Intumescent paint CHAR 21

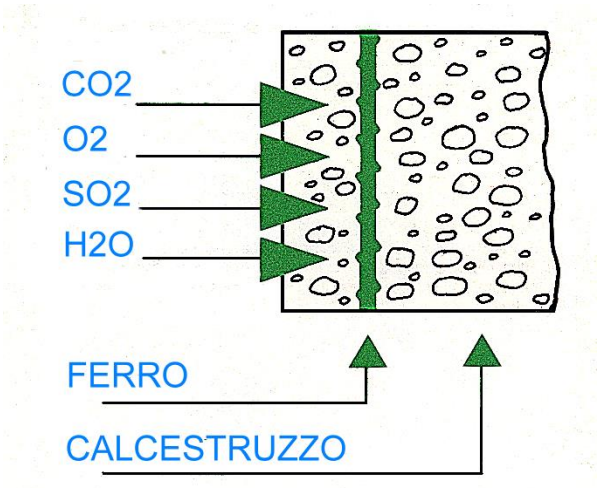
ANTI-CARBONATATION PERFORMANCE (barrier to CO_2)

The carbonatation issue

The concrete based materials, especially the reinforced concrete (RC) and the prestressed concrete (PRC) have been considered as high strength materials, at the beginning of their widespread application century ago. Architectural works were also created, among the most important ones of this century, with "exposed" concrete finishes.

Nowadays it is well known that concrete based systems are prone to serious degradation phenomena linked to the combination of various causes, where carbonatation plays a fundamental role.

Concrete based materials feature a high porosity which allows the transport of various pollutants from the external environment to the material interior part. In particular, the gases in the atmosphere migrate, through the capillary pores to the part in which the reinforcing rods are embedded. Similarly, various soluble salts are conveyed within the water.

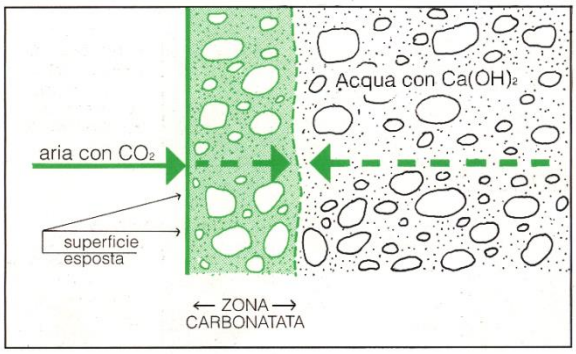


The oxygen in contact with the water and the electrolytes causes electrochemical reactions leading to the oxidation of iron and its corrosion. In this case, in addition to the shrinking of the resistant metal part, a strong expansion of oxidation products takes place (iron oxides and hydroxides). This expansion causes the concrete cover (the cement layer placed to protect the reinforcement) to break and allows an even higher access of harmful substances, as well as visually highlighting the phenomenon of degradation.

In a cement-based system, iron is initially protected against corrosion thanks to the strongly alkaline nature of the water phase occurring in the conglomerate. Carbon dioxide (normally found in the air in the ratio of about 0.025%, but in town or industrial atmospheres even in percentages four times higher) reacts with alkaline hydroxides (calcium hydrate) neutralizing them according to the reactions:

$CO_2 + H_2O \leftrightarrows H_2CO_3$

$H_2CO_3 + Ca(OH)_2 \leftrightarrows CaCO_3 + 2H_2O$



As the reaction develops, the concrete pH decreases and the iron passivation disappears. When the pH decreased to less than 11-11,5, the iron electrochemical corrosion reaction starts.

The simplest and most advantageous system to prevent reinforced concrete from damages consists in creating a barrier to CO2 mass transfer applying a protective coating with adequate properties.

According to the opinion of several experts, especially Prof. Klopfer (University of Dortmund) “the alkalinity of cement must be kept at a high level for as long as possible by suppressing the carbonatation processes".

CHAR 21

CHAR 21 water-based intumescent paint, used for fire protection of concrete structures, also provides an effective barrier to CO_2, thus acting as an effective anti-carbonatation protection agent. To evaluate the anti-carbonatation performance, specific tests were carried out at GFC Chimica accredited laboratory, according to the European standard EN 1062-6, and the results were evaluated according to EN 1504-2.

The results obtained (test report 104/L dated 30.03.2022) prove an excellent anti-carbonatation protection which, at the maximum application thickness of CHAR 21 (about 1300 mm dry film) even provides an $SdCO_2$ of 450 m.

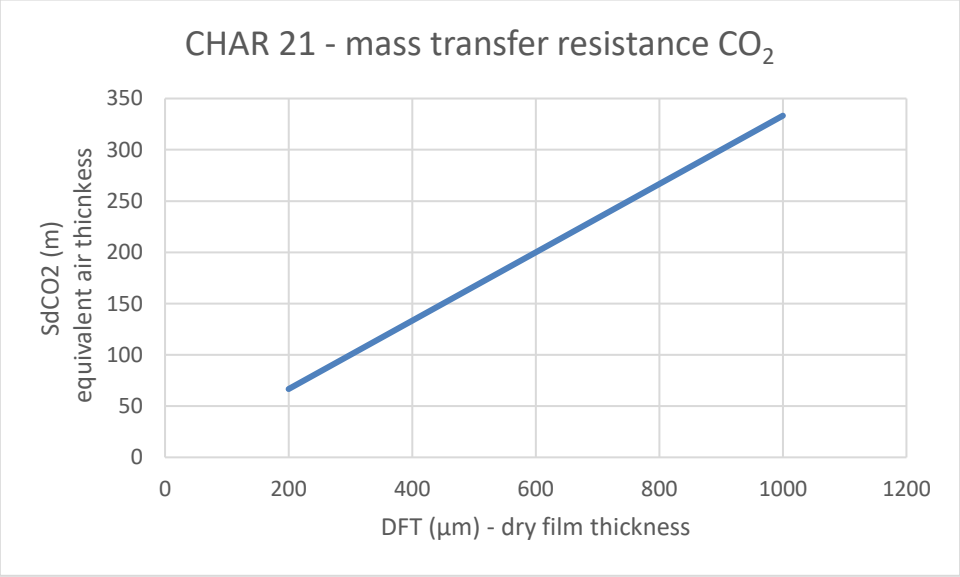
This excellent result decreases proportionally with the decrease in the applied dry thickness; however, with the minimum application thickness of CHAR 21, the excellent value of 6 m is still found, which is enough to guarantee the anti-carbonatation protection, according to EN 1504-2 ($SdCO_2$ >50 m).

The $SdCO_2$ parameter conventionally stands for the equivalent air thickness, that is the thickness of still air, expressed in meters, which offers the same resistance to the incoming CO_2.

The test result also provides the measure of the anti-carbonatation performance of the coating product as specific resistance to the diffusion of CO_2 (mCO_2) which is for CHAR 21 333270.

Performance graph

The graph below, for the designer's use, shows the $SdCO_2$ value as a function of the applied dry film thickness of the intumescent paint CHAR 21, with reference to the thickness of the same product suggested for the fire protection of elements in RC/PRC in the assessment reports of the fire resistance tests carried out according to EN 13381-3 for fire resistance certification purposes.



This information is the result of extensive testing and our best experience. Nevertheless, this information is to be considered indicative given the extreme variability of the operating conditions. In recommending the execution of application tests, we confirm the best availability of our technological service.

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