

Master Thesis

Critical Metals Recovery: Comparative Analytical Methods for Rare Earth Element Adsorption

A joint research project between the Hamburg University of Technology (TUHH) and the University of Hamburg (UHH)

Duration	6 months (start date: April)
Location	TUHH, Hamburg / UHH, Hamburg (hybrid across labs)
Supervisors	Prof. Kuchta (TUHH), tbd
Contact	Yelda Demirdögen, yelda.demirdoegen@gmail.com
Language	English (thesis & reporting); German proficiency beneficial

Background & Motivation

Rare Earth Elements (REE) are critical raw materials essential to modern technologies including electric motors, wind turbines and advanced electronics. Their secure and sustainable supply is a key challenge for the European Union's green transition. Adsorption-based separation and recovery from secondary sources offers a promising pathway – but rigorous analytical characterisation of sorbent materials and REE uptake is essential to advance the science.

This thesis sits at the intersection of materials science and analytical chemistry. The student will benefit from direct access to state-of-the-art instrumentation and expertise distributed across two leading Hamburg universities.

Research Objectives

- Conduct systematic adsorption experiments
- Apply and critically compare a suite of analytical techniques for characterising REE sorption behaviour
- Evaluate the strengths, limitations, and complementarity of each method for REE recovery applications
- Contribute to inter-group data sharing and collaborative interpretation within the TUHH–UHH consortium

Analytical Techniques & Research Group Assignments

The thesis will involve close collaboration with the following groups and their respective instrumentation:

Group / PI	Method	Institution
Kuchta	ICP-OES	TUHH
Penn	NMR Spectroscopy	TUHH
Grüner	XRF	UHH

Note: FTIR, SEM/EDX, XRD and XPS are currently under discussion for inclusion. The student will be involved in planning the final analytical scope.

Your Tasks

- Review literature on REE adsorption mechanisms and analytical characterisation strategies
- Plan and execute adsorption experiments with selected REE-containing solutions
- Coordinate and perform measurements across the participating laboratories
- Statistically analyse and cross-validate results obtained from different analytical methods
- Critically evaluate methodological uncertainties, detection limits and information content of each technique
- Prepare a written thesis and present findings in joint group meetings of TUHH and UHH partners

Your Profile

Required

- Enrolled in a Master's programme in Chemistry, Chemical and Bioprocess Engineering, Environmental Engineering, Materials Science or a closely related field
- Solid background in analytical chemistry
- Structured, independent working style with attention to data quality and reproducibility

How to Apply

Please send your CV to yelda.demirdoegen@gmail.com.

We look forward to hearing from you.
