



Swansea
University
Prifysgol
Abertawe

Steel and Metals Institute
Sefydliad Dur a Metelau



STEEL AND METALS *INSTITUTE*

samiswansea.co.uk
enquiries.sami@swansea.ac.uk

ABOUT *US*



SaMI is an open access facility created to provide practical research solutions for the steel and metals industry. We achieve this through a combination of our expertise and equipment capability.

We bring together skills and knowledge with an adaptable environment, enabling our leading academic experts and industrial technologists to design and implement bespoke research that delivers innovation and industrial decarbonisation.

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SAMI IN *SUMMARY*

**INDUSTRIAL
DECARBONISATION**

**COLLABORATIVE
RESEARCH
BIDS & PROJECTS**

10+ EXTREME GAS ENVIRONMENTS

NET ZERO MANUFACTURING
& MATERIALS
PRACTICAL SOLUTIONS

20+ INDUSTRIAL PARTNERSHIPS
ACROSS SEVERAL INDUSTRY SECTORS

15 ACADEMIC
& INDUSTRY
EXPERTS

£28M+
RESEARCH
INCOME



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RESEARCH CAPABILITIES

SaMI was founded at Swansea University to help the steel and metals industry and supply chain decarbonise through lower carbon products and processes, reduced carbon emissions, and creation of a circular economy.

ACADEMIC EXPERTISE AND EQUIPMENT CAPABILITY

- Bespoke testing & evaluation in extreme environments
- Innovative, effective pilot scale product and process development for alloys and downstream
- Product characterisation
- Fatigue, fracture and annealing analysis
- Product and process integrity testing of materials

“With our flexible approach and ability to create bespoke testing, we are focusing our expertise more broadly on industrial decarbonisation solutions”

Dr Barrie Goode
Director of Industrial Research & Development

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WORK WITH US

Confidentiality, trust, and listening...

RESEARCH PARTNERSHIPS TO BENEFIT INDUSTRY

Our professional industry partnership provides versatile, bespoke support. We develop research activity based on what companies need, taking a flexible approach and listening to our customers to determine how best to support their research and innovation.

We are adaptable and physically bring together an extensive network of academic specialists and industrial innovators.

HOW DOES SAMI'S RESEARCH PARTNERSHIP WORK?

We develop directly funded projects with companies and other customers for specific research as well as collaborative research applications requiring industrial-academic collaboration.

How we establish our partnership is flexible and comes down to what works best for you. Our expert team of researchers will work closely with you to determine how best to support your research and innovation.

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TESTIMONIALS

Neil Jenkins BSc MRICS
Director, Creo Group



We approached SaMI to test Creo's designs for an internal coating system to prevent embrittlement of the steel in the tanks, to make them safer with longer lifespans. We also collaborated on Innovate UK grants. We would have no hesitation in working or collaborating with SaMI again on steel or hydrogen projects.

Peter Warren
Development Metallurgist, British Steel



Between British Steel and Tata Steel we have worked closely with Mike Dowd who through his considerable and unique expertise and experience supplied a full results analysis with valuable insight. SaMI's standard of work and analysis are of the highest quality.

Dr Chris Weirman
Technology Director, Wall Colmonoy Ltd



Mike Dowd's thorough understanding of the field of high intensity corrosion resistance has enabled the adoption of a range of testing criteria. Understanding the product's performance to a more detailed level with this testing. Only working closely with SaMI was this possible. We're extremely thankful SaMI's approach allows an SME like us to have the option to research this data.

PILOT *NET ZERO*



PRODUCT AND PROCESS DEVELOPMENT

Our pilot team develop new or alternative practices to simulate as closely as possible an industrial process, working with any industry that wants to carry out research on, or improve on, an alloy or other materials.

Our VIM uses electricity to create an induction field around materials prone to react in an induction field that will heat and melt them. The process takes place in a vacuum chamber to remove any gases that might react with the heating or molten material.

Other metals that won't react to an induction field can still be melted with the additional use of electrodes. We also have the capacity to melt with open top furnaces which are open to the atmosphere.

Our pilot lab has the potential to run with minimal to no carbon emissions as our VIM and rolling mills can be run on renewable electricity.

AT A GLANCE

- ◆ 2 vacuum induction melting furnaces
- ◆ Hot-rolling simulation mill
- ◆ Range of high-temperature furnaces

As we can get a vacuum in the VIM of e^{-5} mbar and have tight control of all the parameters we have a higher probability of getting an accurate composition free from contaminants compared with melting under atmospheric conditions. The capacity of our furnaces are between 5 and 50kg depending on what we are melting.

ACCURACY & CAPACITY

PILOT *NET ZERO*

CUSTOMERS AND PARTNERSHIPS

We establish our industry partnerships with customers looking to carry out research on, or improve on, an alloy or other materials.

We developed our expertise with steel, however we work with any metals, and are developing our capabilities to work with other non-ferrous materials such as glass. Our diverse team of experts have the skills and capabilities to alter processes, to conduct experiments and develop bespoke methods for undertaking projects.

One of our strengths is that we support smaller companies to enable them to win manufacturing contracts and develop capabilities with machinery that would otherwise be unavailable to them. We also work closely with industry to develop practical decarbonisation solutions.

RESEARCH HIGHLIGHT

Cost effective ways of recycling by-products classified as “waste” into clean usable alloys, and other usable products and materials. This work will help create a circular economy towards industrial decarbonisation.

“We developed our expertise working with steel, now we work with any metals and other non-ferrous materials such as glass”

PHILL STADDON
Technology Support Officer

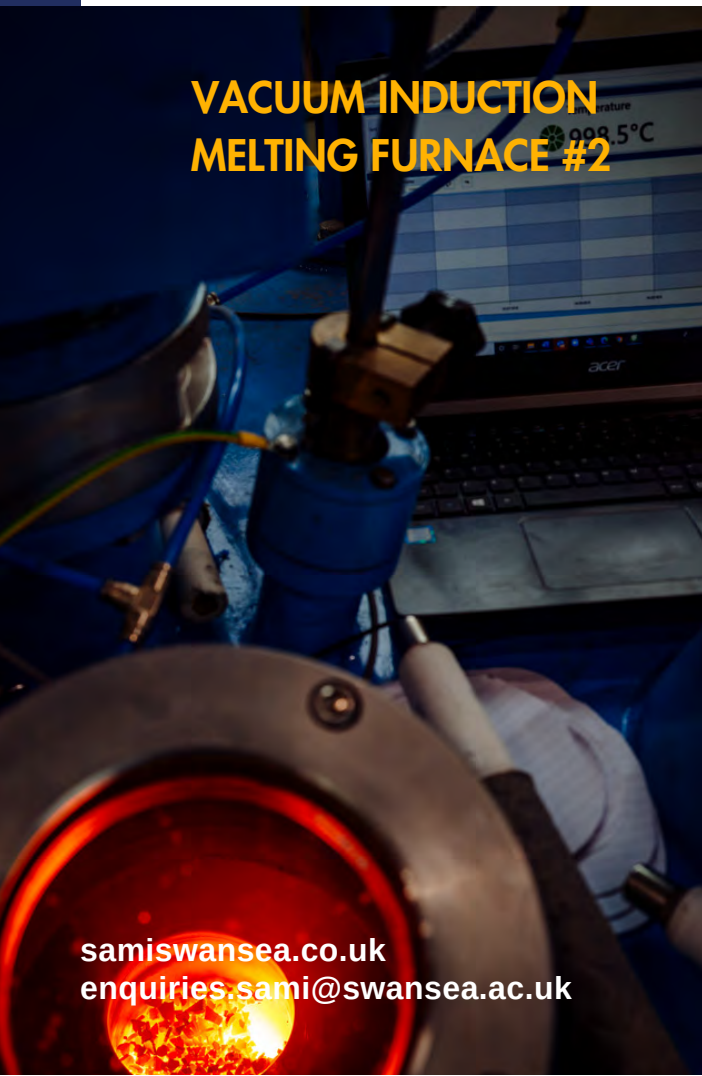
PILOT *NET ZERO*

VACUUM INDUCTION MELTING FURNACE #1



PARAMETER	DETAILS
Temp. range	Current liner set up to 1650°C Others up to 1850°C
Melt size capability	3kg - 50kg
Vaccum	e ⁻¹ 5 mins e ⁻² 25 mins e ⁻³ 30 mins e ⁻⁴ 1 hr e ⁻⁵ 12 hrs
Atmospheres	Argon & Nitrogen atmosphere max. 780 mbar
Casting	Standardly casting up to 60kg moulds Can cast into a mould up to 1m * 1m * 1.5m

VACUUM INDUCTION MELTING FURNACE #2



PARAMETER	DETAILS
Temp. range	Current liner set up to 1650°C Up to 1850°C with new liners
Melt size capability	25kg - 60kg
Vaccum	e ⁻¹ 15 mins
Atmospheres	Argon & Nitrogen atmosphere max. 450 mbar
Casting	Up to 60kg moulds



PILOT *NET ZERO*

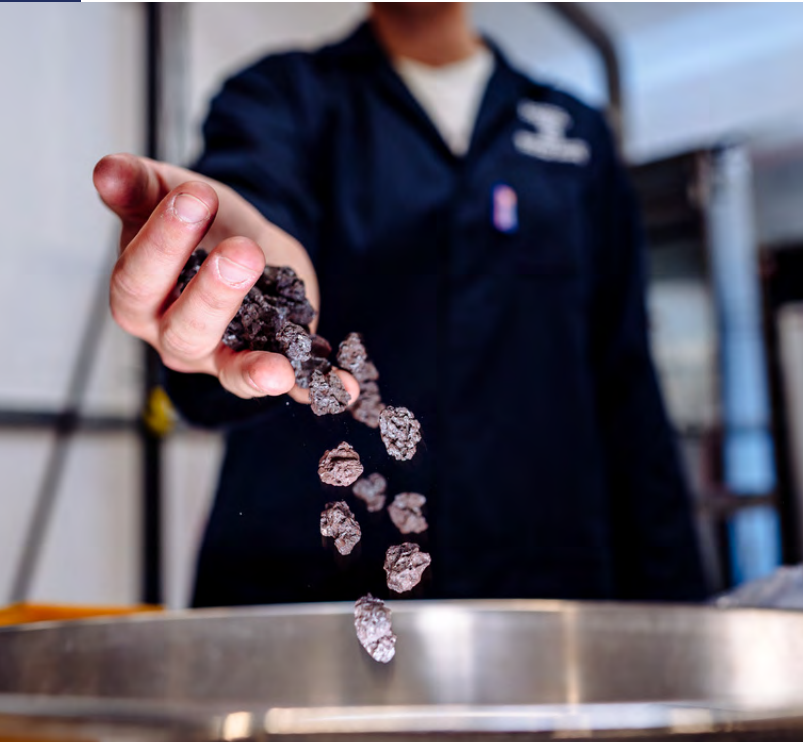


HOT ROLLING MILL

PARAMETER	DETAILS
Product thickness range	3.4 - 68mm
Roll force range	80 tonne split between rolls
Run out table features	Max. 0.102 m ³ / hr flow rate with 26 headers top & bottom
Product range	Any metal – can design a schedule to fit load capabilities for any material

SINTEC

DECARBONISATION



SIMULATION AND INTEGRITY TESTING IN EXTREME CONDITIONS

Our SINTEC lab enables process simulation and asset integrity testing of materials at very high temperatures in reactive gas environments such as hydrogen, carbon monoxide and sulphur dioxide.

We deliver optimised materials testing solutions for all industry sectors, working closely with customers to deliver practical solutions.

By simulating industry processes on the lab scale we can research breakthrough technologies to address industrial decarbonisation and net zero manufacturing and materials.

RESEARCH HIGHLIGHTS

- Looking at how materials behave in the hydrogen reduction process with our reducibility rig that simulates what happens to materials at very high temperatures in gas-laden environments.
- Researching fuel switching opportunities, looking at using less carbon heavy or carbon free fuel sources such as biomass or hydrogen to reduce carbon emissions.

Corrosion fatigue life assessment

Fire & ignition testing

Heat treatment with controlled atmosphere

Hydrogen embrittlement combined mechanical testing

Industrial gas sampling

Iron ore reduction

Pyrolysis, gas chromatography, mass spectrometry

Thermogravimetric analysis

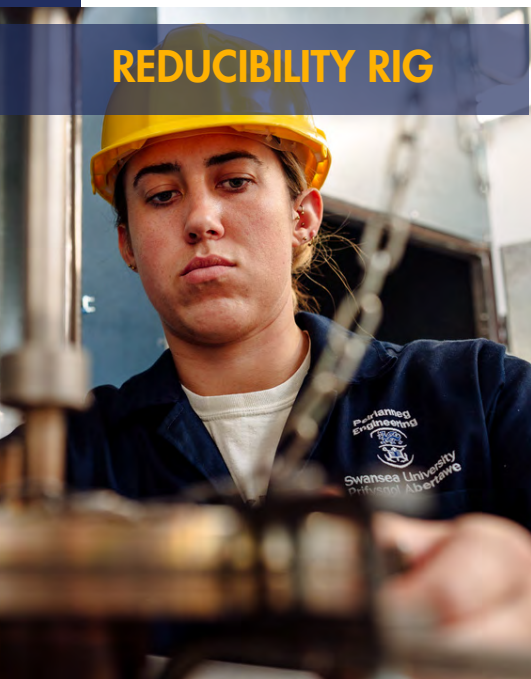
Wet SO₂ and sour service corrosion

CAPABILITIES

SINTEC

DECARBONISATION

REDUCIBILITY RIG



PARAMETER	DETAILS
Range of environments (gases)	CO, CO ₂ , H ₂ , N ₂
Programme range	Blast furnace, DRI, RDI
Product testing type	Iron ore, carbon capture materials, scrap, refractories
Temperature capability	1100°C
Flow rates	0.5-26 L/min
Augmentations	Gas analysis (CO, CO ₂ , H ₂) Gravimetry (+/- 0.1g)

VISUALISATION FURNACE

TGA

PARAMETER	DETAILS
Range of environments (gases)	CO, CO ₂ , N ₂ , H ₂ , CH ₄ , NH ₃
Programme range	Heat treatment and visualisation
Product testing type	Metals, ceramics
Temperature capability	1600°C
Flow rate	Max. 5 L/min
Augmentation	High speed and thermal imaging Gas analysis (CO, CO ₂ , H ₂) Hydrogen gas safety system O ₂ sensor purge switch

PARAMETER	DETAILS
Range of environments (gases)	CO, CO ₂ , H ₂ , N ₂ , Air-SO ₂
Programme range	Thermal Gravimetric Analysis
Product testing type	Metals
Temperature capability	1600°C
Flow rate	Max. 5 L/min

SINTEC *DECARBONISATION*

HORIZONTAL FURNACE

PARAMETER	DETAILS
Range of environments (gases)	CO, CO ₂ , N ₂ , H ₂ , CH ₄ , NH ₃
Programme range	Heat treatment
Product testing type	Metallic, Refractory
Temperature capability	1200°C
Flow rates	Max. 5 L/min
Augmentations	Gas analysis (CO, CO ₂ , H ₂) Hydrogen gas safety system O ₂ sensor purge switch

ENVIRONMENTAL CHAMBER RIG

PARAMETER	DETAILS
Range of environments (gases)	H ₂ , N ₂
Programme range	Fatigue
Product testing type	Metals, ceramics
Temperature capability	1800°C (induction coil)
Flow rate	5 L/min
Augmentation	Emissivity correcting pyrometry Hydrogen gas safety system

SUPPORTING CAPABILITIES

FATIGUE AND FRACTURE

SaMI has the ability to provide information on the mechanical properties of materials and components, using its suite of mechanical testing machines to perform destructive testing.

- Two Tensile Testing machines
- Four Universal Testing machines
- A 450J Charpy Impact tester
- A 600kN Sheet Press Machine
- 20kN High Strain Rate Machine

Given the versatility of the machines to perform multiple test types on uniquely shaped components, SaMI has been able to produce novel tests using bespoke machined equipment.

250kN FATIGUE RIG

PARAMETER	DETAILS
Maximum specimen dimensions	3-point bend testing, tube length max. 2500mm Static & dynamic testing on specimens max. 750mm tall & 450mm diameter
Max. loading capability	250kN (approx. 25 tonnes)
Displacement rate	Max. 100mm/s
Maximum cyclic load	Max. 200kN (cyclic frequency and component shape depending)
Additional information	Interchangeable load train fixtures to accommodate novel and bespoke testing

CHARACTERISATION

- Field Emission Gun Scanning Electron Microscope (FEG-SEM)
- Vickers Hardness Testing
- Precision Polishing
- Optical Emission Spectroscopy (OES)
- Glow-Discharge Optical Emission Spectroscopy (GDOES)





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