



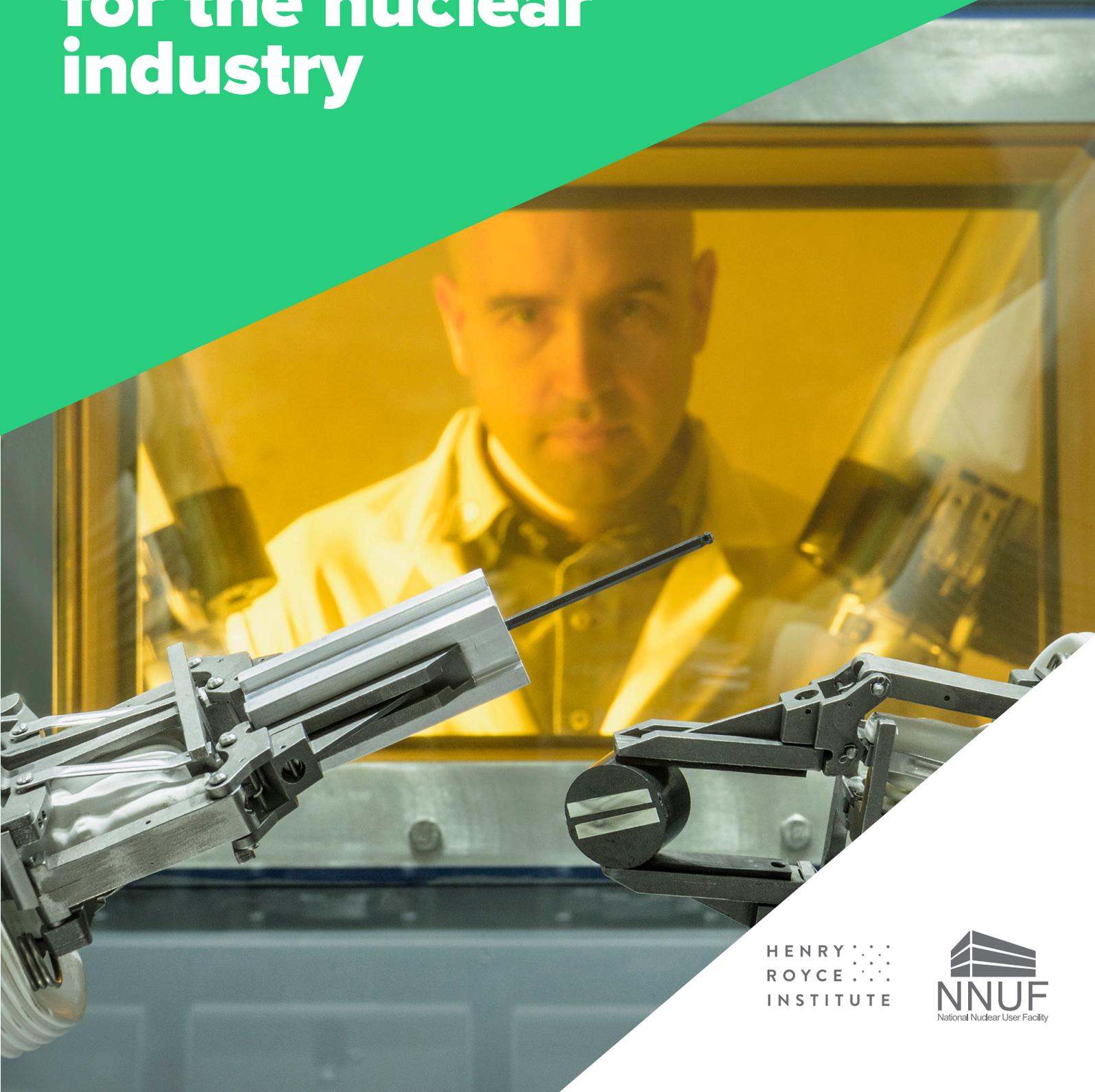
MATERIALS  
RESEARCH  
FACILITY



UK Atomic  
Energy  
Authority

# MATERIALS

## Developing materials for the nuclear industry



HENRY  
ROYCE  
INSTITUTE

  
**NNUF**  
National Nuclear User Facility

# Welcome to the Materials Research Facility

UKAEA's Materials Research Facility (MRF) is used to prepare and examine microscopic samples of materials to assess their performance in today's power stations and their suitability for use in future nuclear reactors.



# Introduction from Professor Ian Chapman



Located at UKAEA's Culham Science Centre near Oxford, the MRF allows academic and industrial researchers to analyse the effects of irradiation on materials. We offer affordable, convenient access for users from fission, fusion and other research programmes – bridging the gap between university and nuclear licensed site laboratories.

The facility was opened in May 2016 by the UK's Minister for Universities and Science, Jo Johnson. It has already received over £10 million of investment; £5 million of this from the UK Government's National Nuclear User Facility (NNUF) initiative.

Culham is presently one of eight NNUF sites. As well as the MRF, NNUF has funded UKAEA's ADRIANA laboratory, which has advanced gamma-ray detection equipment for use by universities, industries and other organisations.

The MRF is also part of the Henry Royce Institute for Advanced Materials. The facility is an important component of the Royce's nuclear materials theme and so the Royce has commenced a £5 million programme of investment in the MRF.

**Professor Ian Chapman**  
**CEO, United Kingdom Atomic Energy Authority**

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# A unique resource for nuclear materials researchers in academia and industry

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The materials in reactors face a unique combination of high temperatures and fast-moving neutrons produced by nuclear reactions. Developing materials that can survive for long periods in these conditions is a high priority. Data from the MRF is used in three main ways:

- ▶ Making existing nuclear power stations safer and helping to extend their operational life;
- ▶ Informing the design of future generations of UK fission reactors;
- ▶ Developing prototype fusion power plants.

In hot cells we can take specimens up to TeraBecquerel levels and from these cut, polish and encapsulate small samples for analysis either on-site or back at your institute. Most on-site analysis equipment is in shielded rooms operated remotely from the MRF control room, allowing experiments on samples with radioactivity up to GigaBecquerel levels. There are also facilities for work on tritium, beryllium and other hazardous materials.

Experienced staff from UKAEA operate the MRF and provide users with support in sample preparation and analysis, as well as logistics advice for the transport of materials.

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# MRF capabilities

## Sample preparation

- ▶ Hot-cell slow-cut saw, grinding and polishing
- ▶ Hot-cell Lab-scale Electro Discharge Machining
- ▶ Cutting, grinding, polishing in glove boxes and for non-active materials
- ▶ Twin jet Electrolytical Polishing for TEM discs, Bulk Electrolytical polishing



- ▶ Precision Ion-beam Polishing
- ▶ Sputter Coater

## Thermo-physical characterisation

- ▶ Thermal Desorption Spectroscopy
- ▶ Laserflash Analyser
- ▶ Dilatometry
- ▶ Simultaneous Thermogravimetical Analyser



*Equipment prior to installation in shielded rooms*

- ▶ Equipment for plasma exposure and tritium retention

## Microstructural analysis

- ▶ Scanning Electron Microscope (with EDX, EBSD, TKD, WDS)
- ▶ Focussed Ion Beam
- ▶ Atomic Force Microscope
- ▶ Positive Material Identification X-ray Fluorescence

## Mechanical testing

- ▶ Universal testing load frame 10 kN, Fatigue load frame 15 kN, In-situ SEM load frame 5 kN
- ▶ Nanoindentation

**There will be further investment from 2018 to 2020 expanding all these capabilities.**



# The National Nuclear User Facility



The MRF is part of the UK's National Nuclear User Facility (NNUF, [www.nnuf.ac.uk](http://www.nnuf.ac.uk)). Established in 2013 as part of the Government's Nuclear Industrial Strategy, NNUF gives academia and industry access to internationally-leading equipment for research on radioactive materials.

UKAEA's other NNUF activity is **ADRIANA** (Advanced Digital Radiometric Instrumentation for Applied Nuclear Activities). ADRIANA provides instruments for use by industrial and university researchers at Culham and at the Universities of Lancaster and Liverpool. We have state-of-the-art high resolution gamma spectrometry systems with digital signal processing and analysis software. This equipment can be used to support power stations, nuclear security applications and decommissioning operations, as well as research projects.

# The Henry Royce Institute

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The MRF is also part of the Henry Royce Institute [www.royce.ac.uk](http://www.royce.ac.uk), which has been established by Government to allow the UK to grow its world-leading research and innovation base in advanced materials science, which is fundamental to all industrial sectors and the national economy. The Royce has its hub at the University of Manchester and has nine core research areas, one of which is nuclear materials.

## EPSRC

Engineering and Physical Sciences  
Research Council

The Henry Royce Institute and NNUF both receive their funding from the Engineering and Physical Sciences Research Council.



## How to apply for access

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For MRF, access models and costs will vary as they depend greatly on the work to be carried out. Factors include the type of material, its activity and associated costs (for example, for radioactive waste disposal), the amount of hot cell work, and which instruments are used. We will be happy to advise you before you submit grant applications that include use of the MRF.

Please also visit our website [www.ccf.ac.uk/mrf.aspx](http://www.ccf.ac.uk/mrf.aspx)

All enquiries concerning use of the Materials Research Facility should be sent to [info@mrf.ukaea.uk](mailto:info@mrf.ukaea.uk) For use of ADRIANA equipment please email [info@adriana.ukaea.uk](mailto:info@adriana.ukaea.uk)

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The UK Atomic Energy Authority's mission is to lead the commercial development of fusion power and related technology, and position the UK as a leader in sustainable nuclear energy



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Find out more  
[www.gov.uk/ukaea](http://www.gov.uk/ukaea)



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