Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19475

UNDERSTANDING CALCIUM CARBONATE CRYSTALLIZATION PATHWAYS FOR CONCRETE RECYCLING

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The use of concrete has been growing continuously in the 20th and 21st century[1], leading to an increase of its environmental footprint. The current global warming crisis and the significant consumption of natural reserves have pushed the building industry to search for new and sustainable solutions. New breakthrough technologies for lowering the CO_2 footprint include a circular utilization of demolished concrete. Recent developments have shown that most of the CO_2 originally released by limestone calcination during clinker production can be sequestered by carbonation of the recycled cement paste [2,3]. This technology, currently under development by the cement industry, consists in the carbonation of a part of recycled concrete in a humid/aqueous medium, leading to the formation of carbonate minerals and therefore to the permanent storage of the CO_2 in solid form.

A successful deployment of this technology at large scale needs a good understanding and, eventually, a control of the $CaCO_3$ polymorphism. Here, we will show a characterization of the carbonation reactions using both laboratory and synchrotron X-ray scattering experiments. The effect that different ions from cement hydrates –e.g., silicate, aluminate, magnesium- and different organics used as modifiers of the hydration kinetics –e.g., gluconate- have on the calcium carbonate crystallization kinetics will be presented and discussed in the framework of existing theories of mineral formation.

- Favier, A.; De Wolf, C.; Scrivener, K.; Habert, G. A Sustainable Future for the European Cement and Concrete Industry. Technology Assessment for Full Decarbonisation of the Industry by 2050; Zurich, 2018. https://doi.org/10.3929/ethz-b-000301843.
- Skocek, J.; Zajac, M.; Ben Haha, M. Carbon Capture and Utilization by Mineralization of Cement Pastes Derived from Recycled Concrete. Rep. 2020, 10 (1), 1–12. https://doi.org/10.1038/s41598-020-62503-z.
- Zajac, M.; Skibsted, J.; Durdzinski, P.; Bullerjahn, F.; Skocek, J.; Ben Haha, M. Kinetics of Enforced Carbonation of Cement Paste. Concr. Res. 2020, 131. https://doi.org/10.1016/j.cemconres.2020.106013.