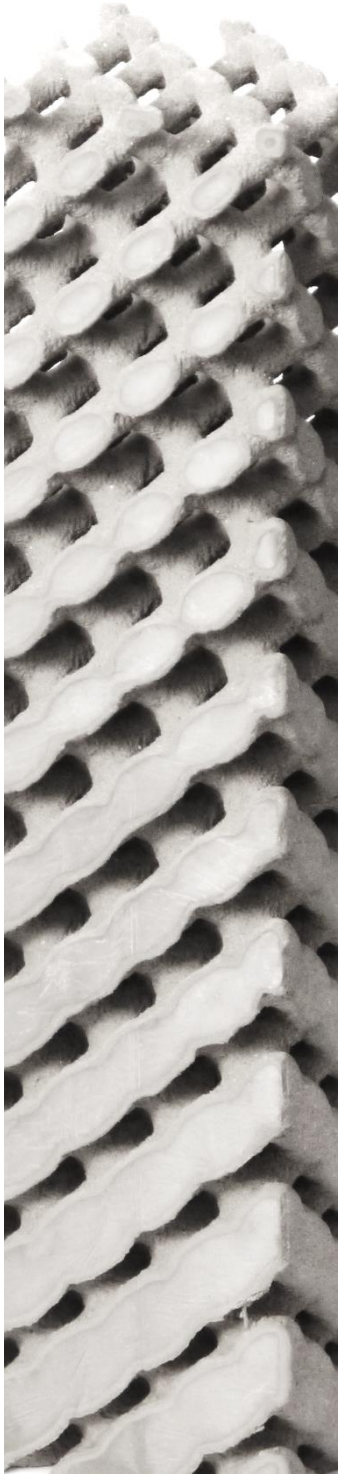
NET-ZERO CARBON CONCRETE



Investigation on CO_2 sequestration potential of lightweight concrete structures through long-term carbonation

To ensure its sustainable future, the concrete construction industry needs to achieve its net carbon neutrality by 2050, applying specific scenarios for this as early as 2030. Minimizing the industry's emissions can only be achieved by implementing a combination of measures, including minimizing resource consumption through more efficient design solutions, as well as the use of alternative materials and technologies. One of the priority research areas is the capture of CO_2 from the atmosphere with its subsequent storage or use in further production processes, which can often be energy intensive.

However, during its life cycle, concrete itself is capable of absorbing CO_2 in the so-called carbonation process, where CO_2 is captured from the air to form calcium carbonate in concrete. The absorption rate depends on the surface area exposed to air, thus becoming a design factor for concrete structure.

The purpose of this thesis is to investigate the relationship between the characteristics of concrete structures (e.g., surface area vs mass) and the speed of the carbonation process to define the trends for maximization of the amount of sequestered CO_2. The work includes the investigation on the theory of the chemical process followed of by experimental studies on the CO_2 sequestration rates for various topologies of concrete structures. To produce concrete test specimens, the Institute for Lightweight Structures and Conceptual Design (ILEK), together with the Institute of Control Engineering (ISW), will provide access to recently developed unit for manufacturing of complex concrete structures with zero-waste sand formworks.

Estimated work packages:

1. Literature study on carbonation process in concrete
2. Definition of the guiding trends for maximization of CO_2 capture rates
3. Design and development of the experimental setup for measuring of CO_2 capture
4. Design and production of concrete specimens with maximized carbonation speeds
5. Testing and evaluation of results

Figure 1: Complex concrete structure and link to related publication:

If you are interested, please apply via email to:

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