

Academic Supervisor Looking for an Industry Partner

Sustainable Valorisation of Industrial Mineral Residues for Critical Metals Recovery

Chemical Sciences (Materials Chemistry and Process Engineering)

Industrial residues from mining and large-scale processing—such as tailings, sludge, and mineral by-products—represent both a significant environmental liability and an underutilised resource. These materials are typically stockpiled, creating long-term risks related to land use, alkalinity, and trace element mobility. At the same time, they contain measurable concentrations of critical raw materials, particularly rare earth elements (REEs), which are increasingly important for modern technologies and industrial resilience.

This project develops an integrated and predictive process framework for the recovery of critical metals from industrial mineral residues. The approach moves beyond conventional single-step extraction by combining physical separation, targeted hydrometallurgical processing, and process modelling to enable efficient and scalable resource recovery.

The methodology focuses on:

- ❖ **Selective mineral upgrading** to concentrate metal-bearing phases and improve accessibility
- ❖ **Low-intensity hydrometallurgical recovery** to extract high-purity metals while minimising reagent use and energy demand
- ❖ **Process modelling and simulation** to optimise performance, reduce uncertainty, and support scale-up

Unlike conventional approaches, the framework is designed to be adaptable across multiple residue types, enabling broader industrial applicability rather than being limited to a single feedstock.

Industry Relevance

The project directly addresses key industry challenges:

- high costs and liabilities associated with waste storage
- increasing demand for critical raw materials
- pressure to improve resource efficiency and meet circular economy targets

It enables:

- conversion of waste into revenue-generating resources
- recovery of critical materials without new mining
- development of scalable, cost-effective processing strategies

Expected Outcomes

- Integrated and scalable process flowsheets for residue valorisation
- Recovery of high-value critical metals from existing waste streams
- Reduction in environmental liabilities and waste management costs
- Improved process predictability and reduced scale-up risk

Industry Mentor Role

- Provide input on relevant industrial residues and constraints
- Offer periodic advisory feedback (low time commitment)
- No requirement for proprietary data sharing

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