X-Ray Tomography Lab - Materials characterisation and evolution

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, Strathclyde, Glasgow, United Kingdom

Operated by

Description

The X-ray Tomography lab at Strathclyde includes a Nikon XTH lab XCT scanner and a cutting edge suite of in situ environmental cells that together allow us to image and quantify the internal microstructure of a wide range of materials.
X-ray Computed Tomography is a non-destructive technique that enables imaging and quantitative characterization of the internal micro-scale structure of materials. In laboratory scanning image resolution is usually linked to the diameter of the sample being imaged, and our Nikon XCT scanner allows us to image everything from large diameter (<20cm) samples with ~50-100 micron resolution down samples of a few mm diameter with ~1.5 micron resolution. We can also support analysis of long samples (up to 60cm length) at all image resolutions. We regularly perform multi-scale studies capturing volumes at ever increasing resolution to fully describe the samples. We can collect a 3D image in as little as 10 minutes meaning we can also track the evolution of samples through time.
We have extensive expertise in imaging all geo-materials (rocks, soils, cements, concrete), as well as metals, ceramics, composites, biological materials (bone, plants, wood), pharmaceuticals, powders, foodstuffs, archaeology and museum artefacts, so please contact us to discuss your needs. We regularly support our users to quantify features of interest to many in this community including pores (and the phases filling them), fractures, mineralogy, fibres, bulk density variations etc.
If you think XCT may be useful, please contact us to discuss your project needs in more detail.

Scientific Environment

The XCT scanner is located within the Advanced Materials Research Laboratory alongside other advanced analytical capability (including XRD, SEM and a range of mechanical and thermal testing instruments), as well as 3D printing, and the suite of equipment for materials testing and chemical analysis available in the Civil & Environmental Engineering laboratories, mechanical and electrical workshops.

State of the Art

In addition to the scanner we host the NERC GeoX in situ suite, which is a pool of environmental cells that allow us to perform 3D imaging during the evolution of the sample. The GeoX suite enables experiments at a range of temperatures (from -20 C up to 1250 C) during compression or tensile testing (5kN and 10kN cells available, all of these have temperature capability while loading), and for porous materials we can also perform imaging during saturated and partially saturated flow. We have performed inhibition and fluid exchange experiments, as well as imaging micro-fracture network evolution, and fluid-rock interactions.
We operate a mail in service for basic XCT scanning, and provide support for all our academic users to enable them to process and analyse their data and help ensure optimal delivery of the project outcomes. This includes advanced techniques such as particle tracking and digital volume correlation, and image based modelling such as flow simulation through the scanned pore structure, and validation application of FEM, and DEM analysis for materials properties and behaviour.
Basic image analysis/interpretation is provided or supported as standard (including access and training on high end image processing software), but we can also perform advanced quantification on behalf of our industrial and academic users depending on project need (not included as part of standard service). Please contact us directly to discuss you needs.
We also deliver regular advanced training in data acquisition and analysis as applied to

Areas of Research

geology, environmental analysis, materials characterisation, materials design, barrier and grot technologies, metallurgy, corrosion, fatigue, civil engineering, environmental engineering, materials science, multi-phase flow

Installations

Quality Control / Quality Assurance (QA)

Quality Commitment

Data quality is controlled by the line manager. All protocols, systems and servicing are compliant with the UK Health & Safety Executive, and University guidelines. Additional and bespoke calibration can be applied as needed for the project, and users will be provided with training and support to highest quality data acquisition and accurate data interpretation and analysis.

CCUS Technologies

Storage

- Caprock/well integrity
- Monitoring
- Static modelling
- Dynamic modelling
- Sub surface characterisation, reservoir enhancement, grout technologies, multi-phase flow and fluid migration
- Leakage

Transport

- Flow Characterisation
- Fluid pathways changes in response to fluid-rock interaction, corrosion, fatigue

Capture

- Non-destructive imaging techniques can support a range of materials applications

Use

- Non-destructive imaging techniques can support a range of materials applications

Research Fields

- Fluid dynamics
- Chemistry/Geochemistry
- Geology/Geophysics
- Mechanics/Geomechanics
- Material science
- Physical processes
- Engineering

Scale of Facility

- Lab Scale

Research Facility Contact

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Facility Availability

Unit of Access (UA)
Day

Availability Per Year (in UA)
30 days

Forms of Access
In Person

Present Facility State of Access
Fully Accessible

Average Duration of a Typical Access
From 4 hours to 5 days per experiment depending on complexity.

Number of External Users for Typical Access

Operational or Other Constraints

Specific Risks
Data acquisition will be performed by trained users (usually your local contact who will have experienced working with similar materials/applications). Users are welcome to come to Strathclyde for their experiments. We offer a mail in service for standard scanning/samples, but for complex and in situ experiments attendance will be required and a risk assessment will need to be completed in collaboration with your local contact.

Legal Issues
none

Figures

NIKON XT H 225/320 LC COMPUTER TOMOGRAPHY

University of Strathclyde