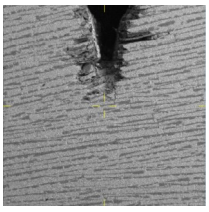
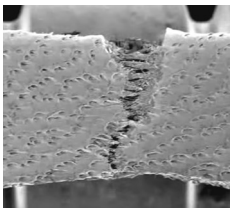
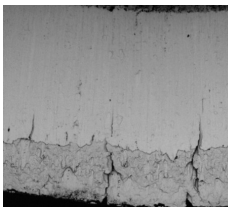
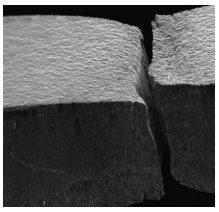
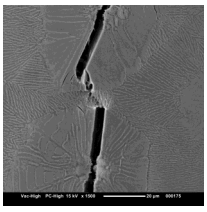
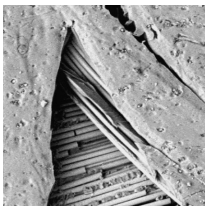
IN-SITU TENSILE AND COMPRESSION STAGES

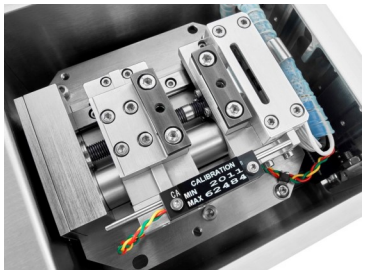
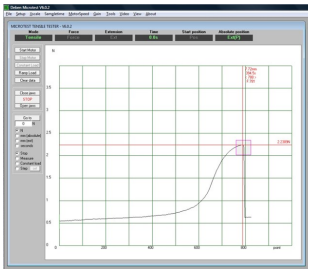
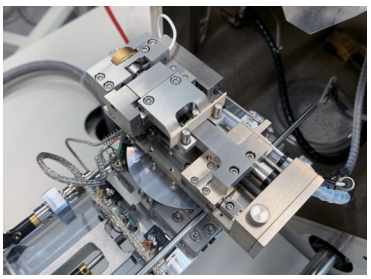
SEM - AFM - Optical - XRD

Traditional tensile testing provides information relating to tensile and compressive strength of a material, but provides no insight into physical changes to a structure. Utilising in-situ tensile testing with optional heating and cooling allows simultaneous loading and imaging which can provide new insights into material properties.

Deben in-situ stages are specifically designed to compliment a variety of imaging techniques such as SEM, Optical Microscopy, XRD, XRM (µXCT) and beam line, most stages can also be used on the bench-top (excluding XRM). All non XRM stages have symmetrical leadscrews keeping the area of interest centralised and are available with optional 3&4 point bending jaws. Control is from comprehensive Windows software. See separate datasheet for XRM and Synchrotron in-situ stages.

- **Loadcells from mN to 5kN**
- **Tensile, compression & bending**
- **Heating & Cooling**
- **Software Controlled**

System Options

Stage	Max load	Exchangeable loadcells	Compatibility			System Options			
			SEM	Optical	XRD	Loadcell options	Heating	Cooling	Applications
MT200	200N	✓	✓	✓	✓	2N,5N, 10N, 50N, 20N,200N	✓	✓	Fibres, bio materials, thin film, polymers, textiles, heating option –20°C to +160°C
MT300	300N	✓	✓	✓	✓	75N,150N,300N			Fibres, thin films polymers, metal films, textiles
MT2000	2KN	✓	✓	✓	✓	660N,2kN	✓	✓	Metals, metal films, composites, polymers, heating option –20°C to +160°C
MT5000	5KN	✓	✓	✓	✓	660N,2kN,5kN	✓	✓	Metals, metal films, ceramics, polymers, heating option –20°C to +160°C
MT1000	1KN		✓	✓	✓	150N, 1kN			Fibres, thin films polymers, metal films, textiles
MT2000DL	2KN	✓		✓	✓	1kN,2kN			Metals, metal films, composites, polymers
MT5000DL	5KN	✓		✓	✓	1kN, 2kN, 5kN	✓	✓	Metals, metal films, composites, polymers, ceramics, cooling option to –100°C heating option to +525°C
MT300B	300N	✓	✓	✓		75N,150N,300N			Vertical bending
MT2000B	2KN	✓	✓	✓		1kN			Vertical bending
MT2000ER	2KN		✓			1kN,2kN	✓		SEM EBSD, heating option to 600°C
DMTT5K	5KN	✓	✓			200N, 1KN,5KN	✓		SEM EBSD, heating option to 1,000°C

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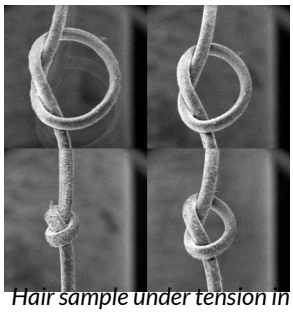
MT1000 Tensile Stage for SEM



Hair sample under tension in a desktop SEM.

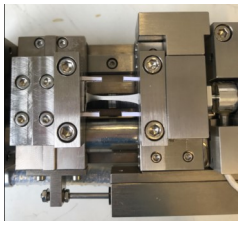
This image shows results obtained with the MT1000 Tensile Stage in use with a desktop SEM during observation of human hair. The application scientist describes our tensile stage: "The tensile stage from Deben is a robust device which is as easy to use as the desktop SEM. It can be loaded into the SEM 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.

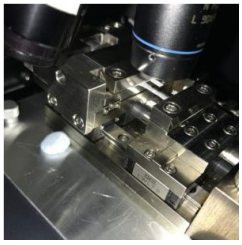
The tensile stage can be used outside the SEM under an optical microscope and inside the SEM when a higher magnification and better depth of focus is required. This bridges the gap between the light and electron microscopy worlds and allows for correlative microscopy techniques.

MT200 Tensile Stage for optical microscope (Raman)

The Bristol Composites Institute (ACCIS), a department of the University of Bristol, looking at materials, structures, manufacturing and design. ACCIS hopes that their work will assist in meeting the demand for high performance, multifunctional materials in a sustainable way. The department focuses on the study of Advanced Composite Materials and the related applications for Aerospace Engineering.

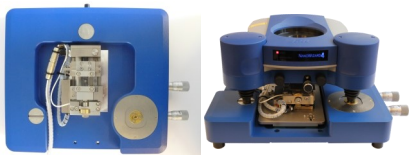
Images on the right show polystyrene nanofibre material with embedded cellulose nanocrystals inside the fibres, being tested in-situ in the Raman spectrometer.



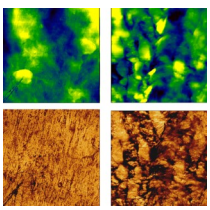


Our system user describes her experience using the Deben 200N tensile stage: 'I use the Deben stage to test the tensile properties of electrospun nanofibrous networks that will be used as interleaves in laminated composites. The networks cover a range of properties, e.g. aligned or random orientation, with or without the addition of nanoparticles etc. Furthermore, the Deben stage is to be used during testing with Raman spectroscopy to try and identify if the nanoparticles are embedded in the nanofibres.' We asked her to identify the positives of using the Deben stage: 'The load cell's high sensitivity means that small force changes can be detected and measured, which other stages have failed to do.'

MT200 Tensile Stage for AFM



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



The Topographic (green) and stiffness (gold) images show paraffin film, both before stretching (left) and after stretching to more than 3x the original length (right).

Dr Torsten Mueller is a member of the development team at JPK Instruments, a nanoscience instrument maker based in Germany. Their main product is the NanoWizard AFM platform and due to user demand JPK needed to find a suitable micro stretching device. Dr Mueller explains the reasoning behind the choice of the the Deben Microtest 200N: "We decided to go with Deben for a number of reasons. 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.