Poland in Silicon Valley Center

for Science, Innovation, and Entrepreneurship

Intelligent technologies for concrete production based on waste copper slag enriched with CO_2 captured from industrial production for zeroemission construction (SPHERE)

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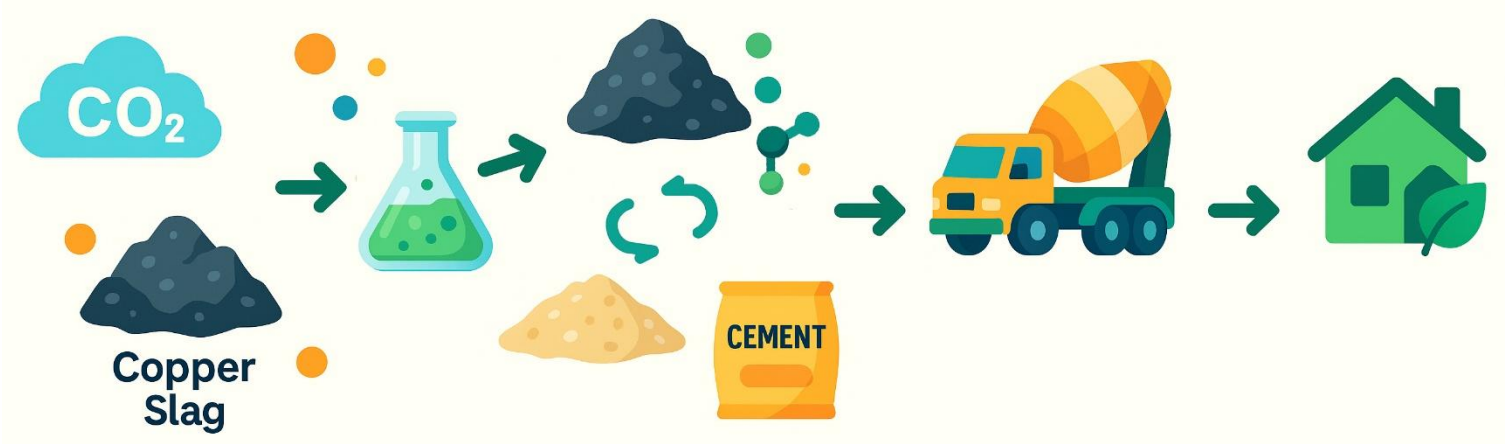
Summary

Transforming Copper Slag with CO_2: A Breakthrough Path to Zero-Emission Construction

Our technology upcycles copper slag through CO_2 mineralization, producing a high-performance, low-carbon material that supports the transition to zero-emission construction.



Team

- **Prof. Łukasz Sadowski** - Project Leader, expertise: concrete diagnostics, NDT/AI methods, sustainable materials.
- **Adrian Chajec**, PhD Eng., expertise: cementitious composites, microstructure, mechanical performance.
- **Agnieszka Chowaniec-Michalak**, MSc Eng., expertise: waste valorization, CO_2 mineralization, SEM/EDS.
- **Martyna Nieświec,** MSc Eng., expertise: environmental analysis, material characterization.
- **Seweryn Malazdrewicz**, MSc Eng., expertise: laboratory procedures, analytical testing.
- **Mateusz Moj**, MSc Eng., expertise: experimental workflows, mechanical testing






Project Status

- Status: Ongoing
- Duration: 2024-2028
- Funding: Fundation for Polish Science (FNP)
  - programme FIRST TEAM FENG
- Financing Type: National funding (via FNP; co-financed from European Union structural funds)

- IP Status: Polish patent granted (November 2025)

The Challenge & Our Solution

- **Problem**

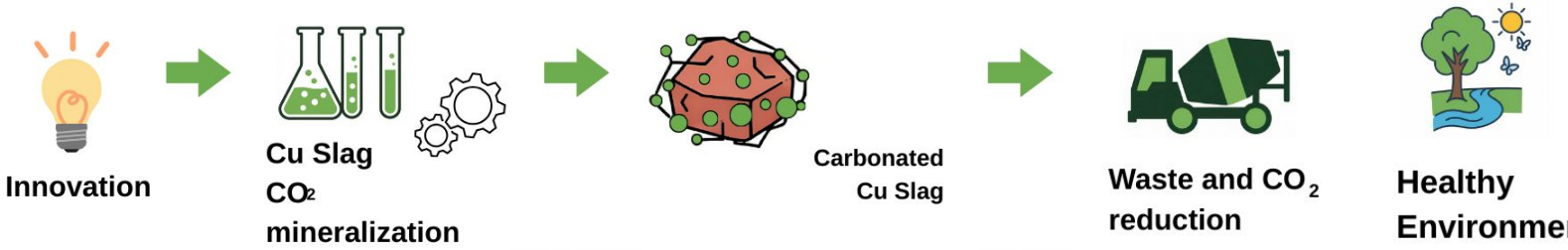
Copper slag is produced in large quantities but lacks standardized processing methods that allow safe, effective use in construction materials. Existing technologies do not provide permanent CO_2 binding nor controlled microstructural improvement.

- **Our Approach**

We develop a controlled mineral carbonation process using industrial CO_2 streams to produce stable carbonate phases and enhance the microstructure of copper slag.

- **Solution**

A CO_2-enriched, structurally improved slag that permanently binds CO_2 and becomes a functional, high-quality raw material for low-carbon construction.



Keywords

CO_2

mineralization

Low-carbon construction

Sustainable materials

Copper slag valorization

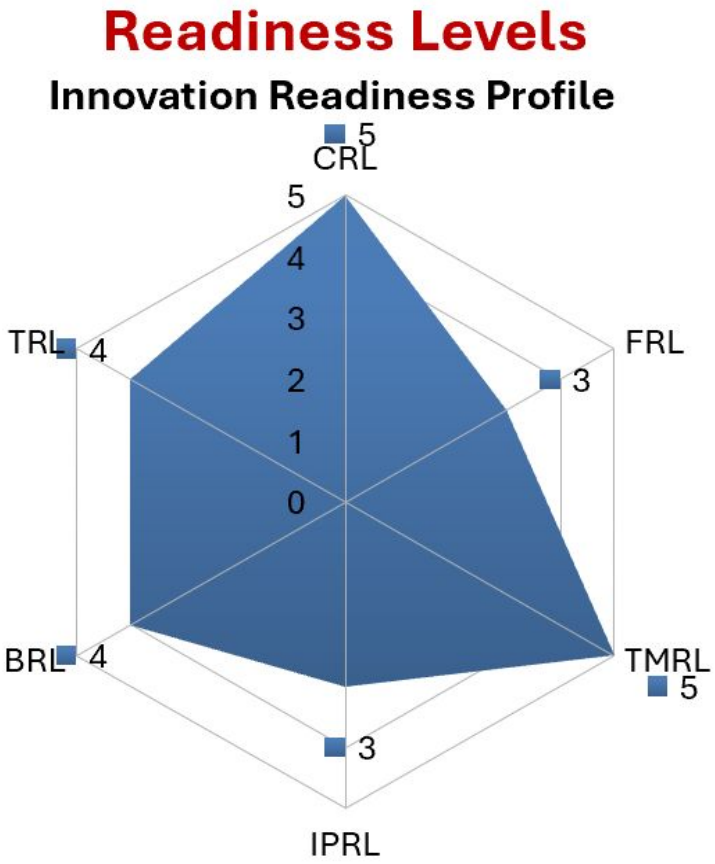
Circular economy

Description of the Idea

- **Unique** and innovative idea.
- Scientists are working on the mineralization of materials and copper slag. However, no one is combining these two paths by **mineralizing copper slag**.
- Competition may come from companies and institutions working on the carbonation of materials.
- Permanent **binding of CO_2** in the slag structure through the formation of stable carbonate phases. As a result, **reduction of emissions** through the use of **CO_2 from industry**.
- In addition, conversion of metallurgical waste into a **functional raw material for low-emission concrete**.

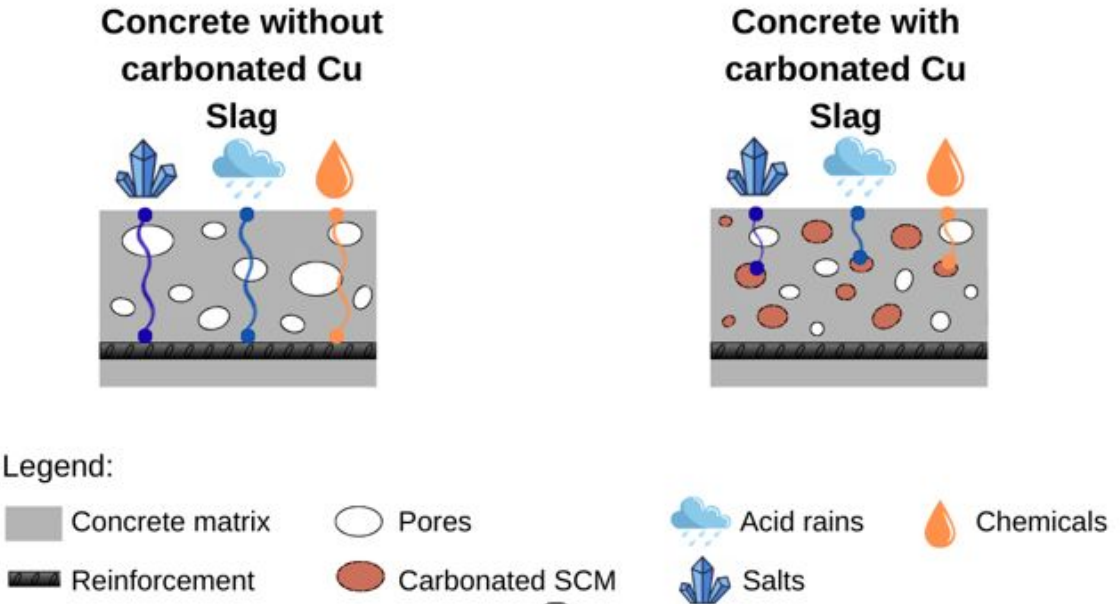
Technology Readiness and Intellectual Property

- **CRL 5 -** indicates a product is ready for scale.
- **TMRL 5** – technology was validated in a relevant (simulated) environment.
- IP Status: Polish patent granted (November 2025).



Desired Audience

- Our project is aimed at companies that **want to reduce CO_2** emissions and contribute to **environmental protection**.
- Benefits: **collection and reuse** of CO_2 to **improve the properties** of powder materials.



Our goals (the ASK)

- **Academic cooperation**: e.g. common reserach, further projects, publications

- **Partnership**: Industry validation or pilot collaboration

Thank you very much for your attention!

Project website

LinkedIn of our Department

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