# X-Ray CTX - HWU-RCCS (UK4.2)

## X-ray CT Scanner Facility

Last Updated: 2022-12-05T06:53:58

Edinburgh, United Kingdom

## Operated by

## Description

### Introduction:

X-ray computerised tomography (CT) is a non-destructive analytical technique used in engineering, science and medicine to visualise the internal structure of machine parts, computer components, man-made and natural materials. The CT Scanner analysis software can output a variety of files for further analysis, reprocessing and presentation, e.g. 2D x-ray images, 3D volume files, image slices, model animation and movies, as well as performing some advanced calculation techniques, e.g. defect analysis (porosity or inclusion), and flow and diffusion analysis (transport phenomena). This newly installed instrument is now fully operational offering imaging analysis across a broad range of research fields.

### Specifications:

| | |
|---|---|
| Up to 225 kV multi-metal reflection target | Spot size 3 to 225 µm (7 to 225 W) |
| Varian 14-bit detector, 2300 x 3200 pixels | Pixel size 127 µm / max. 3 fps |
| 5-axis manipulator, max. weight 15 kg | Circular and helical sample analysis |
| VG Studio's 3D inspection / analysis software | Inspect-X reconstruction software |

## Scientific Environment

The Research Centre for Carbon Solutions (RCCS) at Heriot-Watt University, is an interdisciplinary world-leading engineering centre, inspiring and delivering innovation for the wider deployment of technologies needed to meet necessary carbon targets. The RCCS occupy over 350 $m^2$, across ten separate and interlinked laboratories, with dedicated high-end analytical research instruments and many bespoke in-house designed systems and rigs for advanced research and process development dedicated to research into Carbon Capture, Storage, Transport and Utilisation, in addition to facilitating several projects in the fields of Low Carbon System and Negative Emission Technologies. Along with facilitating our core research activities, the RCCS welcomes Academic and Industrial collaborators, and offers external contract analysis services.

## State of the Art

Non-destructive imaging technique providing valuable information about the internal structure of an array of materials is accomplished using a Nikon XT H 225 CT Scanner is fitted with a

## CCUS Technologies

### Capture

- Non-destructive imaging technique with a range of applications

### Storage

- Non-destructive imaging technique with a range of applications

### Use

- Non-destructive imaging technique with a range of applications

### Transport

- Non-destructive imaging technique with a range of applications

## Research Fields

- Fluid dynamics
- Chemistry/Geochemistry
- Geology/Geophysics
- Mechanics/Geomechanics
- Material science
- Modelling
- Physical processes
- Engineering
- Non-destructive imaging technique with a range of applications

## Scale of Facility

- Lab Scale

## Research Facility Contact

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225kV x-ray gun, a 5-axis manipulator sample stage, and a 14-bit 3140x2360 pixel detector. The micro-focus x-ray gun has a multi-metal target and numerous filtration options, which allows the production of hard and soft x-rays, hence increasing the type of samples that can be analysed. The 5-axis manipulator stage allows for precise control of the sample during analysis in either circular or helical mode, and has a maximum sample weight limit of 15kg. The detector panel has a pixel size of 127µm, and can collect 65536 shades of grey, at up to 3 frames per second. The ultimate resolution of the system is dependent on numerous factors, including but not limited to, magnification and rotation intervals, but is typically in the range of 10-100µm.

## Quality Control / Quality Assurance (QA)

### Quality Commitment

Equipment calibrated and validated by qualified staff using recognised industry standard techniques

### ECCSEL RICC Representative

Audrey Ougier-Simonin
audreyo@bgs.ac.uk

### Website

https://rccs.hw.ac.uk/

# X-Ray CTX - HWU-RCCS (UK4.2)

## Facility Availability

### Unit of Access (UA)
Day

### Availability Per Year (in UA)
40 days

### Forms of Access
In Person

### Present Facility State of Access
Fully Accessible

### Average Duration of a Typical Access
Average interaction will be 1 UA (day)

### Number of External Users for Typical Access

## Operational or Other Constraints

### Specific Risks
Specialist research equipment will require qualified facility staff to operate, therefore access depending on resource and staff availability. A risk assessment will be required prior to any work taking place in the facility. All external visitors will undergo a safety induction and be provided with written safety instructions.

### Legal Issues
n/a

## Selected Publications


2019 - ACS Applied Materials and Interfaces. 11, 40, p. 36789-36799.
**Novel porous carbons derived from coal tar rejects: Assessment of the role of pore texture in CO2 capture under realistic postcombustion operating temperatures.**
García-Díez, E., Schaefer, S., Sanchez-Sanchez, A., Celzard, A., Fierro, V., Maroto-Valer, M. M. & García, S.

2019 - Faraday Discussions, 215, p. 329-344.
**A microfluidic photoelectrochemical cell for solar-driven CO2 conversion into liquid fuels with CuO-based photocathodes.**
Kalamaras, E., Belekoukia, M., Tan, J. Z. Y., Xuan, J., Maroto-Valer, M. M. & Andresen, J. M.

2019 - Energy Procedia. 158, p. 767-772.
**Thermodynamic Analysis of the Efficiency of Photoelectrochemical CO2 Reduction to Ethanol.**
Kalamaras, E., Maroto-Valer, M. M., Andresen, J. M., Wang, H. & Xuan, J.

2018 - Industrial and Engineering Chemistry Research. 57, 41, p. 13802–13810.
**High-Temperature CO2 Capture by Li4SiO4 Sorbents: Effect of CO2 Concentration and Cyclic Performance under Representative Conditions.**
Izquierdo, M. T., Saleh, A., Sanchez Fernandez, E., Maroto-Valer, M. M. & García, S.


## CCUS Projects

2019-2022 - EU-funded CCUS projects - ACT

**PrISMa**
Process-Informed design of tailor-made Sorbent Materials for energy efficient carbon capture, This project tailor-makes novel materials that yield optimal carbon capture solutions for a range of different CO2 sources and CO2 use/destinations. Of particular interest to this proposal is then capture materials optimised for CO2 conversion.

2017-2020 -EU-funded CCUS projects - ACT
**ALIGN-CCUS**
The project's aim is to support the quick and cost-effective deployment of CCUS, enabling Europe's industrial and power sectors to be part of a low-carbon future while remaining economically viable.

2016-2021 -EU-funded CCUS projects - ERC
**MILEPOST**
The ERC MILEPOST project will transform our ability to analyse and predict the behaviour of a wide range of pore-scale processes governing the macroscopic behaviour of complex subsurface systems and open up new horizons for science in other areas, e.g porosity controlled in polymers and bioprinting.

2016-2020 -EU-funded CCUS projects - RFCS
**PROMOTEE**
Functional porous carbon materials derived from coal tar for energy and environmental applications. This EU-Research Fund for Coal & Steel (RFCS) project is aiming at the development of novel porous carbon materials for energy and environmental applications using low value coal-derived liquids as the carbon precursors.

2017-2019 -Other CCUS Projects - EPSRC
**Low carbon jet fuel through integration of novel technologies for co-valorisation of CO2 and biomass**

2016-2020 -Other CCUS Projects - EPSRC
**Novel adsorbents applied to integrated energy-efficient industrial CO2 capture.**

2014-2022 -Other CCUS Projects - EPSRC
**CRITICAT**
Centre for Doctoral Training in Critical Resource Catalysis

2013-2020 -Other CCUS Projects - EPSRC
**Solar fuels via engineering innovation**

2013-2017 -Other CCUS Projects - EPSRC
**CO2 injection and storage - Short and long-term behaviour at different spatial scales**

2016-2019 -Main/major non-CCUS projects - Innovate UK
**Next Generation Green Data Centres for Environmental and Business Sustainability**

## Figures

Examples of material types and imaging capabilities.

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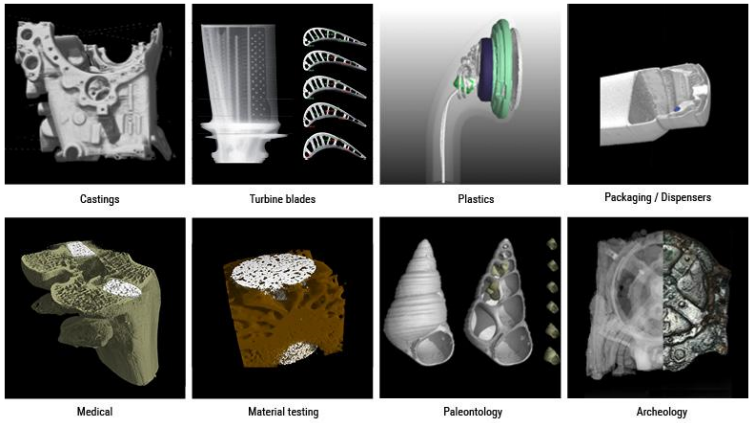
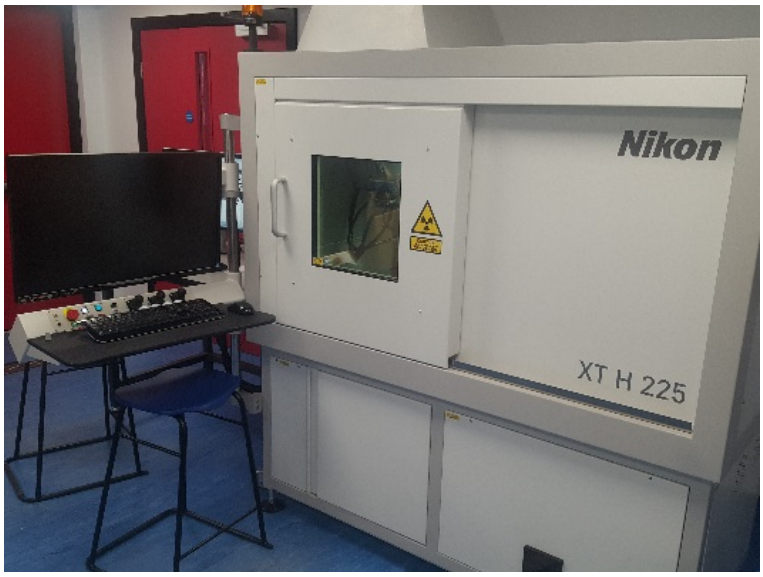
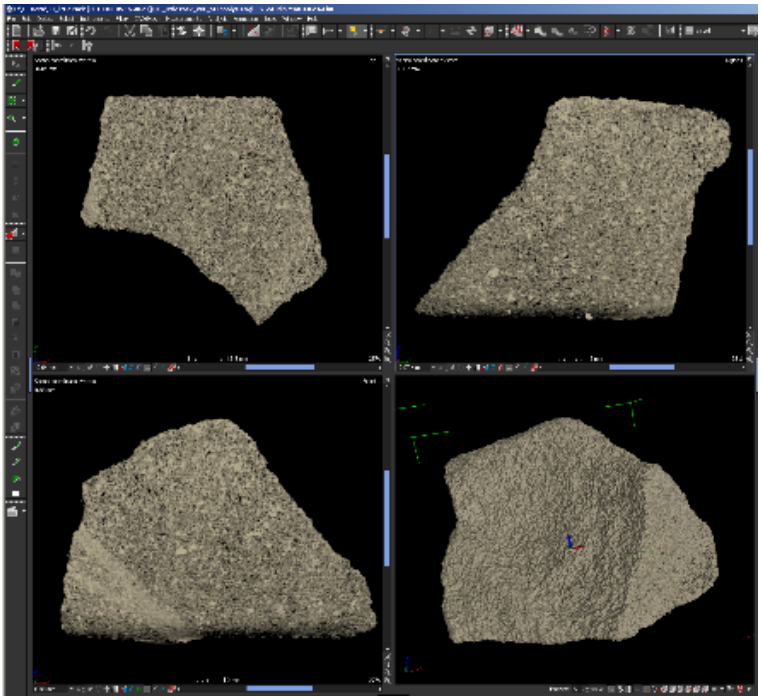
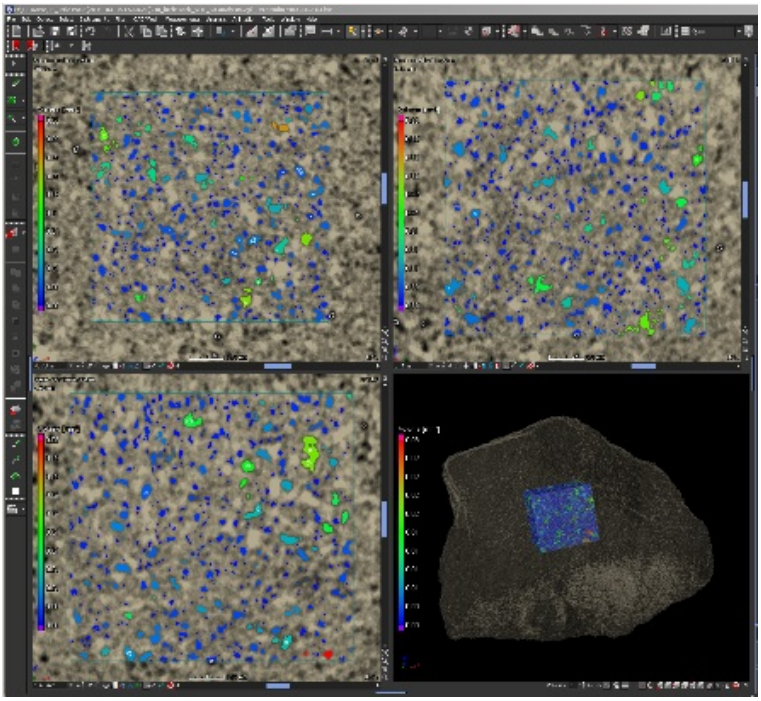



Nikon XT H 225 Scanner.

Rock images.





Porosity calculation .