Influence of hydrophobic treatments applications on the concrete carbonation delay

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Abstract. Water-repellents are increasingly used in the recent years. Those ones are generally used to reduce the degradation caused by freeze / thaw, by alkali-aggregates reaction or by chloride ions. The objective of this study is to determine if hydrophobic treatments also have an influence on the propagation of the carbonation front into the concrete. Capillary absorption tests, permeability to water-vapor and oxygen, FTIR, DSC and porosity were carried out on concrete samples. Six products with different concentrations, solvent and molecules were tested. The results showed that the application of a water-repellent delays the propagation of the carbonation front. The most efficient products were the silanes which presented a higher penetration depth. Concrete compactness and porosity played also an important role in silane penetration depth.

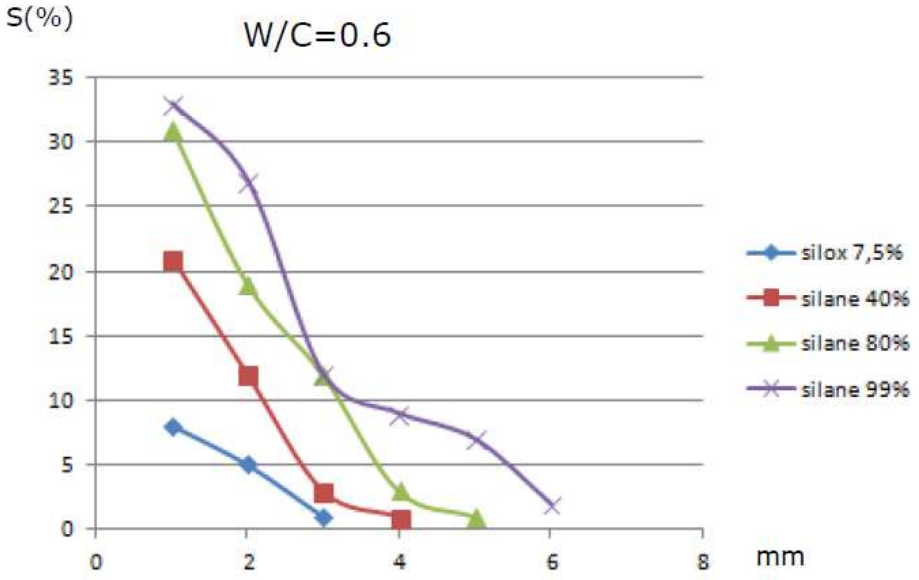

Figure 1: Evaluation of hydrophobic treatments penetration depth by FTIR (S is the product saturation level).

Silane is more efficient in penetrating the concrete (W/C = 0.6) with regard to siloxane due to dimension of molecules. Higher concentration of active matter induces an increase of penetration as well as saturation level.

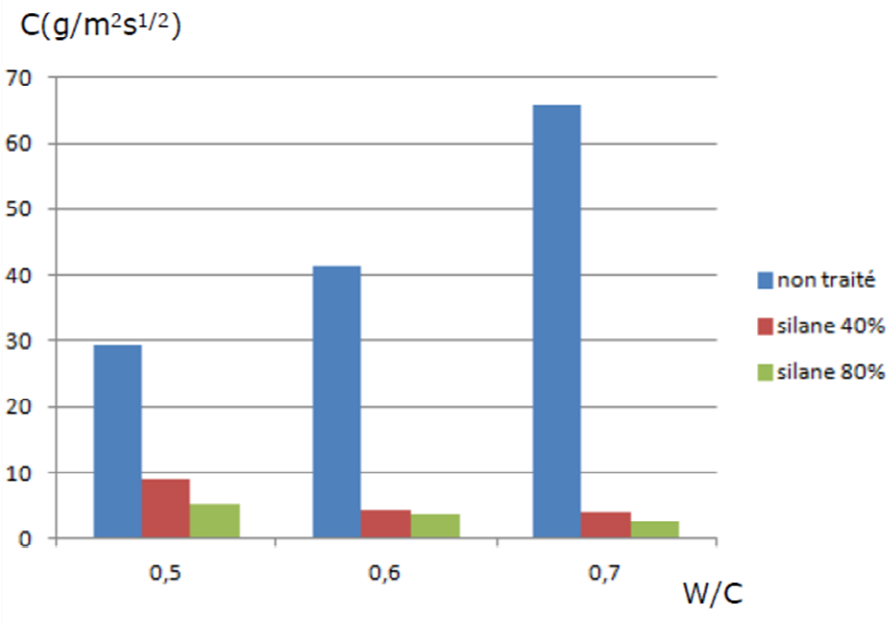

Figure 2: Evolution of the capillary absorption (EN 1062-3) after treatment.

Effect of silane on capillary succion is more visible on more porous concrete. Concentration doesn't appear to be fundamental for concrete with high W/C ratio's, which means classical concrete from cultural heritage.

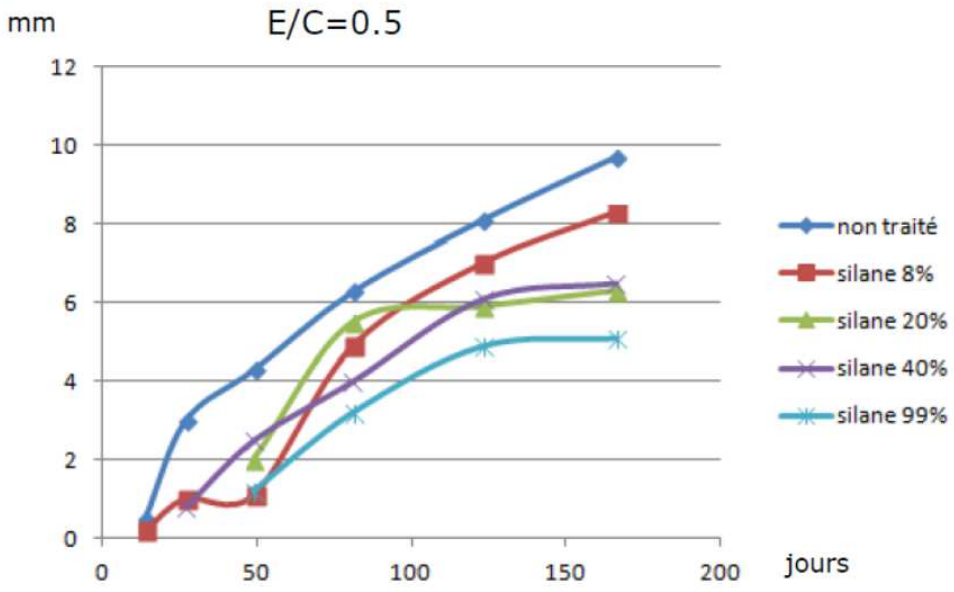

Figure 3: Evolution of the carbonation speed as a function of time (W/C = 0.5).

Carbonation depth decreasses with silane concentration: the repulsive effect on water seems to be effective for reducing concrete carbonation process, which is fundamental for reducing steel corrosion and reinforced concrete degradation.