ABSTRACT

This work reports the results of an experimental study concerning the drying of cement mortar and specially the mechanism of moisture transfer during the process.

- The effect of the mix-composition, in particular the water-to-cement ratios (W/C), on the microstructure and transfer parameters is investigated.
- The experimental campaign aims to characterize from textural and hydric point of views, the materials, by mean of DVS (dynamic vapor sorption). This technique allows to obtain desorption-adsorption cycles and to identify the moisture diffusivity coefficient of mortar for a broad range of relative humidity.
- The results show a small dependence on W/C ratio but there is a clear difference between absorption and desorption branches.
- Moisture diffusivity in liquid state and in the vapour one was also determined from sorption experiments.

INTRODUCTION

Drying plays a major part in many industrial sectors as a way to conserve the matter, to reduce the volume of bulky materials, or to finalize the manufacture of a product after a processing under wet conditions. This is why drying investigations concern so many materials, like food products and sludge [1]. But drying also occurs under natural conditions [2]. Mortar is submitted to natural wet conditions. This is why drying investigations of mortar are of great importance. The moisture transfer during the process of drying was given by Darcy’s law (Richards, 1931).

Global moisture diffusivity Dm is obtained by the sum of water and vapor diffusivity Dm= Dm_w + Dm_v. Consequently, we can conclude that in the three tested materials, the global moisture diffusivity is not obvious. Therefore W/C ratio cannot explain alone the mortar transfer capabilities; connectivity of the very complex porous network plays an important role in the moisture transfer aptitude of the mortar.

RESULTS

Fick's approach

The evolution of moisture diffusivity with the water saturation degrees in desorption of the three mortars, obtained with the two methods Fick's approach and Darcy's approach is shown in Table 1.

Global Moisture diffusivity Dm was obtained from DVS experiments. The results of moisture diffusivity for the three tested materials is obtained from sorption kinetics with different water saturation degrees.

Isotherm sorption cycle of mortars M04, M05 and M06 at 20°C

- Global moisture diffusivity Dm is expressed as the sum of diffusivity in liquid state "Dml" and in the vapor state "Dmv".

Darcy’s law: The Richards equation (Richards, 1931) represents the movement of water in unsaturated porous solids, the liquid water saturation Sr is the equation solution.

Dynamic vapor sorption DVS

Sorption isotherms of mortar were determined using the DVS (dynamic vapor sorption), a well-established technique for the study of the interaction of water molecules with porous media and of moisture transfer in general.

MATERIALS

<table>
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<tr>
<th>Mortars</th>
<th>Components</th>
<th>References</th>
<th>Portions (g)</th>
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<tr>
<td>M04</td>
<td>Cement</td>
<td>CIMI-525 R HES</td>
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<tr>
<td></td>
<td>Sand</td>
<td>references CEN</td>
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<tr>
<td></td>
<td>Tap water</td>
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<tr>
<td>W/C</td>
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<tr>
<td>O/C</td>
<td>Sand cement ratio</td>
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<td>Table 1. Mix proportions of mortars</td>
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REFERENCES