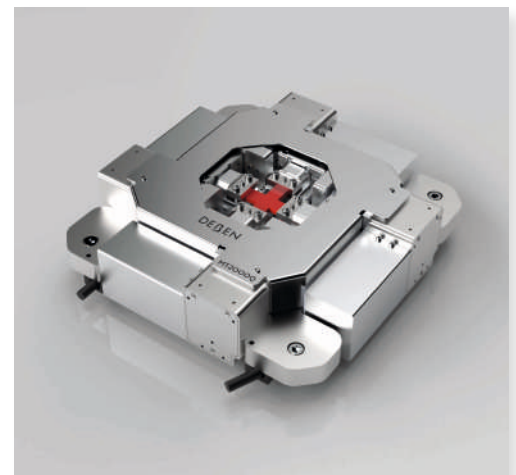
- Three-point bending inverted for microscopy with four point bending adaptor included
- Precision slides with stainless steel leadscrew
- Sliding sample clamps allowing stroke width to be set between 10mm and 30mm
- 2kN loadcell, linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 3 μ m resolution
- Standard speed range of 0.02mm/min. to 0.4mm/min.
- Maximum sample size 50mm x 10mm x 10mm (L, W, H)
- Displacement 10mm
- Approximate dimensions: 85mm x 133mm x 41 mm (L, W, H)
- Weight 1.3kg approx.
- MICROTEST™ software control



MT2000Q

The quad axial tensile stage is designed to suit a wide range of testing capabilities from bench-top all the way through to synchrotron use. This in-situ stage has four independently controllable axis each with separate motors, extensometers and loadcells that can also be combined in pairs. The central through hole enables 2D evaluations with CT and Synchrotron systems.

- Cruciform style sample
- 2kN loadcell, linearity $\pm 1\%$ of full-scale range
- Extensometer for position readout, 100nm resolution
- 4 x Uniaxial or 2 x biaxial operating mode
- Force or displacement control to each axis / pair
- Line of sight for transmission samples
- Force resolution better than 0.01% FS
- Weight: 5.8kg approx.
- DEBEN TEST SUITE™ software control





CT stages - X-Ray Computed Tomography

Deben in-situ CT stages are specifically designed for X-Ray microscopy systems and provide tensile & compression loading from <50N up to 20kN.

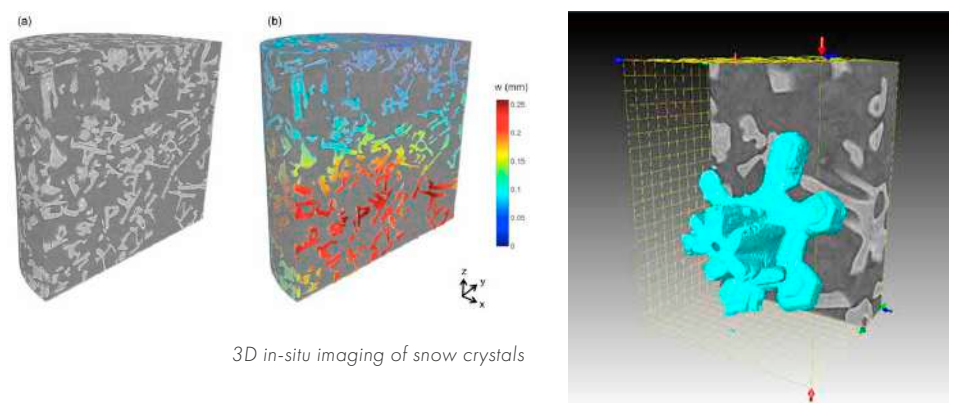
Conventional tensile testing provides information on the tensile and compressive strength of a material, but no information on physical changes to the internal structure. By using X-Ray microscopy together with in-situ tensile testing and heating or cooling, dynamic microstructural observations can be observed from within the sample, providing new insights into materials research.

From the acquired 3D data, it is possible to make a quantitative characterization of internal features such as porosity, cracks, grains, fibers, etc., as well as to determine material deformation and strain.

Applications are varied, with systems being used for testing paper/cardboard, fibres, polymer foams, biological & life science samples at low forces. At higher forces, systems are being used to test metal foams, artificial joints, automotive components and turbine blades.

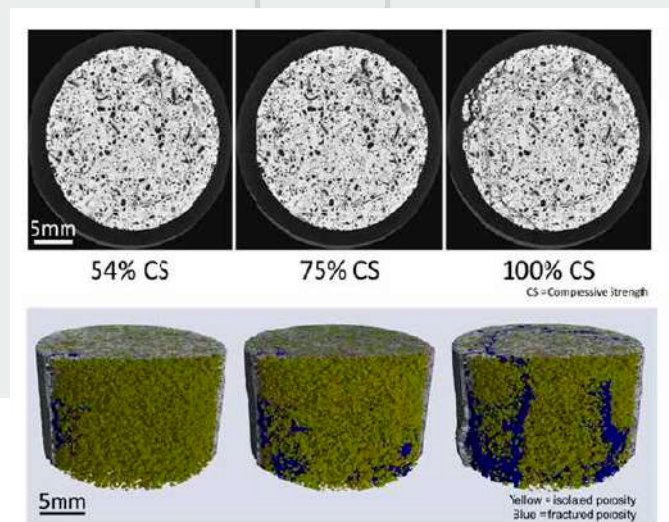
Dr Forsberg at Luleå University of Technology (LTU) in Sweden describes one of his recent projects using this experimental set up.

"A recent study, of which we are very proud, is the 3D quantitative in-situ imaging of microscale snow crystals and how they respond to compaction."

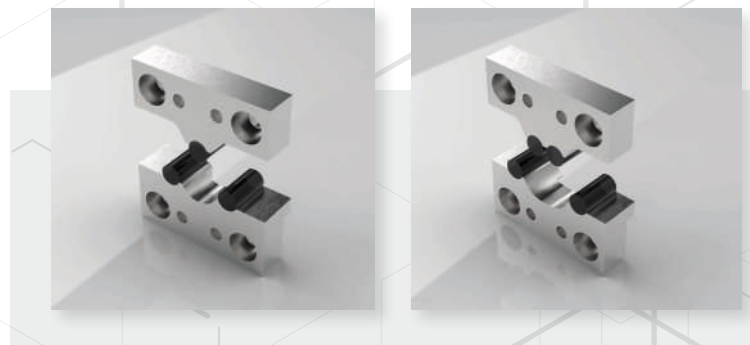


Prof. Cnudde of the UGCT uses non-destructive techniques, including X-ray Computed Tomography, to investigate dynamic processes in geomaterials.

"The CT5000 system is one of the few systems which are highly adaptable to the needs of individual test cases. It allows different set-ups to be made according to the requirement of the experiment. Important in our research is that it can reach the high loads necessary for rock samples to be broken. Also, the possibility to have a custom made cell (in which the distance between the two jaws was altered to our needs), fitting on two of the scanners at UGCT was one of the decisive points why we chose for the CT5000 system."



- Optional 3 & 4 point bending clamps for CT stages



X-ray CT Tensile and Compression Stages

CT500

- X-ray CT tensile & compression testing stage
- High strength ULTEM support tube, 25mm OD, 2mm wall thickness (4mm in beam path)
- Tensile and compression jaws
- Compression jaws have a flat surface and tensile jaws have screw clamps and single centred dowel pin
- Choice of fixed single 200N or 500N loadcell (default is 500N), linearity $\pm 1\%$ of full-scale travel
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 3 μ m resolution
- Speed range 0.2mm/min. to 2.0mm/min.
- Maximum extension: 10mm
- Standard stroke (customisable): 10-20mm tensile, 11-1mm compression
- Height to match X-ray source
- Weight: 1-3kg approx.
- MICROTEST™ software control



CT5000RT

- X-ray CT tensile & compression testing stage
- 5kN loadcell with linearity $\pm 1\%$ of full-scale range including loadcell exchange kit
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 300nm resolution
- Maximum travel: 10mm, standard gauge length 10mm – 20mm tensile, 15mm – 5mm compression (different gauge lengths available upon request)
- User exchangeable gearbox with speed range 0.1mm/min. to 1.0mm/min.
- Simple specimen exchange mechanism with high strength vitreous glassy carbon support tube: 60mm OD, wall thickness 3mm, (6mm in beam path)
- Tensile & compression jaws as well as compression plates
- Maximum sample size: Compression: 39mm diameter x 50mm high; Tensile: 30mm long including 10mm clamping region at each end x 20mm wide x 5mm thick
- Height to match X-ray source
- Stage weight: 5kg approx.
- MICROTEST™ software control



**for illustration only, tubes do not appear transparent and heights vary*

CT5000TEC

- X-ray CT tensile & compression testing stage with heating and cooling
- User exchangeable 5kN loadcell with linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 300nm resolution
- Variable temperature jaws with live temperature display
- Ceramic cartridge heaters in each jaw providing maximum heating to +160°C
- Peltier TEC elements in each jaw providing cooling to -20°C
- Simple specimen exchange mechanism with high strength vitreous glassy carbon support tube: 60mm OD, wall thickness 3mm, (6mm in beam path)
- Tensile & compression jaws as well as compression plates
- User exchangeable gearbox with speed range 0.1mm/min. to 1.0mm/min.
- Maximum sample size: Compression: 39mm diameter x 15mm high; Tensile: 30mm long including 10mm clamping region at each end x 20mm wide x 5mm thick
- Maximum travel: 10mm, standard gauge length 10mm – 20mm tensile, 15mm – 5mm compression (different gauge lengths available upon request)
- Height to match X-ray source
- Stage weight: 5-6 kg approx.
- MICROTEST™ software control



**for illustration only, tubes do not appear transparent and heights vary*

CT5000H250

- X-ray CT tensile & compression testing stage with heating to 250°C
- User exchangeable 5kN loadcell with linearity $\pm 1\%$ of full-scale range
- Accuracy $\pm 0.5\%$, dynamic resolution 0.1%, static resolution 0.05% of full-scale range
- Extensometer for position readout, 300nm resolution
- Variable temperature jaws with live temperature display
- Ceramic cartridge heaters in each jaw providing maximum heating to +250°C
- Simple specimen exchange mechanism with high strength vitreous glassy carbon support tube: 60mm OD, wall thickness 3mm, (6mm in beam path)
- Tensile & compression jaws as well as compression plates
- Maximum sample size: Compression: 39mm diameter x 15mm high; Tensile: 30mm long including 10mm clamping region at each end x 20mm wide x 5mm thick
- Maximum travel: 10mm, standard gauge length 10mm – 20mm tensile, 15mm – 5mm compression (different gauge lengths available upon request)
- User exchangeable gearbox with speed range 0.1mm/min. to 1.0mm/min.
- Height to match X-ray source
- Stage weight: 6kg approx.
- MICROTEST™ software control



**for illustration only, tubes do not appear transparent and heights vary*

X-ray CT Heating Stages

Also available is a stage without tensile capability, providing heating/cooling only. This stage can be used for observing small frozen samples or samples at elevated temperatures.

CT160

- CT160 with 7mm diameter specimen platen or CT160+ with 15mm diameter specimen platen
- Peltier heating platform system
- Temperature range -20°C to +160°C at atmospheric pressure and ambient temperature at or below 20°C.
- Temperature accuracy $\pm 1.5^\circ\text{C}$ or 2%, whichever is the greatest
- Temperature display resolution 0.1°C, temperature stability $\pm 0.2^\circ\text{C}$
- Maximum cooling/heating rate 10°C per minute
- Simultaneous display of actual and target temperature
- Dimensions: 102mm x 225mm (Max. OD, H)
- Weight: 780g approx.
- Keypad/control panel for temperature display and control



CT350

- Temperature range ambient to +350°C at atmospheric pressure and ambient temperature at or below 20°C
- Temperature accuracy $\pm 1.5^\circ\text{C}$ or 2%, whichever is the greatest
- Temperature display resolution 0.1°C, temperature stability $\pm 0.2^\circ\text{C}$
- Maximum heating rate 10°C per minute
- Simultaneous display of actual and target temperature
- Dimensions: 102mm x 225mm (Max. OD, H)
- Weight: 780g approx.
- Front panel control





X-ray CT Open Frame Stage

We are now able to offer an integrated tensile/compression/torsion testing solution for your μ XCT and Synchrotron applications. Using tensile testing with μ XCT and Synchrotron provides a clear visual interpretation of how the properties of materials and composites change under different loading conditions.

The design of this testing stage allows it to be used with larger high resolution micro CT systems and Synchrotrons with forces up to 20kN. The system is controlled from custom software giving a wide range of control functions and a live display of load versus extension. The Deben Open Frame OF20kN™ System offers simultaneous torsion loading to 100Nm.

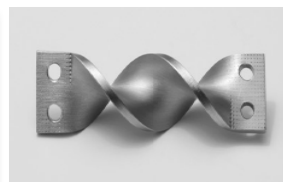
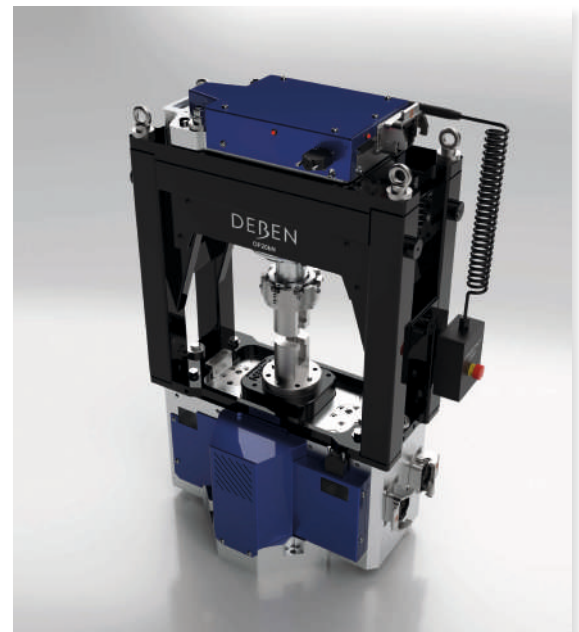
OF20kN Open Frame testing rig installed at Auburn University, USA

The Open Frame is a Tensile, Compression & Torsion rig capable of applying force of up to 20kN and is designed for Synchrotron and room based X-ray CT imaging systems.



OF20kN

- Top and bottom jaws contain independent high resolution rotation mechanisms allowing synchronised sample rotation
- Torque can be applied by rotating one jaw further than the opposite jaw up to 100Nm loading
- Tensile or compression load can be applied at the same time as torsion and loads can be applied and held while the sample is being rotated
- Sample rotation can be controlled in step or continuous mode from the associated imaging system or from the supplied control software
- Many different materials may be tested at loads from -20kN to +20kN, and torsion from -100Nm to +100Nm
- An optional furnace may be fitted for sample heating to 1,000°C
- Acquisition software is supplied for system control, real-time data display and recording of force/extension curves

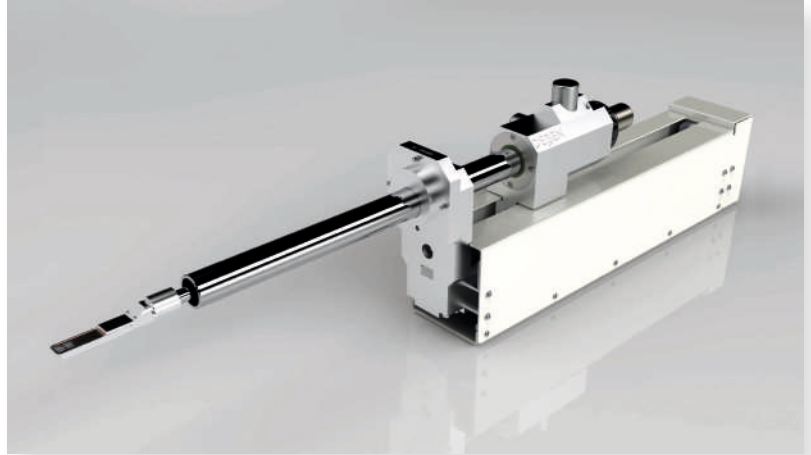




Detectors

ARM2™ STEM detector

The Deben Solid state Gen5™ SEM detector is modular, with the motorised ARM2™ mechanical interface at the heart of the system. Also included are Gen5™ electronics and software GUI, as well as various diode options available for both STEM and BSE imaging. ARM2™ can be adapted to most conventional SEMs having a free chamber port at 90° to the beam axis. Control of diode segments and brightness/contrast is from within the software GUI, with up to three simultaneous video channels available (optional).



1. Four Element Dark Field (DF) and Bright Field (BF)

- x2 modes of operation, including DF and BF
- Hardware configuration allowing over 9 combinations of signal

2. Triple Annular STEM

- Ideal for life sciences and material science applications
- x4 modes of operation, including HAADF, MAADF, LAADF and BF
- Hardware configuration allowing over 14 combinations of signal

3. Bi-Annular 4 Quadrant STEM

- Ideal for material science applications
- x5 modes of operation, including HAADF, ADF, DF, BF and Phase Contrast
- Hardware configuration allowing over 34 combinations of signal, including bi-directional phase contrast imaging



12 Position sample holder



1. Four Element Dark Field (DF) and Bright Field (BF)



2. Triple Annular STEM



3. Bi-Annular 4 Quadrant STEM

ARM2™ BSE detector

Motorised and retractable four quadrant BSE.

Choice of 10mm, 14mm or 18mm four quadrant detector diodes or 26mm Annular diode.



• 10mm diameter



• 14mm diameter



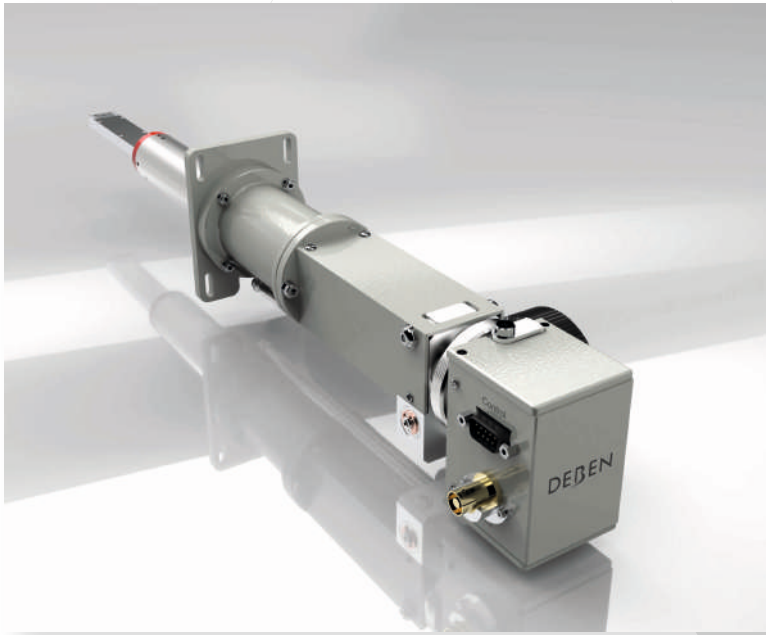
• 18mm diameter



• 26mm diameter



Centaurus™ Cathodoluminescence (CL) detector



Centaurus is a scintillation type Cathodoluminescence (CL) panchromatic detector and/or Backscattered Electron (BSE) detector, which can generate either high-resolution CL images or be easily converted to a BSE imaging detector for compositional imaging (with topographic information). With a user-exchangeable tip, the Centaurus can be converted between CL and BSE imaging, providing an additional function for little extra cost.

Cathodoluminescence (CL) imaging - used widely in geology, mineralogy, ceramic materials research and luminescent material development. Photon emissions can provide general information on trace elements. CL combines functional optical information with added spatial resolution.

Backscattered Electron (BSE) imaging - provides image contrast as a function of elemental composition, as well as an element of surface topography.

Using a diamond polished parabolic reflector tip, the Deben detector collects far more signal than other products on the market. The photomultiplier may also be exchanged to select a particular wavelength range with sensitivity available from UV to deep IR at 185nm to 1200nm.



- Cathodoluminescence tip
- panchromatic, parallel, exchangeable



- Backscattered Electron (BSE) tip
- parallel, exchangeable



- Backscattered Electron (BSE) YAG tip
- parallel, exchangeable



SEM Coolstage

The Deben Coolstage is a popular addition to any SEM to provide both heating and cooling to your samples and is ideal to control dehydration of biological samples. Temperature and vacuum can be perfectly matched to keep the specimen fully hydrated during imaging. By cooling a specimen in low vacuum, changes in specimen structure due to sublimation can be minimised and the ability to operate at higher vacuum provides a better signal to noise ratio and clearer images. FE-SEM airlock compatibility is also available.

Systems are fully self-contained and comprise of:

- Thermally isolated specimen holder
- Single or dual stage Peltier device
- Vacuum feed-through flange
- Water chiller / PSU
- Keypad for digital temp control & readout

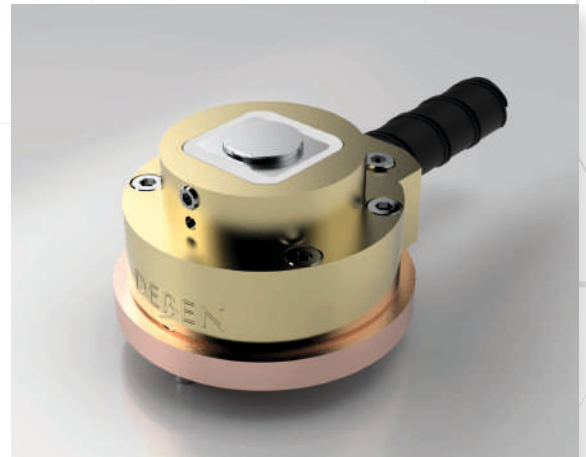
Standard Coolstage

- Temperature range between -25°C to $+50^{\circ}\text{C}$
- Temperature accuracy: $\pm 1.5^{\circ}\text{C}$ or 2%, whichever is greater
- Temperature display resolution: 0.1°C
- Maximum specimen size: 5mm height and 10mm diameter
- Temperature stability: $\pm 0.2^{\circ}\text{C}$
- Maximum cooling / heating rate: 12°C per minute
- Supplied with 15x standard & 15x dished specimen stubs



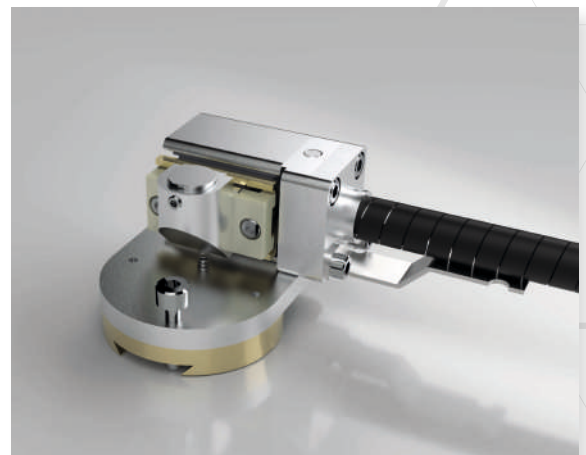
Enhanced Coolstage

- Temperature range between -25°C to $+160^{\circ}\text{C}$
- Temperature accuracy: $\pm 1.5^{\circ}\text{C}$ or 2%, whichever is greater
- Temperature display resolution: 0.1°C
- Maximum specimen size: 5mm height and 10mm diameter
- Temperature stability: $\pm 0.2^{\circ}\text{C}$
- Maximum cooling / heating rate: 12°C per minute
- Supplied with 15x standard & 15x dished specimen stubs



Ultra Coolstage

- Temperature range between -50°C to $+50^{\circ}\text{C}$
- Temperature accuracy: $\pm 1.5^{\circ}\text{C}$ or 2%, whichever is greater
- Temperature display resolution: 0.1°C
- Maximum specimen size: 5mm height and 10mm diameter
- Temperature stability: $\pm 0.2^{\circ}\text{C}$
- Maximum cooling / heating rate: 12°C per minute
- Supplied with 15x standard & 15x dished specimen stubs

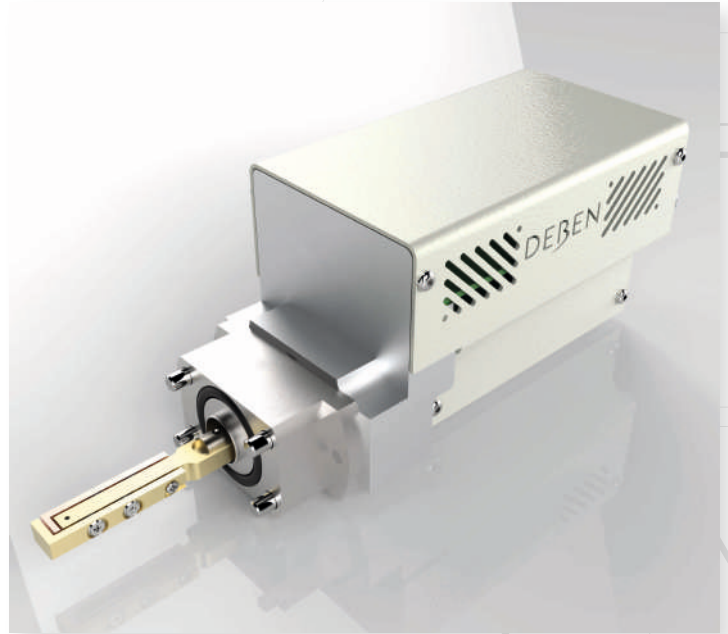




PCD (Probe Current Detector) Beam Blanker

The Deben PCD Beam Blanker has been designed to provide SEMs with the capability of blanking, pulsing or otherwise modulating the electron beam. This applies to FEG, LaB₆ and tungsten SEMs. Many in-built beam blanking systems rely on the column scan coils for millisecond blanking, but if faster blanking is required, the Deben Beam Blanker should be used. The blanking unit utilises the PCD port on the side of the column (opposite the final aperture) and will operate at up to 40kV with an on/off switch time of approximately 50ns. There is also the added benefit of an integral Probe Current Detector (PCD) and the option of a stand alone Probe Current Meter (PCM).

- Blanking plate assembly to fit PCD port
- Cobalt gold-plated blanking plates
- Integrated faraday cup
- Motorised plate position adjustment
- Pulse drive amplifier (at plates) & power supply
- 5V (TTL) blanking pulse input
- Blanking voltage standard 300V (400V max.)
- Digital probe current display
- Probe current output for picoammeter
- Supply voltage: 100V (from SEM power supply)
- Maximum pulse frequency: 1MHz
- Maximum HT voltage: 30kV
- Switching rise time: ~50ns
- Blanking efficiency over beam voltage from 1kV to 40kV



Probe Current Meter (optional)

If a more accurate reading of probe current is required, there is the option to add and connect to a Deben Probe Current Meter (PCM).

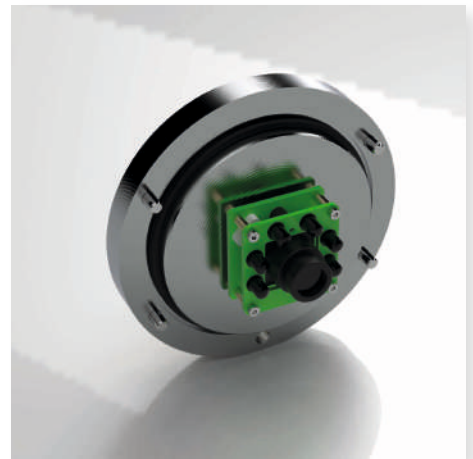
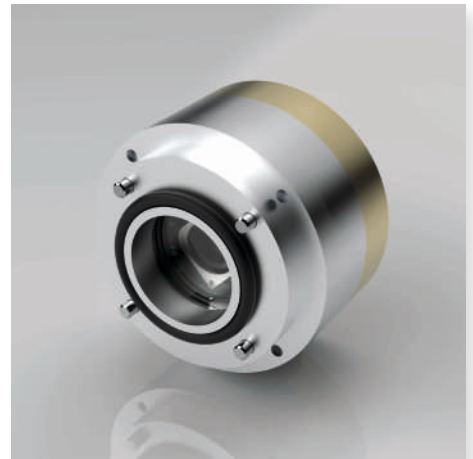
The PCM is also available as a separate standalone item - please contact us for more details.

- Auto Zero correction
- Maximum error 5pA at 25°C
- Overload: in excess of 100uA
- Power: 4xAA alkaline battery cells (provides 100k hours/ 1.2 years)
- Size: 130mm (W) x 70mm (H) x 115mm (D)

Chamberscope

By fitting a Deben Chamberscope to your SEM, you can get an instant view inside the chamber to see the position of detectors and samples. A Chamberscope is an essential accessory for any SEM - hitting a detector with a large sample can be an expensive mistake. The monitor system allows for easy positioning of the control box on the SEM console and manual adjustment of chamber illumination using push buttons on the front panel. The USB system allows for integrated installation on the SEM PC and is Windows compatible. Two separate Chamberscopes can be connected to provide different chamber views.

- Monitor or USB versions available
- Dual or single camera options
- Available for most SEMs
- Adjustable Infra-red (IR) LED illumination
- Exchangeable lenses
- X-Ray Shielded & with heatsink



Feedthroughs

3x BNC:-

- 3x hermetically sealed BNC sockets externally mounted
- O-ring to metal vacuum seals
- 1A DC per pin maximum current
- X-Ray shielded for normal SEM usage up to 30kV



15-way D-Type:-

- 15-way D-types inside and out with 14 pins connected (1-1 connections, Pin 3 not connected)
- X-ray shielded to 40kV indirect X-Rays
- Vacuum leak rate better than 1×10^{-9} Pa

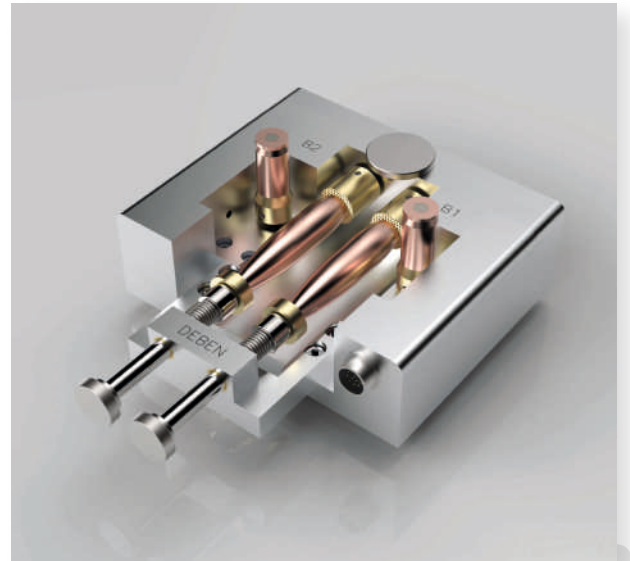




Forensic Stage

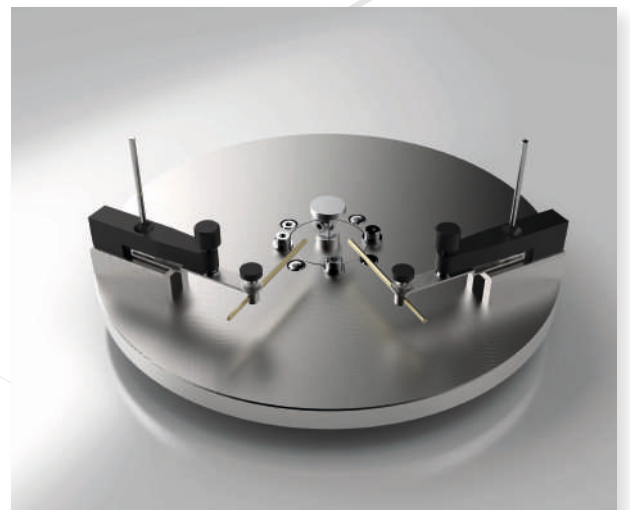
Deben forensic comparison stage is a sub-stage designed for use with SEMs and optical microscopes. Designed to accept the most common bullets and cartridge cases and allowing two bullets and cartridge cases to be mounted side by side for detailed comparison. Each sample can be independently rotated through 360° and their relative heights adjusted. Comparisons can be made by image comparison techniques after which the results can be archived for subsequent recall for future inspection and comparisons of further evidence.

- Forensic Science
 - Gunshot residue analysis
 - Striation comparison
 - Hammer indent comparison
-
- Vacuum compatible
 - Compatible with large SEM chambers
 - Dual bullet and Dual cartridge mounting
 - GSR calibration stub mounting position
 - Synchronised rotation
 - Keypad operation
 - Stage mounts onto SEM stage using dovetail fittings to match SEM
 - Electrical connections are via an X-Ray safe vacuum feed-through
 - 99 position memory store
 - Cases from 10 - 90mm long & 4.5 - 19mm diameter
 - Weight: 1kg approx



SEM Probe

- Isolated baseplate with two positioning mechanisms carrying an isolated needle-type probe/clip
- Coarse and fine positioning control
- Sample bias up to 5V and maximum current up to 5-10mA
- Requires SEM accessory kit for feedthrough and mounting





Deben continue to develop environmental stages to manage humidity, temperature and liquid conditions - *please contact us if you have any questions or a particular project in mind.*

Standard product not quite what you're looking for?

Our fantastic engineering team are also capable of modifying these standard products, or creating a solution specifically tailored to your needs - speak to your Deben sales representative about any such enquiries.

Heating and Cooling Stages

Standard Coolstage

- Temperature range between -25°C to $+50^{\circ}\text{C}$
- Temperature accuracy: $\pm 1.5^{\circ}\text{C}$ or 2%, whichever is greater
- Temperature display resolution: 0.1°C
- Maximum specimen size: 5mm height and 10mm diameter
- Temperature stability: $\pm 0.2^{\circ}\text{C}$
- Maximum cooling / heating rate: 12°C per minute
- Supplied with 15x standard & 15x dished specimen stubs



Enhanced Coolstage

- Temperature range between -25°C to $+160^{\circ}\text{C}$
- Temperature accuracy: $\pm 1.5^{\circ}\text{C}$ or 2%, whichever is greater
- Temperature display resolution: 0.1°C
- Maximum specimen size: 5mm height and 10mm diameter
- Temperature stability: $\pm 0.2^{\circ}\text{C}$
- Maximum cooling / heating rate: 12°C per minute
- Supplied with 15x standard & 15x dished specimen stubs



Ultra Coolstage

- Temperature range between -50°C to $+50^{\circ}\text{C}$
- Temperature accuracy: $\pm 1.5^{\circ}\text{C}$ or 2%, whichever is greater
- Temperature display resolution: 0.1°C
- Maximum specimen size: 5mm height and 10mm diameter
- Temperature stability: $\pm 0.2^{\circ}\text{C}$
- Maximum cooling / heating rate: 12°C per minute
- Supplied with 15x standard & 15x dished specimen stubs





CT160

- CT160 with 7mm diameter specimen platen or CT160+ with 15mm diameter specimen platen
- Peltier heating platform system
- Temperature range -20°C to +160°C at atmospheric pressure and ambient temperature at or below 20°C.
- Temperature accuracy $\pm 1.5^\circ\text{C}$ or 2%, whichever is the greatest
- Temperature display resolution 0.1°C, temperature stability $\pm 0.2^\circ\text{C}$
- Maximum cooling/heating rate 10°C per minute
- Simultaneous display of actual and target temperature
- Dimensions: 102mm x 225mm (Max. OD, H)
- Weight: 780g approx.
- Keypad/control panel for temperature display and control



CT350

- Temperature range ambient to +350°C at atmospheric pressure and ambient temperature at or below 20°C
- Temperature accuracy $\pm 1.5^\circ\text{C}$ or 2%, whichever is the greatest
- Temperature display resolution 0.1°C, temperature stability $\pm 0.2^\circ\text{C}$
- Maximum heating rate 10°C per minute
- Simultaneous display of actual and target temperature
- Dimensions: 102mm x 225mm (Max. OD, H)
- Weight: 780g approx.
- Front panel control



Humidity Stages

CT5000TEC ENV

Using tensile testing with μXCT provides a clear visual interpretation of how the properties of materials and composites change under different loading conditions.

- Modular tensile & compression testing system to be installed within X-ray enclosure
- 5kN loadcell with linearity $\pm 1\%$ of full-scale range including loadcell exchange kit
- Simple specimen exchange mechanism with high strength vitreous glassy carbon support tube. 67mm OD, wall thickness 3mm, (6mm in beam path)
- Tensile & compression jaws as well as compression platens
- Maximum sample size. Compression: 39mm diameter x 15mm high. Tensile: 30mm long including 10mm clamping region at each end x 20mm wide x 5mm thick
- Mounting adaptor for fitting onto existing rotating table/chuck (one supplied)
- Maximum travel: 10mm, default jaw travel is 15-5mm using compression platens and 10-20mm in tension/compression using clamping jaws
- Variable temperature jaws are supplied
- Ceramic cartridge heaters in each jaw providing maximum heating to +160°C
- Peltier TEC elements in each jaw providing cooling to -20°C
- Speed range 0.03mm/min. to 0.3mm/min.
- Weight: 6.5kg approx.



DEBEN:



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