Technical University of Munich
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Influence of the Pre-Curing Procedure on Carbonation Curing of Cementitious Materials

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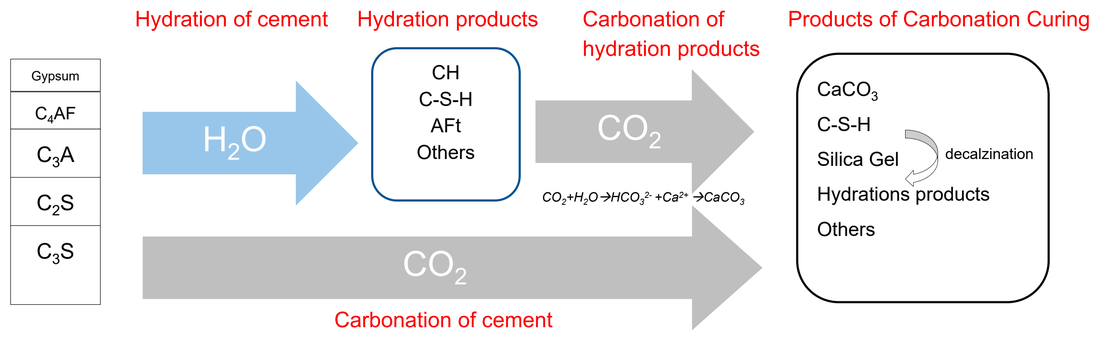
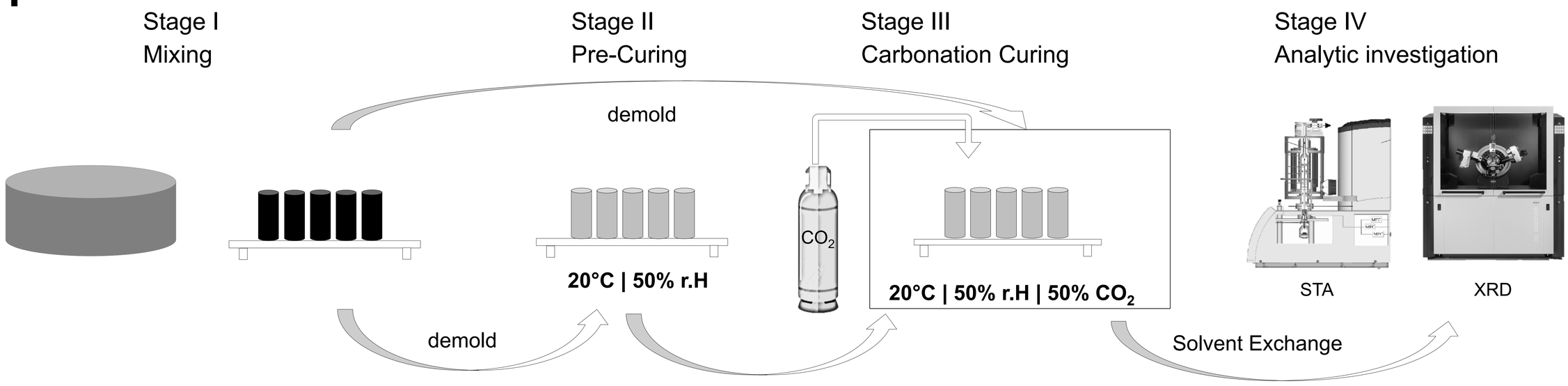
Motivation & Background

The cement industry is responsible for ~ 8% of the global anthropogenic CO_2-emissions. A promising method to reach a net-zero cement industry is carbon capture and utilization (CCU). Carbonation Curing is one approach of CCU technologies, and consist of the following steps: i) Pre-Curing ii) Carbonation Curing iii) Post Curing. This study investigates the effect of the pre-curing of 6h, 12h and 24h on cement pastes and the w/c-ratio of porous concrete.



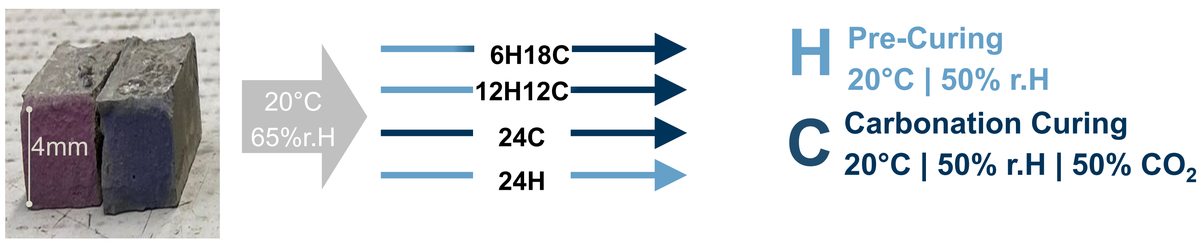
Experimental Procedure



Investigation Matrix

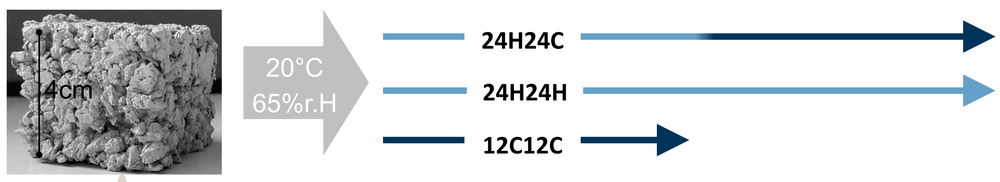
Carbonation of cement paste

CEM I 52.5 N, w/c-ratio= 0.4

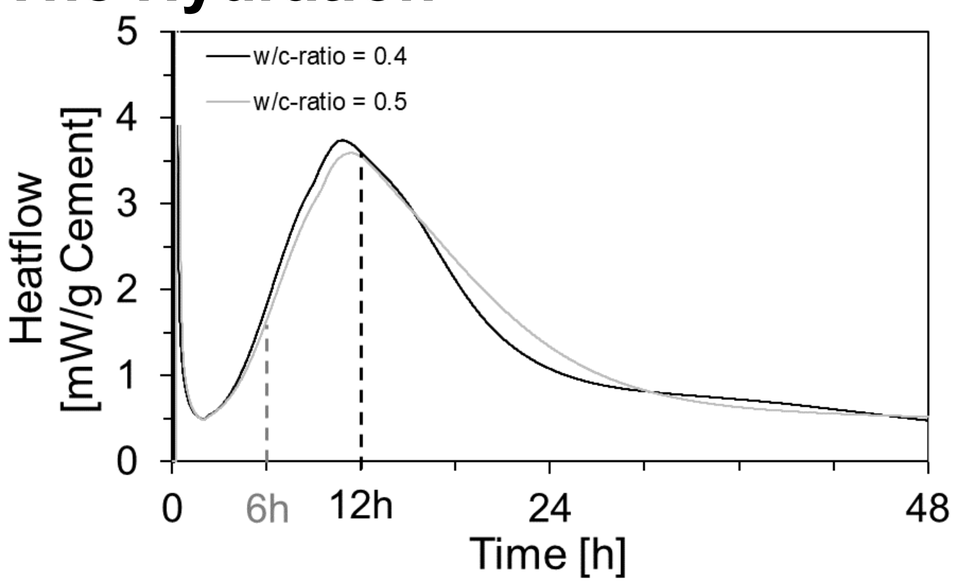


Carbonation of concrete

CEM I 52.5 N, Basalt (2/5), w/c-ratio= 0.35 – 0.5

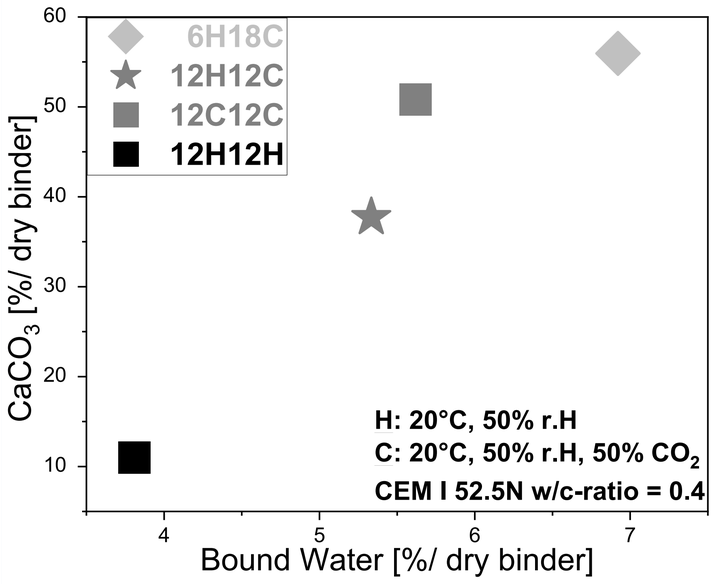


The Hydration



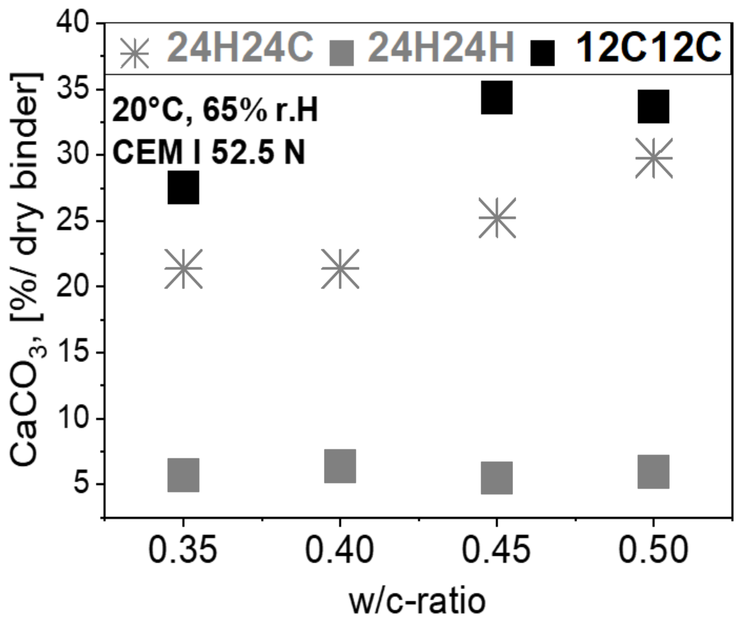
- as hydration progresses, the microstructure of the hardened cement paste becomes denser and more water is bound in the hydration phases

Effect of Pre-Curing on cement paste



- Extented Pre-Curing periods tend to reduce the $CaCO_3$ precipation (12C12C, 6H18C > 12H12C)
- With increased quantity of $CaCO_3$ the quantity of proven bound water increases

Effect of Pre-Curing on concrete



- 24H24C affects a decrease in $CaCO_3$ precipitation compared to 12C12C
- The proven quantity of $CaCO_3$ increases with increased w/c-ratio for pre-cured samples

Conclusion

The results of the pre-curing study on cement pastes and concrete samples show that the quantity of $CaCO_3$ decreases with pro-longed pre-curing period. In contrast to the known mechanisms, the samples show a higher content of bound water with increasing degree of carbonation. To better understand and control the carbontion curing reaction, further investigations are needed. The effect of the free water due to increasing w/c-ratio can be seen in the 24h pre-cured concrete samples.

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