HILT CRC

Australian Government
Department of Industry, Science and Resources

Cooperative Research Centres Program

PROJECT SUMMARY

OFP002: EXPERIMENTAL EVALUATION OF METALLOTHERMIC PROCESSING OF AUSTRALIAN IRON ORES

OVERVIEW

Decarbonising iron and steel production will require new ways of turning iron ore into metal without using coal. Current dominant pathways for rely on hydrogen, but with concerns about cost and availability of green hydrogen, there is a growing interest in non-hydrogen-based processing routes. Metallothermic reduction is one such option, but its technical and commercial feasibility for Australian ores is not yet well understood.

Helios is developing a new metallothermic ironmaking process that uses sodium instead of carbon as the reductant. The process emits oxygen rather than CO_2 and is designed to work with low-grade ores, tailings, steelmaking slags and red mud – materials that are difficult or uneconomic to treat through conventional routes.

This project will run an experimental campaign on Australian samples to evaluate how the Helios process performs across a wide range of iron-bearing materials and operating conditions, and to help determine its potential as a breakthrough pathway for green iron production.

PROJECT DETAILS

As a Stage 1 Opportunity Fund project under Program 1 – Processing Technologies, OFP002 will:

- Test the Helios sodium-based metallothermic process on Australian materials, conducting laboratory-scale trials in a dedicated reactor at Helios' facility, focusing on the first step of the Helios 'cycle': the reaction of iron-bearing feedstocks with sodium at controlled temperatures, followed by two solid–liquid separation stages to remove and recover sodium from the reduced iron product.
- Assess a diverse set of feedstocks from HILT partners, processing 8–16 samples spanning low-grade iron ores, iron ore tailings, basic oxygen furnace and electric arc furnace slags, filter cake and alumina-industry red mud, to demonstrate the versatility of the technology and its applicability to real industrial materials.
- Map process performance across key operating parameters, running a series of experiments that vary temperature, sodium-to-ore ratio, dwell time and total mass loaded, and reporting mass balance, metallisation and iron yield for each material–condition scenario.
- Undertake detailed materials characterisation to quantify phase composition and metallisation before and after processing, building a comparative dataset of performance for each feedstock.
- Enable external scrutiny and validation – inviting interested HILT CRC industry and research partners to observe experiments at Helios' laboratory and to review detailed technical reports, lifting the technology's readiness level and de-risking future collaboration.

The work will move the Helios process from technology readiness level (TRL) 3 to TRL 4 for Australian materials, providing the experimental foundation needed to consider larger-scale trials or follow-on R&D.

PROJECT LEADER

Inbal Shenfeld, Helios

PARTNERS

- Helios
- Swinburne University of Technology
- Australian National University
- Grange Resources
- Hancock Iron Ore
- South32
- BlueScope

INDUSTRIES

- Iron & Steel

TOTAL PROJECT VALUE

$1,127,451 (cash and in kind)

COMMENCED

18 August 2025

END DATE

17 January 2026

CONTACT

For more information on this project, contact enquiries@hiltcrc.com.au

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OFP002: EXPERIMENTAL EVALUATION OF METALLOTHERMIC PROCESSING OF AUSTRALIAN IRON ORES

HILT CRC MILESTONES

- 1.1 Producing green iron products from magnetite
- 1.2 Producing green iron products from hematite/goethite ores

RESEARCH AREAS

- Decarbonising production of green iron products from magnetite ores
- Low-grade ore beneficiation

PLANNED OUTCOMES & BENEFITS

OFP002 will deliver:

- Laboratory-scale proof-of-concept for the Helios metallothermic process using a representative suite of Australian ores, wastes and by-products.
- A comprehensive dataset and technical reports for each tested material, including operating parameters, mass balance, iron yield and product characterisation.
- Independent validation and shared understanding of process performance among HILT CRC partners, through direct involvement in sample provision, observation of experiments and scrutiny of results.

For HILT CRC industry partners, the project offers an early, low-risk opportunity to see how their own materials perform in a potentially disruptive green ironmaking technology, helping them assess future options for enhancing and adding value to low-grade ores and waste streams and informing decisions on deeper engagement with Helios and subsequent demonstration projects.