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BOOK OF ABSTRACTS

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A study on leaching of crystallisation inhibitor in mortars

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Abstract: Crystallisation due to commonly occurring salts like sodium chloride (NaCl) is a known cause of damage in the built environment. Use of crystallisation inhibitors is a potential solution to reduce salt decay in building materials. Researchers have reported lower damage when sodium ferrocyanide (NaFeCN), a known NaCl crystallisation inhibitor, is mixed in fresh mortar. However, the high solubility of NaFeCN in water could make it susceptible to leaching and thus diminish its effect over time.

This paper investigates leaching of NaFeCN, when mixed in natural hydraulic lime (NHL) mortars. Leaching due to diffusion and advection were studied experimentally on cylindrical hardened mortar specimens. Leaching via diffusion was assessed in a tank where specimens were submerged in demineralised water. The demineralised water was replenished at prescribed time intervals with same volume and the leachate was analysed for ferrocyanide ions (FeCN) using UV-Vis spectrophotometer. Leaching via advection was studied on mortar specimens containing FeCN, subjected to repeated capillary wetting-drying cycles using demineralised water. The FeCN distribution over the specimen height after each cycle was quantified using UV-Vis spectrophotometer. The accumulation of NaFeCN crystals in the first 2 mm was mapped using SEM-EDS (Fig 1).

The results show that FeCN has a high diffusion coefficient and that almost 80% of the initial amount leached out at the end of the diffusion test. Repeated wet-dry cycles show transport of FeCN by advection and accumulation at the evaporation surface, with corresponding depletion in the inner depths. Efflorescence of NaFeCN crystals were observed at the surface.. Based on these results, it can be concluded that the rate of leaching of FeCN is significant and that steps need to be taken in order to reduce the leaching rate and prolong durability of mortars with mixed-in inhibitors.

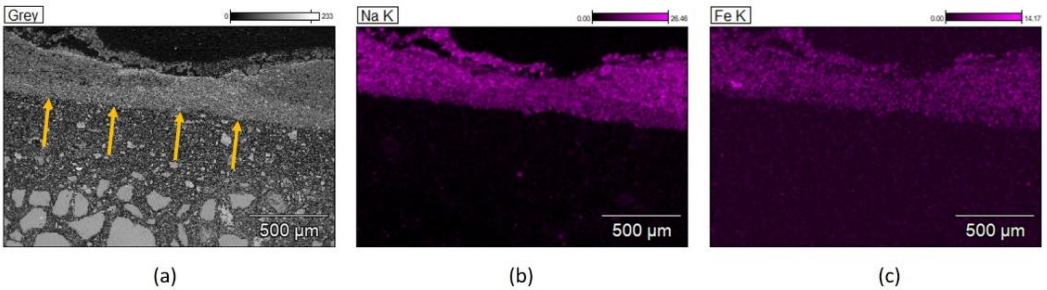

Figure 1: SEM-EDS map of the top 2mm of a polished section of a mortar specimen at the end of 1st wet-dry cycle. (a) Accumulation of NaFeCN crystals near the surface due to capillary transport confirmed by elemental mapping of (b) Na and (c) Fe