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RAWMINA Project Newsletter #7

Building an integrated,
innovative pilot system
for recovery of critical
raw materials from
mine waste



Project News

**Innovation in Composite Materials for critical raw
materials recovery: Nanofibers and
Electrospinning**

Center

The growing demand for **critical raw materials** such as cobalt (Co), antimony (Sb), germanium (Ge), and tungsten (W) is driving the need to find sustainable solutions for their recovery. **Nanofibrous composite materials** manufactured using the **electrospinning technique** have shown great potential in applications for the recovery of these elements. In addition, the integration of **Metal-Organic Frameworks (MOFs)** in nanofibers could lead to greater efficiency and selectivity in the extraction and recovery processes of these materials, essential for various industries, from electronics to renewable energy.

Electrospinning is a manufacturing process whereby nanofibers with a very fine and porous structure can be produced. The incorporation of MOFs into these nanofibers can be achieved during the electrospinning process, in which the MOFs are dispersed in the precursor solution that is used to form the fibers. This technique allows:

1. **High surface load:** MOF-modified nanofibers provide a larger active surface area for metal adsorption.
2. **High selectivity:** MOFs can be functionalized to selectively recognize and capture certain metals, improving the efficiency of the extraction process.
3. **High adsorption capacity:** Nanofibers with MOFs can recover a large amount of target elements due to their porous structure.

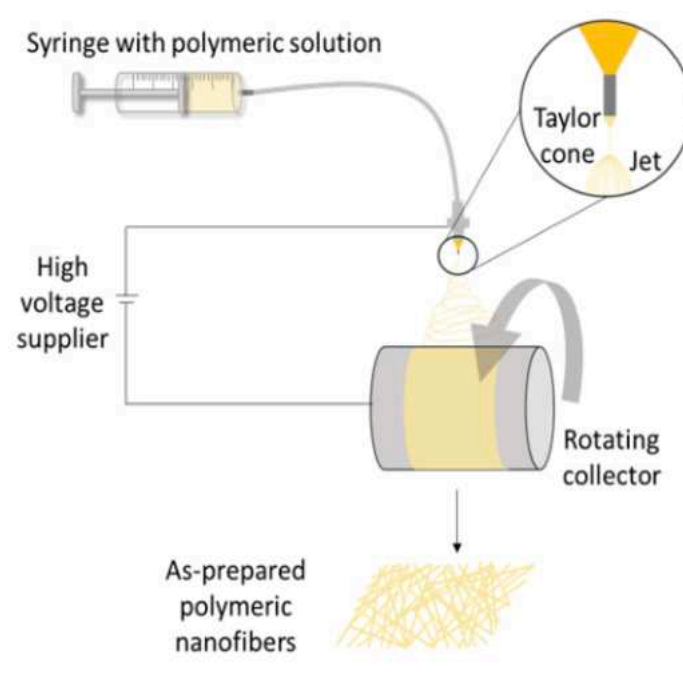


Figure 1 The Electrospinning process

The combination of nanofibers and MOFs has significant advantages in the recovery of critical raw materials:

1. **Better performance in terms of adsorption capacity:** MOFs have a porous structure that, combined with nanofibers, increases the capture capacity of metals.
2. **Sustainability:** Recovery processes based on these materials can reduce dependence on primary mining sources, favouring recycling and the use of secondary materials.
3. **Reduced costs:** Implementing these materials in metal recovery processes could make production cheaper by optimizing the extraction of valuable metals from e-waste or

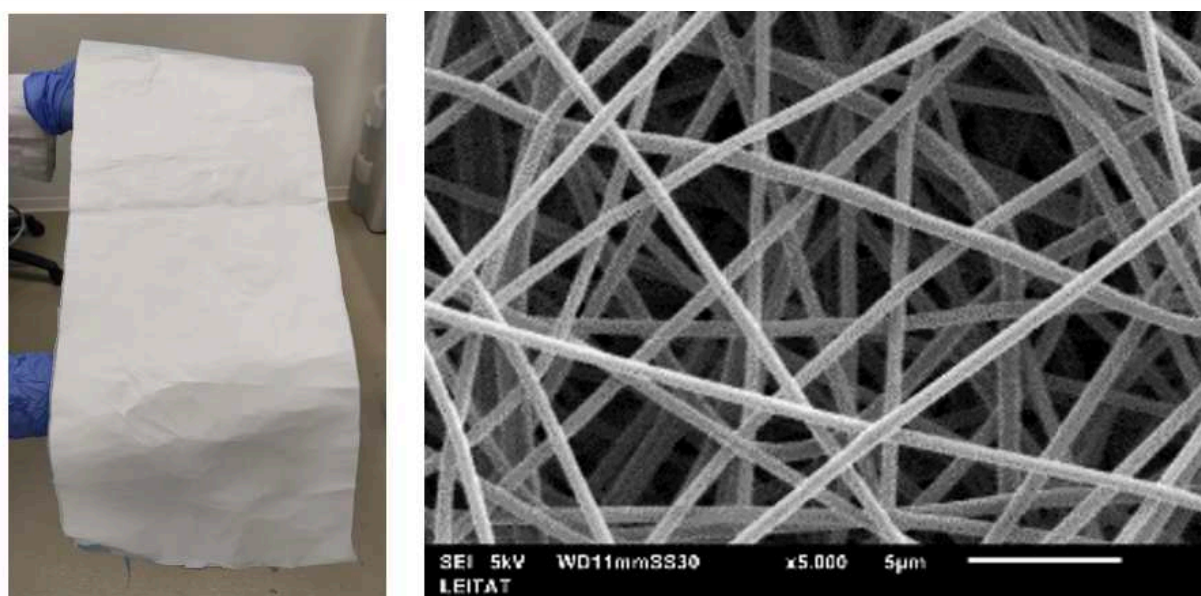


Figure 2 Nanofibres and Metal-Organic Frameworks

Challenges and Future Prospects

Despite their promising prospects, there are challenges in the large-scale implementation of these materials. The **stability** of MOFs, their **cost of production** and the **efficiency** in the regeneration of materials after adsorption are key factors that need to be optimised. However, research continues to advance, and it is expected that in the near future nanofibrous composite materials with MOFs will play a fundamental role in the transition to a more circular and sustainable economy.

Conclusion

The combination of **nanofibers manufactured by electrospinning** and **Metal-Organic Frameworks (MOFs)** represents one of the most promising solutions for the recovery of **critical raw materials**. The ability of these materials to selectively and efficiently adsorb and recover precious metals opens up new possibilities for recycling and sustainability in various industries. As research in this field progresses, we can expect a significant impact in reducing dependence on non-renewable resources.

In the RAWMINA project, different nanofibrous composite materials have been developed for application in the recovery of antimony (Sb), tungsten (W) and germanium (Ge), showing good efficiency and high capacity to be regenerated (adsorption and desorption cycles).

The methodology has been the following:

1. Identification and selection of potential materials for the nanofibrous composite materials (NCMs) development.
2. Synthesis and characterization of different materials found as potential adsorbents for CRMs is described, as well as the results of stability, adsorption, selectivity, and desorption of these adsorbents
3. Development and characterization of NCMs based on modified polymer nanofibres with the best adsorbents.

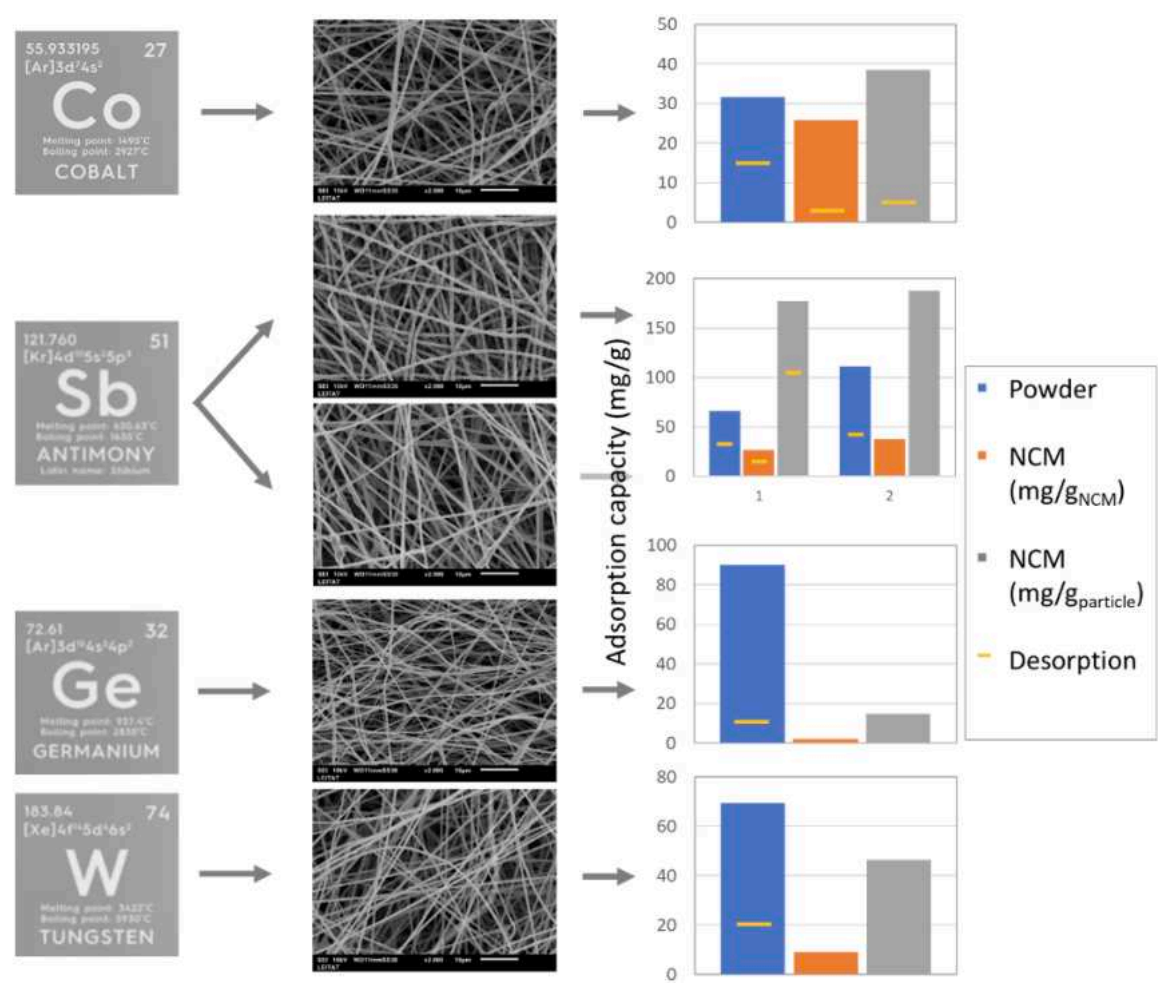


Figure 3 Nanofibrous composites developed for recovery of cobalt (Co), antimony (Sb), germanium (Ge) and tungsten (W)

These materials and their application have been included in two patent applications:

PCT/ES2024/070792: USE OF METAL-ORGANIC FRAMEWORKS FOR THE ADSORPTION OF GERMANIUM IONS IN AQUEOUS SOLUTIONS AND METHOD FOR THE ADSORPTION OF GERMANIUM IONS. December 18th 2024

and

PCT/ES2024/070791: USE OF METAL-ORGANIC FRAMEWORK PARTICLES (MOF) FOR THE ADSORPTION OF SB AND/OR W IONS AND METHOD FOR SUCH ADSORPTION. December 18th 2024.

In case you missed us

RAWMINA @ MMH, Seville, Spain
October 2024



The RAWMINA project partners from Leitat Technological Center, AGQ Labs, and the University of Seville showcased our project at the Mining and Minerals Hall (MMH) in Seville, Spain. The MMH brings together the mining sector worldwide, to discuss technological innovations implemented in all the processes of exploration, extraction, production and treatment of mineral raw materials.

RAWMINA @ Prospectors & Developers Association of Canada (PDAC), Toronto, Canada

March 2025



RAWMINA was chosen as part of the 19 projects under the [European Health and Digital Executive Agency \(HaDEA\)](#), driving innovation in raw materials to attend **PDAC 2025**. At the [Prospectors & Developers Association of Canada \(PDAC\)](#) event, the EU delegation showcased groundbreaking solutions across the entire raw materials value chain. Our coordinator, **Diego Morillo Martín**, represented RAWMINA at the event, fostering valuable connections and collaborations.

RAWMINA @ ABC de Sevilla Newspaper



RAWMINA was featured in the ABC de Sevilla newspaper, a large Spanish publication. The article explores the roles of partners CLC and Tharsis in developing new technologies capable of recovering critical raw materials from mine waste in the framework of the projects RAWMINA and Metallico.

Read more [here](#) (in Spanish).

Interested in Raw Minerals Innovation?

Raw Minerals Open Innovation Helix



Critical Raw Materials (CRMs) are crucial to Europe's economy, and for the green and digital transitions. They form a strong industrial base, producing a broad range of goods and applications, both current and future.

Research into sustainable, reliable and resilient sources of CRMs and transfer of process technologies into use has never been more important.

Our members are currently targeting opportunities under Cluster 4 of Horizon Europe, seeking international collaborations relevant to the Raw Minerals community

Our community of researchers, technologists, innovators and policy makers continue to be active on the Crowdhelix platform. [Join free as an individual stakeholder from the link on the Helix page!](#) [Organisational memberships are required for some functions].

Visit and join the Helix!

Funding Opportunities

Horizon Europe Calls 2025

Achieving global leadership in climate-neutral, circular and digitised industrial and digital value chains

HORIZON-CL4-INDUSTRY-2025-01-MATERIALS-61: Technologies for critical raw materials and strategic raw materials from end-of-life products

(IA) Deadline - 23 September 2025

Learn more [here](#).

HORIZON-CL4-INDUSTRY-2025-01-MATERIALS-62: Strategic Partnerships for Raw Materials: Innovative Approaches for sustainable production of Critical Raw Materials

(IA) Deadline - 23 September 2025

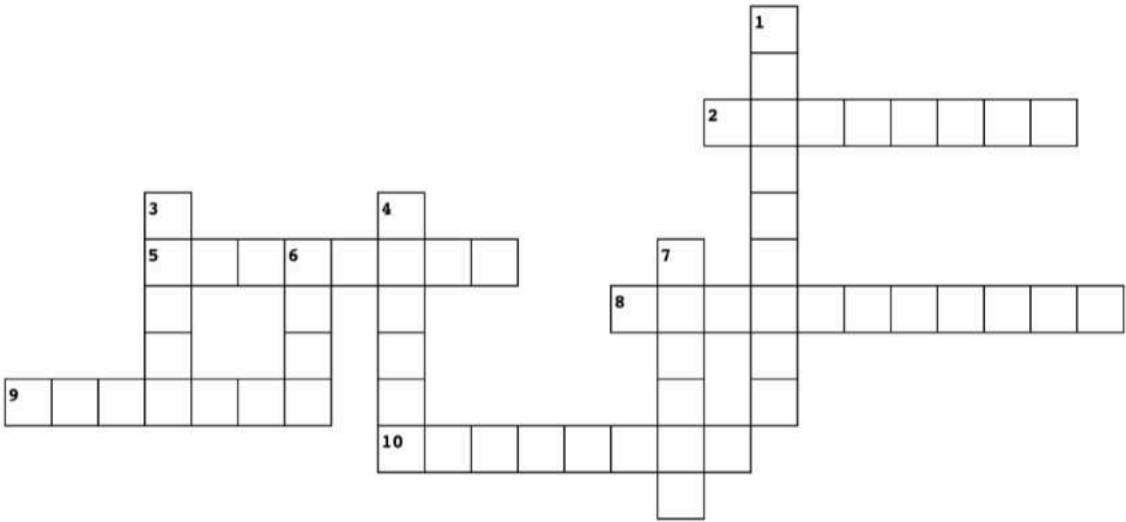
Learn more [here](#).

Try your hand at the RAWMINA crossword

To end this newsletter, we'd like to invite you to enjoy a bit of geological trivia fun - the RAWMINA crossword 😊

Play the RAWMINA Crossword

Print Share Edit ■ Answers ≡



Across

- 2. CRM refers to what type of Raw Materials? (8 letters)
- 5. A silver-coloured, brittle element, used extensively in the electronics industry. (8 letters)
- 8. The RAWMINA project has received funding from this European Union research and innovation programme. (7 letters, 4 numbers)
- 9. The RAWMINA project focuses on mines and minerals representative of this peninsula. (7 letters)

Down

- 1. The first element in the periodic table named after a country. (9 letters)
- 3. Part of RAWMINA's mine waste valorisation aims is to recycle up to 90% of this precious resource. (5 letters)
- 4. Essential element for ensuring longer life span of batteries. (6 letters)
- 6. RAWMINA focuses on removing this mineral by means of magnetic separation. (4 letters)
- 7. Chile has the world's largest deposits of this mineral ore. (6 letters)

Play

All the answers to the crossword can be found on the RAWMINA project website.



The RAWMINA project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 958252.



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