STEEL REINFORCEMENT CORROSION IN ALKALI-ACTIVATED FLY ASH MORTARS

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Corrosion of steel rebars in concrete presents one of the main deterioration mechanisms limiting service life of the reinforced structures. The corrosion is accompanied by an expansion of the corrosion products causing high pressures, concrete cracking and finally spalling of a cover layer. Critical chloride concentration, loss of alkalinity and modeling of the steel corrosion are in researchers' spotlight for decades, however reinforcement corrosion in alkali activated materials is insufficiently described and understood yet.

In this work, the steel reinforcement corrosion in alkali-activated fly ash mortars is investigated in terms of electrochemical behaviour of the reinforced mortars exposed to aggressive environments such as leaching, carbonation and chloride ingress. A selected geopolymer mixture based on hard coal fly ash activated with sodium hydroxide and sodium silicate solutions is used for the steel reinforcement-corrosion experiments. The formation of passive layer on the steel rebars is observed after approx. two weeks of hardening at laboratory temperature. However, alternative heat-treatment at 80°C for several hours leads to immediate formation of the passive layer as well as to a faster strength gain (80 MPa after 24h at 80°C). Chloride-induced corrosion, leaching and carbonation resistance of the alkali activated fly ash-based concrete is studied, where leaching in deionized water or carbonation under natural conditions (~0.04 % CO_2) for 300 days did not lead to corrosion of the embedded steel. On the other hand, accelerated carbonation under 100 % CO_2 atmosphere lead to depassivation within two weeks.

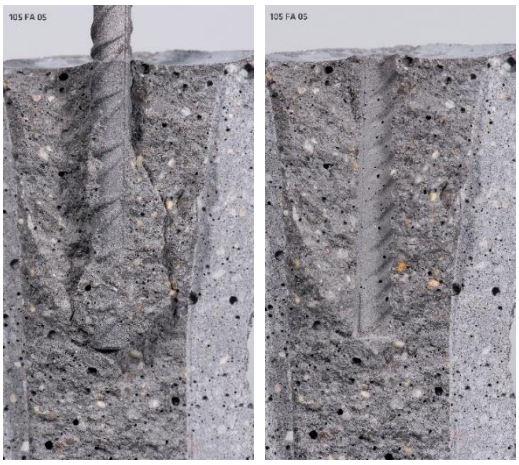

Figure 1 – Carbon steel reinforcement in alkali-activated fly ash mortar after passivation – two weeks of ambient curing.