

09.03.2020

TC 281-CCC WG6 – CARBONATION OF ALKALI-ACTIVATED CONCRETE: STATUS OF ACTIVITIES

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Aim of WG6



Identification, and 'ranking' as regards influence, of mix-design parameters that determine carbonation resistance of alkali-activated concretes

- Approach of WG6: Analyse published carbonation depth and mix-design of mortars and concretes (pastes not considered) to identify relationships.
- Consideration of data for concretes based on OPC/GGBFS blends with at least 66 % GGBFS (CEM III/B and CEM III/C) or at least 70 % fly ash (or other SCMs).

Available data: alkali-activated concretes and mortars



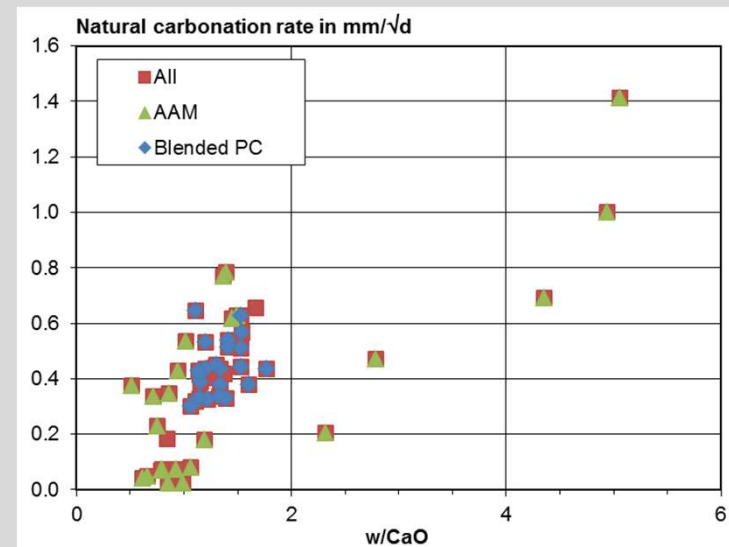
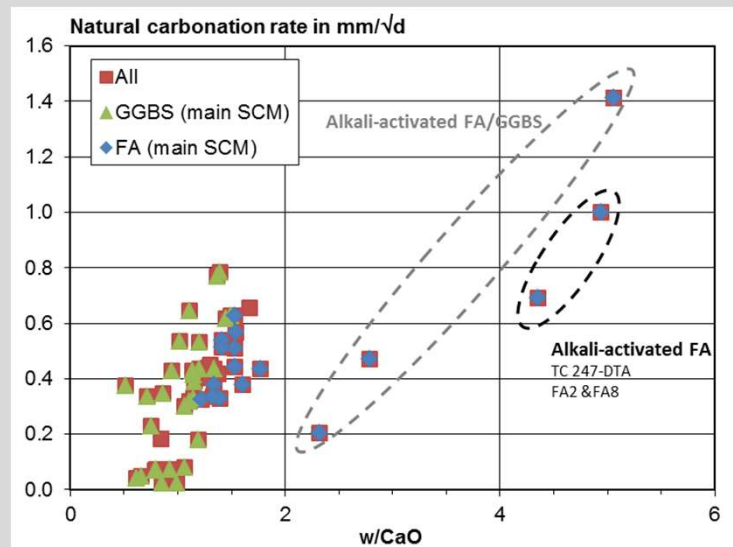
- **40** potentially relevant papers on alkali-activated concretes and mortars were evaluated.
 - **27** contained analyzable carbonation data (mostly AAS; mostly carbonation depths *versus* time, some only carbonation rates).
 - 13 could not be used (e.g., data “hidden” in *X-versus-Y* plots, mix-design information incomplete or internally conflicting, ...).

Available data: concretes based on OPC/SCM blends with $\geq 66/70$ % slag/SCMs



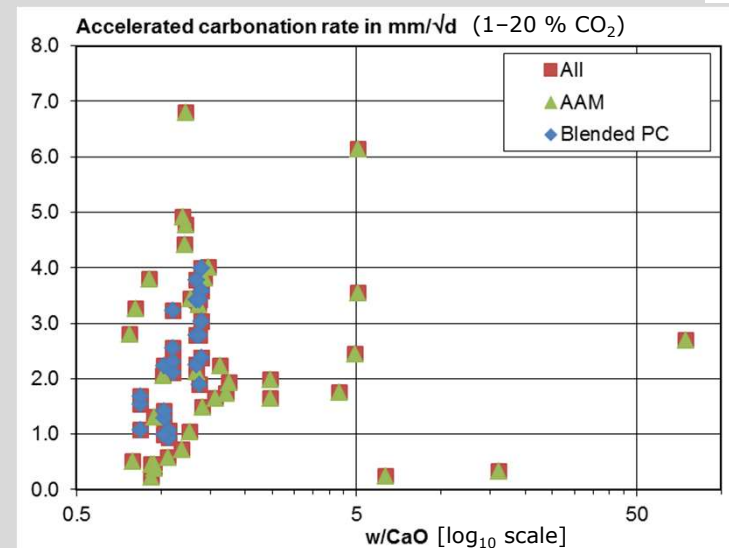
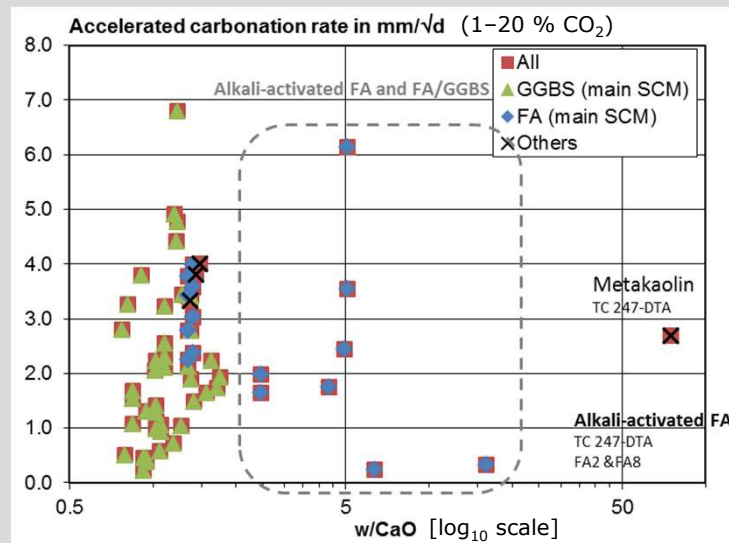
- **7** project reports (RWTH Aachen/ibac and Univ. Hannover) on concretes based on blended cements with a high volume of SCMs (mostly CEM III + fly ash).
- Unpublished data from RWTH Aachen/ibac (**3 concretes**: CEM III/B, CEM II/B + natural pozzolan, CEM III/C), kindly provided by Anya Vollpracht
- In addition, **11** potentially relevant papers/reports on concretes based on blended cements with a high volume of SCMs were evaluated.
 - **6** contained analyzable carbonation data (carbonation depths *versus* time or only carbonation rates).
 - 5 could not be used (mix-design information incomplete or internally conflicting, ...).

Preliminary results: Natural carbonation rate *versus* w/CaO



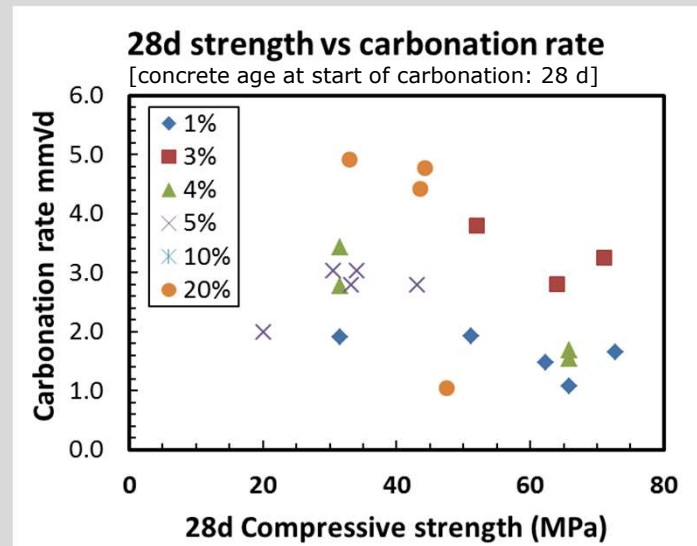
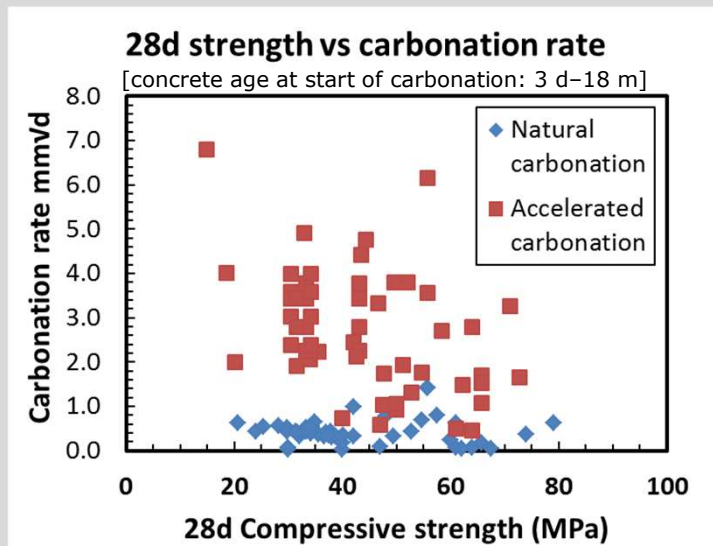
- Very similar trend of carbonation rate *versus* w/CaO identified for alkali-activated GGBS and PC/GGBS blend concretes.
- Data for alkali-activated GGBS/fly ash blend concretes appears to follow the same trend, but more data is needed to confirm this.

Preliminary results: Accelerated carbonation rate *versus* w/CaO



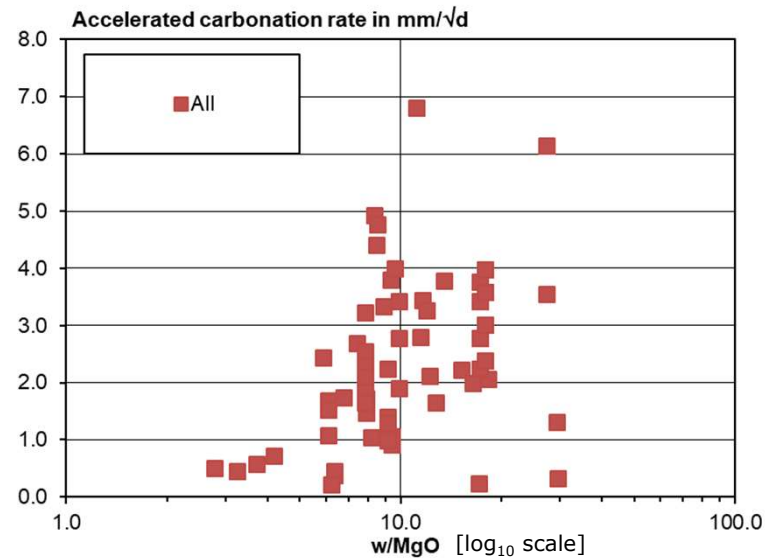
- Again, similar trend of carbonation rate *versus* w/CaO identified for alkali-activated GGBS and PC/GGBS blend concretes.
- Again, more data available for AAS concretes than for AAFA concretes.

Preliminary results: Carbonation rate *versus* compressive strength



- As has been stressed previously quite frequently, there is **no correlation** between carbonation rate and compressive strengths in alkali-activated concretes.
- This holds true no matter whether all data points are considered (left figure) or only samples with an age of 28 days at the start of the carbonation test (right figure).

Preliminary results: Accelerated carbonation rate *versus* w/MgO



- Despite considerable scatter, there seems to be a trend of increasing carbonation rate with increasing w/MgO.
- This may be simply related to the slag-content in slag/fly ash blends; needs to be checked ...

Parameters not looked at yet ...



... but presumed to be important:

- Total water content or water/solids ratio
- Activator type (sodium silicate, NaOH, Na₂CO₃)
- Paste fraction

Presentation of fully plotted/analyzed data and first interpretations of the data planned for RILEM week in Sheffield.

Thank you for your kind attention.

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