HILT CRC

Australian Government
Department of Industry, Science and Resources

Cooperative Research Centres Program

PROJECT SUMMARY

RP2.016: PHYSICAL AND CHEMICAL PROPERTIES OF ORES ASSOCIATED WITH NEW PROCESSING TECHNOLOGIES

OVERVIEW

The heavy industry sector is exploring new ways to process ores using low-carbon technologies, such as those associated with electrification- and hydrogen-based methods. This project seeks to understand the physical and chemical behaviours of ores as they are converted, using such technologies in alternative reduction and calcination atmospheres. Low-carbon approaches also introduce different heating rates compared to conventional systems, potentially affecting how ores react chemically and physically during processing.

This project aims to assess the impact of new reactor conditions and heating techniques by studying their influence on the properties of reacting ores in real-world conditions, which can differ significantly from traditional lab settings. This will assist HILT CRC Partners in understanding how new low-carbon technologies may influence their product quality and production rate, as well as the optimal design of such technologies.

Additionally, the study seeks to improve the flexibility and accuracy of measuring an ore's heating history, as current systems have limited ability to adapt rapidly to changes in heat flux. Better in-situ detection methods are needed to provide more comprehensive data during ore processing, helping to develop more accurate simulation tools for industry Partners.

PROJECT DETAILS

This project aims to de-risk the use of emerging low-carbon, high-temperature reduction and calcination reactors for the processing mineral ores by providing new and complementary measurements and models of the transient behaviour of these materials as they pass through representative profiles of temperature, atmosphere and heating rates.

These state-of-the-art, in-situ measurements will be coordinated with other types of measurements to provide data to other HILT CRC projects to assist Partners in understanding how to optimise reactors to address mineral processing challenges in low-carbon reactors, such as sticking behaviour.

The project also aims to develop computational models needed for reactor design and upscaling. This involves the use of tools such as computational fluid dynamics for reactors relevant to iron ore reduction (such as pellet, fluidised bed and flash reactors), or calcination of alumina and lime.

The project will build a new measurement system to provide in-situ measurement of temperature, mass, morphology and stickiness through precisely controlled reduction or calcination atmospheres, together with heat fluxes that can match industrial reactors. Some of these properties are presently unable to be analysed via conventional methods, while others can be measured but require access to specific facilities.

The project aims to provide HILT CRC Partners with:

- A measurement system for studying the kinetics and physical properties of their specific ores as they are processed under different heating rates and reacting atmospheres, particularly those related to new decarbonisation technologies.
- Reliable data and understanding to inform decisions on: (a) the most suitable technology for decarbonisation based on specific ores; and (b) de-risking technique development and upscaling.

PROJECT LEADER

Dr Zhiwei Sun,
The University of Adelaide

PARTNERS

- The University of Adelaide
- The University of Newcastle
- Australian National University
- Norsk Hydro
- South32
- Emirates Global Aluminium
- Calix Limited

INDUSTRIES

- Alumina
- Cement & Lime
- Iron & Steel

TOTAL PROJECT VALUE

$1,173,990 (cash and in kind)

COMMENCED

01 September 2024

END DATE

31 August 2026

CONTACT

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

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IDENTIFIED PATHWAYS

- New technology to accommodate multiple energy sources and offer flexibility in switching between them
- Alternative low-carbon ironmaking
- Low-carbon alumina and lime – calcination
- Low carbon iron – hydrogen and electrification

OUTCOMES

- A laboratory analysis system for measuring the physical and chemical properties of reacting ores.
- Knowledge/datasheets of ore properties as they are processed in new reduction and calcination atmospheres and heating methods/sources, along with an associated report, providing valuable insights for reactor design, operation and optimisation for each ore.