

Ongoing Research Projects – Building Materials

Date: October 2025

Websites:

<https://www.ltu.se/en/research/research-subjects/building-materials/research-projects>

<https://www.linkedin.com/in/buildingmaterialsatltu/>

1. LTU as leader

1.1. Project title: A groundbreaking zero-emission recycled structural material for a resource-efficient and sustainable built environment

PI: Andrzej Cwirzen

Funding agency: Formas

Budget: 10,354,637 SEK

Project duration: 07.2025 - 06.2029

Doctoral project: Yes (to be recruited)

Description:

The project aims to tackle the sustainability of concrete and building materials and resource efficiency by developing a new method to produce ZERO-emission concrete using only recycled materials.

1.2. Project title: Climate-friendly concrete through the cement industry's transition for future infrastructure and industrial establishments in cold climates

PI: Andrzej Cwirzen

Project duration: 01.2024 – 12.2026

Funding agency: Tillväxtverket, The Swedish Agency for Economic and Regional Growth, co-funded by EU

Budget: 3,451,929 SEK

Doctoral project: Yes (David Sebastian Cotes Prieto)

Description:

The project focuses on developing climate-reduced concrete with particular application to construction and industrial projects in the north. Opportunities for large reductions in climate impact while maintaining function and performance are investigated. In particular, early-stage properties are studied and how these affect the possibilities for construction in cold climates.

1.3. Project title: Low clinker content cement

PI: Andrzej Cwirzen

Project duration: 03.2024 – 02.2027

Funding agency: Tillväxtverket, The Swedish Agency for Economic and Regional Growth, co-funded by EU, Boliden

Budget: 4,244,978 SEK

Doctoral project: Yes (Emmanuel Mache)

Description:

The ultimate aim of this PhD project is to support cement industry in their climate transition towards carbon neutral production. The project objective is to develop a modified clinkering technology that combines usage of mixture of alternative raw materials and modified clinkering process to achieve the carbon neutral production goal.

1.4. Project title: Cement production process optimized for sustainable use of resources

PI: Andrzej Cwirzen

Project duration: 09.2023 – 08.2026

Funding agency: Energimyndigheten, Boliden

Budget: 4,490,60 SEK

Doctoral project: Yes (Alaeddine Ben Tarzi)

Description:

The ultimate aim of this PhD project is to support cement industry in their climate transition towards carbon neutral production. The project objective is to develop a modified clinkering technology that combines usage of mixture of alternative raw materials and modified clinkering process to achieve the carbon neutral production goal.

1.5. Project title: Hybrid CSA-OPC cement for durable shotcrete and cast-in-place concrete

PI: Andrzej Cwirzen

Project duration: 01.2023 – 08.2027

Funding agency: SBUF, Skanska, BeFo

Doctoral project: Yes (Sergio Ruiz Martinez)

Description:

The current PhD project application is a continuation of two recently completed feasibility study projects funded by SBUF No. ID: 13863. The results confirmed that concrete containing 20-40 wt.% of CSA cement has up to 28% lower CO₂ footprint, comparable price, fast curing, faster initial strength development, significantly reduced shrinkage and shorter curing time. However, several areas require further investigation. The aim of this PhD project is to investigate these areas and to perform full-scale tests. The project's production should enable the use of CSA-OPC in Sweden

1.6. Project title: Energy conservation through phase-change materials in concrete structures

PI: Thanyarat Buasiri

Project duration: 04.2023 – 12.2026

Funding agency: SBUF, Skanska

Doctoral project: No

Description: This project aims to test and evaluate a climate-improved building material with increased thermal efficiency due to the use of bio-based PCMs. Both application methods (impregnation and microencapsulation) will be evaluated and compared in terms of thermal storage properties, final mechanical properties and cost-effectiveness.

1.7. Project title: ENSURE: Efficient Nuclear Shielding with Ultra-durable Low-carbon concrete

PI: Magdalena Rajczakowska

Project duration: 01.2024 – 12.2026

Funding agency: Swedish Radiation Safety Authority (Strålsäkerhetsmyndigheten)

Budget: 2,712,000 SEK

Doctoral project: No

Description: The project aims to better understand how the interaction between harsh environments, exposure to high temperatures, and the presence of gamma and neutron radiation affects the longevity and mechanical performance of low-carbon concrete. The focus of the research is on two areas, i.e., the interfacial transition zone between coarse aggregate/binder matrix and high-temperature performance of the material.

1.8. Project title: Feasibility Study for Small-Scale Infrastructure Development in Sustainable Nuclear Shielding Concrete Research

PI: Magdalena Rajczakowska

Project duration: 12.2025 – 05.2027

Funding agency: Energimyndigheten

Doctoral project: No

Budget: 1,352,315 SEK

Description: This feasibility study will evaluate the technical, regulatory, and economic conditions for establishing a small open-access facility to systematically test the radiation properties of nuclear shielding concrete. The project will review regulations, consult stakeholders to clarify needs, analyze infrastructure gaps, draft facility designs, and develop detailed cost-benefit and risk assessments. The final deliverable will be a feasibility report to support investment applications. The project will strengthen Swedish competence in advanced shielding materials and position Sweden as a leader in sustainable nuclear technology.

1.9. Project title: Lightweight 3D-Printed Metamaterials for Sustainable Buildings

PI: Magdalena Rajczakowska

Project duration: 09.2025 – 03.2026

Funding agency: LTU Creaternity

Doctoral project: No

Budget: 100,000 SEK

Description: The project seeks to establish whether a bio-cementitious paste containing micronised plant fibres can be reliably extrusion-printed into a simple periodic lattice while meeting baseline mechanical requirements for non-structural building elements.

2. LTU as partner/WP leader

2.1. Project title: HOME: Hydrogen and circularity in Västerbotten's mineral and metal industry

Coordinator / Lead: IVL Svenska Miljöinstitutet

Partners: Luleå University of Technology (Building Materials and Applied Geochemistry research groups), Swerim, Länsstyrelsen i Västerbotten, Region Västerbotten, Boliden, Envigas, Norrlandsgjuteriet och Kåge Gjutmek.

LTU Role: WP3 - Cirkularitet i Västerbottens metallindustri

LTU PI: Magdalena Rajczakowska (Andrzej Cwirzen – supervisor of PhD student)

Funding / Program: Tillväxtverket, The Swedish Agency for Economic and Regional Growth, EU co-funded

Budget: 24,000,000 SEK (total)

Project duration: 10.2023 – 09.2026

Doctoral project: Yes (Kyriaki Papadopoulou)

Website: <https://www.ivl.se/vart-erbjudande/forskning/cirkulara-floden/hallbar-metallindustri-i-vasterbotten.html>

Description:

This project focuses on three key areas: hydrogen production, the reuse of mining waste and the reduction of fossil carbon use in foundries. The second focus area, led by LTU, explores the reuse of mining waste, especially tailings and waste rock often disposed of in landfills. This work aims to find innovative applications for this waste, such as producing a cement-based binder, reducing its environmental footprint and promoting resource efficiency.

2.2. Project title: Ar2CorD – Low Carbon Concrete for Arctic Climate with Excellent Sustainability and Durability

Coordinator / Lead: UiT The Arctic University of Norway

Partners: Luleå University of Technology, University of Oulu, Reykjavik University, Heidelberg Materials Cement Norway, Heidelberg Materials Concrete Sweden, BM Vallá ehf., Permagreen Grønland A/S,

LTU Role: WP2 – Durability test procedure

LTU PI: Andrzej Cwirzen/Magdalena Rajczakowska

Funding / Program: Interreg NPA, EU co-funded

Budget: € 1,407,160 (total)

Project duration: 01.2023 - 12.2025

Doctoral project: No

Website: <https://www.interreg-npa.eu/projects/ar2cord/>

Description:

Project Ar2CorD focuses on the optimization and durability of low-carbon concrete (LCC). Cementitious materials will be developed using traditional, present-on-the-market, supplementary cementitious materials as well as novel locally available binders, potentially applicable in the future. LTU is responsible for the durability studies of the LCC, with an emphasis on the freeze and thaw resistance. A review of the currently established accelerated tests is performed with respect to their applicability to the assessment of LCC performance. The repeatability of reproducibility of the testing methods is analyzed, and possible modification/new experimental setup design will be proposed.

2.3. Project title: OFFwind – Offshore Wind Turbine Farms

Coordinator / Lead: YH Novia (Leader Partner EU), SINTEF Narvik (Leader Partner Norway)

Partners: Luleå Tekniska universitet, Tampereen korkeakoulusäätiö, Merinova

LTU Role: WP2, activities related to Concrete technology

LTU PI: Andrzej Cwirzen/Magdalena Rajczakowska

Funding / Program: Interreg Aurora, EU co-funded

Budget: € 1,373,999 (total)

Project duration: 11.2022 - 10.2025

Doctoral project: No

Website: <https://offwindproject.com/>

Description:

The overall objective of OFFwind is to contribute to boost the uptake of offshore wind energy in the Aurora program area. LTU works with low carbon concrete technology solutions.