HADES
A User Facility for High Activity Decommissioning Engineering Science
PI: Prof. Neil Hyatt

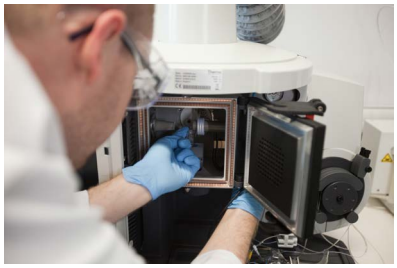
The University Of Sheffield.

The HADES Facility at the University of Sheffield is a national centre of research excellence supporting the UK nuclear decommissioning and disposal programme, as part of NNUF. HADES is accommodated within 500 m^2 of high quality radiomaterials chemistry laboratories, refurbished in 2015, with state-of-the-art equipment and instrumentation for materials formulation, processing, characterisation and performance assessment.

All HADES laboratories are designed and operated as supervised areas, for research with limited inventories of radioactive materials (unsealed sources). Controlled area laboratories enable work with MBq quantities of α and $\beta\gamma$ nuclides. The integrated nature of the Facility enables acceleration of materials optimisation, through rapid feedback between synthesis and characterisation.

The Facility is organised in a suite of capability platforms, for working with radioactive materials:

- **Materials handling.** Enabling glove box manipulation of α and $\beta\gamma$ nuclides under air or inert conditions (<ppm O_2, <ppm H_2O); comprehensive metallography suite with equipment for cutting and sectioning of materials, grinding and polishing.
- **Materials processing.** Thermal treatment of materials up to 1800°C under controlled atmosphere, with off gas analysis and quenching capability; the platform incorporates the UK's only radiological Hot Isostatic Press operating up to 2000°C and 200 MPa; suite of ball mills.
- **Diffraction and spectroscopy.** Including: X-ray diffraction (room temperature; high temperature and controlled atmosphere to 1200 °C; grazing angle capability); Raman and IR, ^{57}Fe Mossbauer; X-ray absorption and emission spectroscopy (XES, XANES, EXAFS).
- **Microscopy and microanalysis.** Optical microscopy; SEM with energy-dispersive X-ray analysis; and – via the Sheffield Hub of the Royce Institute – AFM, optical profilometry, and electron probe microanalysis.
- **Thermal and physicochemical analysis.** Coupled thermo-gravimetric, differential thermal/scanning calorimetry, and mass spectroscopy analysis; surface area analyser; pycnometer; particle size analyser; and high temperature glass rheology.
- **Chemical and radiochemical analysis.** ICP-OES; ICP-MS; ion chromatography; liquid scintillation counting; wavelength dispersive X-ray fluorescence analysis; total carbon and nitrogen analysis (coming soon).
- **Wasteform alteration and dissolution.** Suite of ovens and equipment for batch and dynamic corrosion experiments, under controlled atmosphere, for short and long duration corrosion experiments.
- **Radiometrics and radiological protection.** High resolution γ-spectroscopy; fixed personal contamination monitors in controlled area; a suite of large area survey meters, contamination monitors, and dose rate detectors available; personal dosimetry if required.



Inductively coupled plasma optical emission spectroscopy

Multimodal thermal analysis

HADES was established with investment of £1M by UKRI EPSRC and the University of Sheffield, in new state-of-the-art materials processing and characterisation equipment, to enable higher throughput research and work with high radionuclide inventories. The Facility incorporates prior investment of c. £8M in laboratory refurbishment, space, and equipment within the **MIDAS facility** and allied Royce Institute, to provide a single point of user access. It incorporates the **STX Facility**, the UK's first capability for laboratory based X-ray Absorption Spectroscopy.

A team of experienced researchers and experimental officers support the Facility, providing user training, supervision, and equipment calibration and servicing. Access to the facility may be in person, remote, or sample mail in.

Contact details

Please email **n.c.hyatt@sheffield.ac.uk** for a discussion about your potential project.

Availability

HADES is currently expected to be available for external users from early 2021. Please consult **https://www.nnuf.ac.uk/hades** for the latest information.

