TC CCC – kick off meeting - discussion 12th April 2018, Ghent, Belgium
Minutes WG6: Carbonation of alkali-activated materials

WG leaders: Susan Bernal and Gregor Gluth

Participants

- Susan Bernal
- Martin Cyr
- Vilma Ducman
- Gregor Gluth
- Marija Nedeljković
- John Provis
- Xinyuan Ke

Opening discussion

The majority of attendees of this discussion are also members of the ongoing RILEM TC 247-DTA which focusses on durability testing of alkali-activated materials. Extensive discussions about carbonation testing of alkali-activated materials have been conducted during the life of the aforementioned TC. Based on the outcomes of those activities the following points where addressed:

- There have been several papers reviewing carbonation of alkali-activated materials (mainly from a chemical reaction perspective), and therefore a review paper of this nature will not be pursued by members of the TC CCC
- Members of the TC CCC, who are also members of the TC 247-DTA will lead the analysis and publication of the outcomes of the ongoing round-robin of accelerated carbonation of alkali-activated concretes organised. **Coordinators: G. Gluth & J. Provis.**

WG objectives

From the experience gained from TC 247-DTA the following activities for this WG were proposed:

- **Testing**
  - Developing a better understanding of the chemical and physical mechanism leading to dramatic differences in carbonation rates in specimens exposed under indoor or outdoor carbonation conditions (monitoring parameters: RH, CO_2 concentration, temperature)
  - Effect of drying microcracking in carbonation, linked to sample pre-conditioning
- **Chemistry**
  - Geochemical modelling of carbonation of alkali-activated materials linked to the Sheffield/ EMPA thermodynamic model for these materials (participation of B. Lothenbach in these activities is required)
  - Service life prediction models combining phase assemblage predictions derived from thermodynamic modelling and diffusion transport models. The carbonation-induced changes in microstructure (e.g. pore size, pore connectivities etc.) that would influence the permeability of the binders should be considered.
  - Understanding of carbonation of C-(N)-A-S-H and LDHs(e.g. hydrotalcite, AFm) phases.

- Understanding of carbonation of N-A-S-H phases. It was suggested that powders with controlled stoichiometry can be produced according to the method published in *Walkley B. et al. Powder Technology, 2016, 297:17-33*)

- **Corrosion**
  - Simulations of changes of pH in pore solutions of alkali-activated materials are necessary, as existing simulations are limited to CO_2 concentrations of 0.04% and 4% (it was mentioned that simulation at 1%, 20% and 100% CO_2 will be interesting)
  - Electrochemical measurement in partially carbonated materials

- **Transport and Engineering**

Knowledge gaps have been identified in the following areas:
  - Limited existing information about effect of carbonation in engineering, pore structure of alkali-activated concretes.
  - Limited attempts to characterise the pore structure of alkali-activated materials with methods that do not require sample pre-conditioning
  - Limited existing knowledge about effect of carbonation in efflorescences of alkali-activated concretes

Initial activities

- Simulations of carbonation of pore solution of alkali-activated materials (expanding the work published in *Bernal S.A. et al. CCR. 2012, 42: 1317-1326*). **Coordinators: X. Ke/ J. Provis**
- Review on consequences of carbonation on mechanical performance, transport properties, efflorescences and corrosion of alkali-activated concretes. This will not be limited to published data, it is expected that members of the WG can contribute with unpublished data as well, if available/ possible). **Coordinators: M. Cyr/ V. Ducman**

Remark

Depending on progress of initial activities, and number of active participants of this WG, selection of the proposed objectives will be discussed during the upcoming TC meetings.