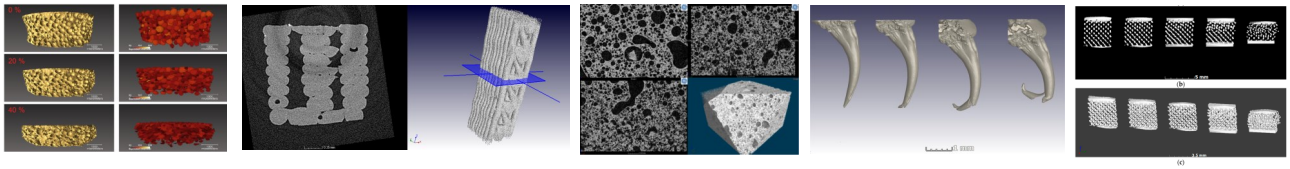
IN-SITU TENSILE AND COMPRESSION STAGES

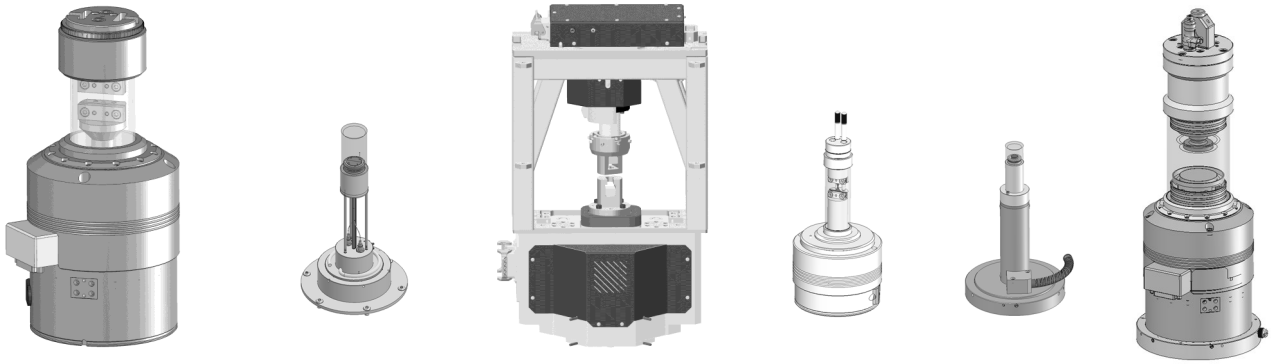
XRM - µXCT - Synchrotron

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. In-situ systems are specifically designed for X-Ray microscopy systems and provide tensile & compression loading from a few N up to 20kN and simultaneous torsion loading to 0.1kNm on the larger open frame systems.

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. In the petrochemical industry much work is carried out analysing core samples, we have users testing such cores in liquid baths. Tensile stages are available with optional 3 & 4 point bending clamps and are controlled from comprehensive Windows software via USB or RS-232 interface. 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.

- **Loads to 20kN / 0.1kNm**
- **Tensile, Compression, Torsion**
- **Heating & Cooling**
- **Liquid bath & gas chambers**





Systems

Stage	Max load	Exchangeable							
		Loadcells	Tensile	Compression	Torsion	Loadcell options	Heating	Cooling	In-Liquid
CT160	-	-	-	-	-	-	✓	✓	-
CT350	-	-	-	-	-	-	✓	-	-
CT500	500N	-	✓	✓	-	100N,200N,500N	-	-	-
CT5000RT	5kN	✓	✓	✓	-	1kN,2kN,5kN	-	-	✓
CT5000TEC	5kN	✓	✓	✓	-	1kN,2kN,5kN	✓	✓	✓
CT5000H250	5kN	✓	✓	✓	-	1kN,2kN,5kN	✓	-	✓
CT20KN	20kN/0.1kNm	-	✓	✓	✓	20kN/0.1kNm	✓	✓	✓

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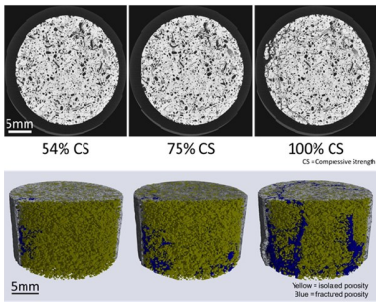
CT5000 in use for studies of geomaterials

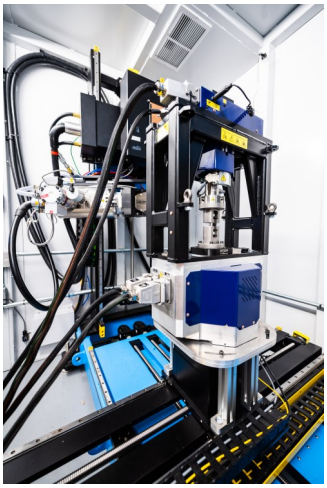


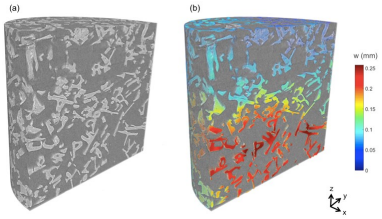
Professor Veerle Cnudde leads the PProGRess team (Pore-scale Processes in Geomaterials Research), one of the co-founding groups of the UGCT. The PProGRess group has the drive to understand the pore scale processes inside geomaterials in order to comprehend and model the macroscopical behaviour in rocks.

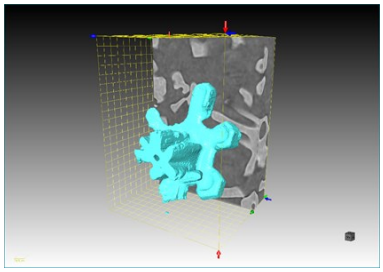
The Deben CT5000 tensile/compression stage not only offers the possibility to combine tensile and compressive strength tests with the X-ray CT scanners available at the UGCT. Asked why she chose to use the CT5000, Professor Cnudde said "The CT5000 system is one of the few systems which are highly adaptable 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."

CT20kN Open Frame testing rig installed at Auburn University

Deben UK installed a CT Open Frame testing rig at Auburn University in Alabama, USA. The Open Frame is a Tensile, Compression & Torsion rig capable of applying force of up to 20kN. It is designed for Synchrotron and room based X-ray CT imaging systems. The University have the Open Frame integrated with their Pinnacle X-ray Solutions Inc. PXS-500/90 CT system. They already have a long list of tests planned to run on their new Open Frame system and we look forward to seeing the results.







CT5000 in use for studies of homogeneous materials

Dr Fredrik Forsberg is an Associate Senior Lecturer in the Department of Engineering Sciences & Mathematics at Luleå University of Technology (LTU) in Sweden. His research goal at the x-ray microtomography lab is to develop methods and tools that help better understand heterogeneous materials and how they behave in different environments and at different spatial scales. Dr Forsberg describes one of the 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.

This study was quite challenging and required a lot of careful planning, but turned out very well. These measurements would have been very hard to achieve without the Deben CT5000TEC stage, since they required precise, simultaneous control of the mechanical load and the temperature (freezing capability)." Previously, we have mainly used test stages that we have built ourselves. However, none of these have had temperature control. A further great benefit in using the Deben stage is the flexibility in using different load cells which may be selected depending on material and application. Also, the software interface is easy to use and is supported by the Scout and Scan software from Zeiss that is used for control of the Versa."

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