Federal Ministry of Education and Research

CO_2WIN
Use Carbon Sustainably

C^2inCO_2: Calcium Carbonation for industrial use of CO_2

CO_2 as a sustainable source of carbon – Pathways to industrial application (CO_2-WIN)

The primary ambition of the transdisciplinary research project "C^2inCO_2" is to develop the full potential of recycled concrete to bind CO_2 and to reuse it as a building material. By developing optimized treatment processes and efficient carbonation methods, the project aims at closing the carbon and material cycles in concrete production and thus, significantly reducing CO_2-emissions from the cement and concrete industry. The project is funded as part of the funding measure "CO_2 as a sustainable source of carbon – Pathways to industrial utilization (CO_2-WIN)". The measure supports projects that make utilize carbon dioxide as a sustainable carbon source for the German economy.

Sustainable reduction of CO_2-emissions

Due to the immense volumes of concrete used, the cement industry emits a significant proportion of the total anthropogenically produced CO_2. While energy-related emissions can be minimized in cement production by using for example alternative fuels, the CO_2 produced during the calcination of limestone is considered system-inherent and therefore unavoidable.

The hardened cement paste or its hydrated clinker phases offer great potential for the permanent binding of CO_2. Already during the use and recycling phase of concrete, about 25 to 30 percent of the CO_2 caused by the raw material processing is bound in a natural way. The key objective of this research project is to unlock the remaining potential of recycled concrete to re-integrate the CO_2 released during calcination into limestone and to use it as a building material.

Inspection of novel cements and concrete products.

Long-term binding of CO_2 in marketable products

Within the framework of the BMBF funding measure "CO_2-WIN", the joint project "C^2inCO_2" addresses an alternative approach to CO_2 utilization based on the mineralization of fines from concrete recycling and their use in the large-scale production of novel cements and concretes.

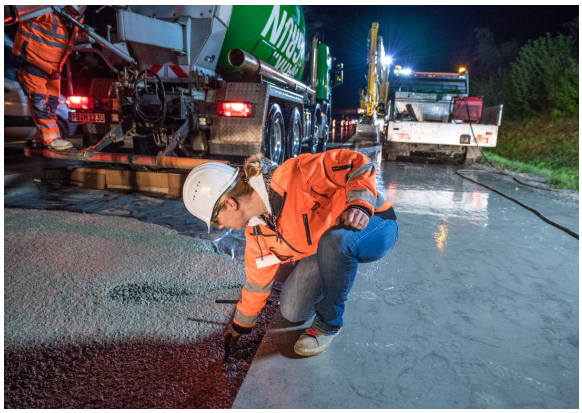
The scientific and technical development activities cover the provision and preparation of the various input materials as well as the design and construction of a pilot plant for the selective comminution and carbonation of the demolition concrete. Further, it includes the performance of practical tests for the production of new types of cements and concrete goods, as well as the detailed analysis of the products produced and their testing upon suitability for industrial application. Furthermore, these novel approaches are evaluated with reliable indicators during an ecological and economic life cycle analysis.

Development of sustainable CO_2 value-added chains

An advanced recycling technology enables the proper separation of the hardened cement paste from sand and aggregates, allowing an efficient use for carbonation. This fraction of recycled concrete fines can easily be carbonated, which facilitates for example the direct use of the CO_2 containing exhaust gases from the cement plant. The carbonated hardened cement paste is used as a clinker substitute and enables a further reduction of the clinker content in cement, preserving natural resources, and reducing CO_2 emissions. If successful, the developed concept as well as the novel cements and concretes can be used on an industrial scale after the extension of corresponding standards.

The development and implementation of the concept take place within the framework of a transdisciplinary collaboration between representatives of the cement and concrete industry (HeidelbergCement AG), large-scale machinery and systems engineering firms (thyssenkrupp Industrial Solutions AG, Loesche GmbH), suppliers of construction chemical products and solutions (Sika AG) and through the involvement of renowned institutes from basic and application-oriented research (F. A. Finger

Institute for Building Materials Science at Bauhaus University Weimar, Fraunhofer Institute for Building Physics, Department of Mineral Resources Processing at RWTH Aachen University).



Potential for CO_2-binding: the cement and concrete industry.

Funding initiative
CO_2 as a sustainable source of carbon – Pathways to industrial utilization (CO_2-WIN)

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C^2inCO_2 – Calcium Carbonation for industrial use of CO_2

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