HILTCRC

Australian Government
Department of Industry, Science and Resources

Cooperative Research Centres Program

PROJECT SUMMARY

OFP001: 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 – using reactive metals such as calcium, magnesium, sodium or aluminium instead of carbon – is one such option, but its technical and commercial feasibility for Australian ores is not yet well understood.

This project will deliver a first-stage evaluation of metallothermic ironmaking routes for Australian iron ores and relevant steelmaking by-products. It will combine thermodynamic modelling, small-scale experiments and preliminary cost analysis to assess energy requirements, impurity behaviour, reductant recycling options and economic feasibility. The aim is to evaluate metallothermic processing as a potential pathway for low-carbon iron production.

PROJECT DETAILS

As a Stage 1 Opportunity Fund project under Program 1 – Processing Technologies, OFP001 will:

- Screen candidate metallothermic routes using thermodynamic modelling to assess how different reductants (e.g. calcium, magnesium, aluminium, sodium, silicon and manganese) perform with Australian hematite/goethite and magnetite ores and selected steelmaking by-products, including energy demand and extent of reduction.
- Investigate impurity and by-product behaviour by examining how gangue elements and alloying constituents partition between metal and slag phases and what valuable or problematic by-products might be generated.
- Conduct laboratory trials, including limited high-temperature experiments on selected ore–reductant systems, to demonstrate proof-of-concept, assess product yield and microstructure, and observe the onset of thermite-type reactions (in which a reactive metal reduces a metal oxide to produce molten metal and an oxide of the reductant).
- Explore reductant recycling options using modelling to identify plausible routes to recover and reuse the oxidised metal reductant, which is critical to the economics of the process and environmental performance.
- Undertake a preliminary technoeconomic assessment to estimate energy consumption, reductant usage, operating costs and overall economic viability under different assumptions for metallisation and recovery efficiency.

Findings from Stage 1 will be used to decide whether to progress to a Stage 2 project focused on detailed kinetics, reactor concept design and upscaling pathways to pilot-scale demonstration.

PROJECT LEADER

Professor Akbar Rhamdhani,
Swinburne University of Technology

PARTNERS

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

INDUSTRIES

- Iron & Steel

TOTAL PROJECT VALUE

$247,651 (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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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
- Decarbonising production of green iron products from hematite/goethite ores
- Low-grade ore beneficiation

PLANNED OUTCOMES & BENEFITS

OFP001 will deliver:

- A thermodynamic and process feasibility assessment for metallothermic iron production using Australian ores and selected by-products, identifying promising reductants, operating windows and technical risks.
- Laboratory evidence of process technical viability, including demonstration of at least one metallothermic route and associated product characterisation.
- Assessment of economic and energy-use relative to conventional and emerging low-carbon routes, highlighting key cost and performance drivers.
- A clear recommendation on next steps, including whether a Stage 2 program on kinetics, reactor concepts and pilot planning is justified.

For HILT CRC's industry partners, the project offers an early, low-cost assessment of a potentially disruptive green ironmaking pathway, helping them decide whether to engage in deeper R&D and future demonstration activities.