Faculty of Material Sciences and
Material Technologies
Institute for Nonferrous Metallurgy and Purest
Materials

TU BERGAKADEMIE FREIBERG

TUBAF
Die Ressourcenuniversität.
Seit 1765.

# MASTER THESIS

## Simulation-based LCA of recycling of spent SOEC components

### Introduction

Nowadays, a sustainable future can not be achieved without the use of renewable energy carriers such as hydrogen, which can be efficiently produced by water electrolysis using energy from renewable sources. This master's thesis contributes to the government-funded project dealing with the industrial-scale production and recycling of solid oxide electrolyzers (SOEC) for the steel industry. To evaluate and optimize the recycling process developed at INEMET for the SOEC components, Simulation-based Life Cycle Assessment (LCA) is applied. In this thesis, different recycling conditions of electrodes and barrier layer tested in the laboratory are modelled, and the environmental impact of the processes are calculated. In this way, it is possible to compare different recycling conditions based on environmental impacts, and identify improvement opportunities. The main objective of the thesis is assessing the impact and identifying opportunities for improvements of the hydrometallurgical recycling of SOEC electrodes and barrier layer, through Simulation-based LCA.

### Tasks

- Definition of Goal and Scope of LCA.
- Data collection (from laboratory experiments, completed with literature data).
- Creation of HSC simulation models, supported with FactSage and OLI software information.
- Calculation of impacts using HSC Sim and openLCA software.
- Analysis, interpretation, and reporting of the analyzed data.

### Requirements

- ✓ Basic knowledge in Metallurgy/Material Science/Chemistry or related.
- ✓ Experience and/or interest to work with LCA (e.g., openLCA) and Simulation (e.g., HSC Sim).
- ✓ Start Date: March 2025, Duration: 6 months. An earlier start of the master thesis can be discussed.

### Benefits

- ❖ Extend your knowledge in the state-of-the-art field of study.
- ❖ Opportunity to gain experience in Simulation-based LCA.
- ❖ Contribute to the circularity of materials for resource security.
- ❖ Publication of the relevant results.

### Contact

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