

From wastes to green cement

The research group of Materials Innovation at the Department of Civil and Architectural Engineering, Aarhus University receives a donation from COWIfonden for a research project in developing green cement based on a Carbon Capture and Utilization (CCU) concept. The technology has a huge potential to promote large-scale reductions of CO₂ emissions and a sustainable development of several related industries, e.g. cement and concrete, CCU and several industries that produce massive Ca/Mg-containing solid wastes.

The rising CO₂ concentrations in the atmosphere (a main cause for global warming and climate change) and the generation of tremendous amounts of solid wastes are major threats to UN Sustainable Development Goals. CO₂ mineralization, the concept of fixing CO₂ in the form of carbonates using Ca/Mg-containing solid wastes as feedstock is an attractive technology since it directly uses CO₂ and well integrates with waste management. However, despite the huge potential, the approach faces important challenges. This project proposes to: 1) develop a robust and efficient mineralization route; 2) transform the mineralized products so that they can be used to replace traditional cement in large proportions. Overall, this project aims to provide a strong basis for the development of a novel CCU technology that can be used to upcycle enormous solid wastes to high-value green cement, thus promoting the sustainable development of various industries.

The expected results include: 1) Carbon capture and utilization techniques related to the use of solid wastes and CO₂ sources, with the possibility for industrial deployment; 2) High value recycling of solid wastes, reducing the complexity required for waste treatment and fostering a circular economy; 3) Development of novel supplementary cementitious materials for cement-based systems, contributing to a significant reduction of carbon emissions from the cement industry; 4) Improved fundamental understanding of existing and the novel cement-based systems. By performing the proposed dedicated research activities, the ultimate goal is to promote Green Transition of the society.