Development of chemical methods for separation and recycling rare earth metals

Summary

The PhD project is part of a broader research effort focused on the separation, processing, and recycling of rare earth metals. The project will exploit mechanochemical methods and metal-organic complexes to separate and valorise rare earth metals. The applicability of recycled magnets and related materials as secondary resources will also be investigated. Project will iclude development of novel membrane materials for selective separation will involve the design and synthesis of new receptor molecules (hemicucurbiturils etc) and functionalized polymers. The successful candidate will investigate the performance of these materials for the binding and separation of lanthanoids. Additionally, the PhD project will explore the reuse and valorization of magnetic materials, unlocking their full potential.

Research field:	Chemistry and biotechnology
Supervisors:	Prof. Dr. Riina Aav Dr. Elena Prigorchenko
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

Description

The PhD project is part of a broader research effort focused on the separation, processing, and recycling of rare earth metals. The overarching goal is to develop innovative technologies for extracting valuable components from intermediate ore enrichment products and secondary resources. To achieve this, the project will exploit mechanochemical methods and metal-organic complexes to separate and valorise rare earth metals. The applicability of recycled magnets and related materials as secondary resources will also be investigated. Furthermore, the development of novel membrane materials for selective separation will involve the design and synthesis of new receptor molecules (hemicucurbiturils etc) and functionalized polymers. The project will utilize liquid-assisted mechanochemical processes, directed formation of metal-organic complexes, and adhere to the principles of circular and green chemistry

We are seeking a highly motivated PhD student to join our team and contribute to the development of innovative mechanochemically assisted methods for synthesizing organic membrane materials. The successful candidate will investigate the performance of these materials for the binding and separation of lanthanoids. Additionally, the PhD project will explore the reuse and valorization of magnetic materials, unlocking their full potential.

Experimental work will be conducted in chemistry research lab equipped with planetary and mixer mills, and suitable for organic synthesis, also access to various chemical analysis methods (like NMR, HPLC, MS, IR, UV, FS, CD, VCD, SC-XRD and PXRD) is available in the group. The PhD student will be supported by Department of Chemistry and Biotechnology and grant of PI (ÕÜF17)

Responsibilities and (foreseen) tasks

- Mechanosynthesis of macrocycles and membrane materials
- Development of new methods (incl mechanochemical) to reuse rare earth metals containing magnetic material.
- Publication of scientific results.
- Supervision of undergraduate students in the group.

Applicants should fulfil the following requirements:

- a master’s degree or equivalent in organic or metalorganic chemistry or in relevant field.

- strong knowledge of chemistry (preferably organic or supramolecular) methods
- a clear interest in the topic of the position
- excellent command of English

- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to provide assistance in organizational tasks relevant to the project

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position with salary starting from 2300 euros in very strong research group
- The chance to do high-level research in very attractive research fileld
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers

About the department

The **department of Chemistry and Biotechnology** is divided to three Divisions. The main research areas of Division of Chemistry n include analytical, computational, industrial, organic, supramolecular, and wood chemistry. The Division of Chemistry is responsible for education in these fields at the bachelor's, master's, and doctoral levels, thus ensuring the ongoing cultivation of proficient specialists in chemistry. In our research and teaching, we put emphasis on the development and implementation of sustainable and green thinking.

The research and teaching facilities at the Division of Chemistry are furnished with modern equipment, supporting high-level research and education. A total of 10 research groups operates within our division, with approximately 80 academic staff members, including 4 professors and 25 doctoral students. Our researchers are engaged in international networks and cooperations, making their research worldwide visible.

Supramolecular Chemistry research group, lead by Riina Aav, is focusing on intermolecular interactions in order to understand complex systems of molecules and find greener approaches in chemistry. We are developing sustainable synthetic methods and designing new chiral supramolecular receptors for sensing chirality and chiral separation. We are also looking for methods to recycle and valorize waste in order to decrease pollution.

(Additional information)

For further information, please contact Prof Riina Aav riina.aav@taltech.ee and Dr. Elena Prigorchenko elena.prigorchenko@taltech.ee or visit https://riinaaav.wixsite.com/grouppage/group-news

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