

Faculty of Engineering

ASPIRE Summer Research Program 2026-2027

Project Title:

Green Electrowinning: Decarbonising Metal Extraction and Processing

Supervisor(s): **A/Prof. Sebastian Thomas**

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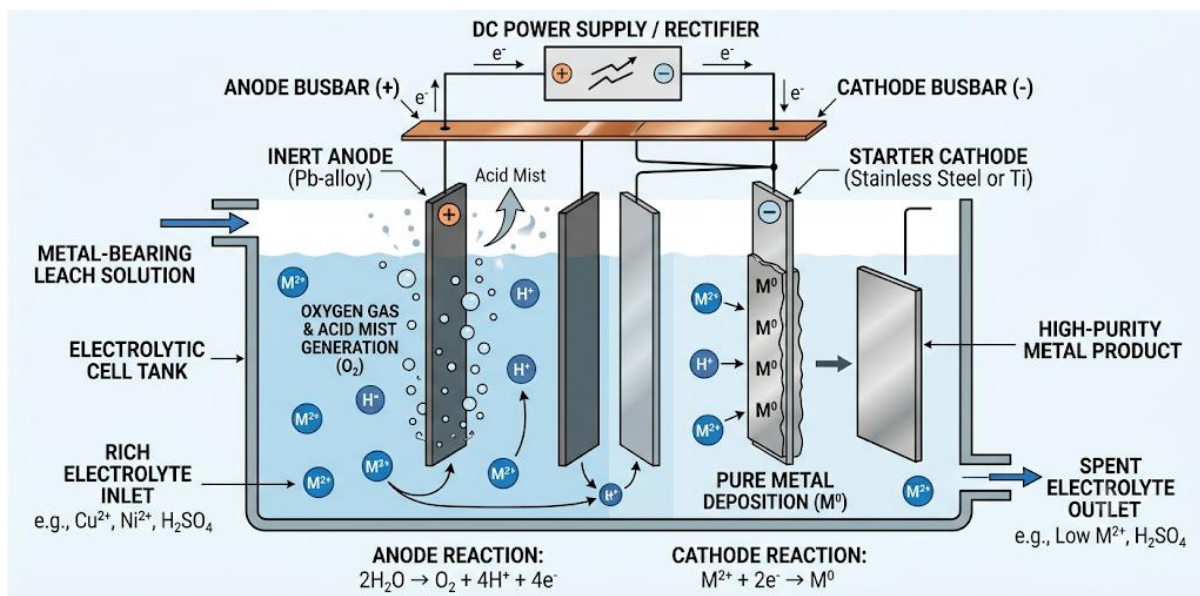
<https://www.monash.edu/engineering/sebastianthomas>

Objective

The primary objective of this project is to perform fundamental research at Technology Readiness Level 1 (TRL 1) to develop a low-energy, eco-friendly "green" electrowinning process for extracting high value metals from aqueous leach solutions.

Project Details

Electrowinning is an electrochemical hydrometallurgical process used to recover high-purity metals such as copper, indium, nickel, cobalt, zinc and even precious metals from liquid leach solutions obtained during mining or recycling [1]. In a conventional electrowinning cell, an electric current pass between an anode and a cathode immersed in a metal-bearing electrolyte solution. The metal ions are reduced and deposited onto the cathode as pure metal, while water oxidation occurs at the anode to produce oxygen gas and hydrogen ions [1]. However, traditional electrowinning is extremely energy-intensive and environmentally taxing, driving an urgent industrial imperative for "green" electrowinning practices. Because global demand for various metals, especially copper (Cu) is soaring to build electric vehicles, power grids, and renewable infrastructure, major mining giants like BHP and Rio Tinto rely heavily on electrowinning to supply the global economy. However, the traditional way of powering these electrowinning cells requires immense amounts of electricity. Green electrowinning aims to decarbonise metal refining by dramatically curtailing grid power demand, eliminating toxic aerosols, and integrating clean, renewable energy inputs directly into the extraction pipeline. The project will be at Technology Readiness Level 1 (TRL 1) where the student will perform some fundamental research on developing a 'green' electrowinning process to extract Cu from leach solutions. The student will receive hands-on training in state-of-the-art electrochemical techniques, electrowinning, electrodeposition and surface characterisation techniques.



A schematic depicting conventional electrowinning used to extract metals like Cu^{2+} and Ni^{2+} from solutions (Diagram generated via AI/Gemini based on standard industry models)

References:

1. Nicol, Michael, Nicholas Welham, and Gamini Senanayake. "Electrowinning and Electrorefining of Metals." In *Hydrometallurgy: Practice*, 2:271–393. Elsevier, 2022. <https://doi.org/10.1016/B978-0-323-99214-5.00009-7>.

Project Timeline

TASK	1	2	3	4	5	6	7	8	9	10
Literature Review (Electrowinning)										
Lab induction										
Equipment training										
'Green' electrowinning testing										
Reporting writing/Analysis										

Prerequisites

MTE 3103 or MTE 5883 or Any Chemistry or Chemical Engineering unit covering basic concepts of electrochemistry or electrochemical techniques.

Student Placement Agreement

A student placement agreement must be signed by the project supervisor and the student prior to commencement of the ASPIRE program.

[LV0554-72741 ASPIRE Program Co-Curricular-Student-Placement-Agreement-Short-term.docx](#)

Short-listed applicants will be interviewed by the supervisor before being selected for this project.