Numerical Investigation of Hygrothermal Behavior on Porous Building Materials

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Abstract : Most of the building materials are considered porous, and composed of solid matrix and pores. In the pores, the moisture can be existed in two phases: liquid and vapor. Thus, the mass balance equation is comprised of various moisture driving potentials that translate the movement of the different existing phases occupying pores and the hygroscopic behavior of a porous construction material. This study suggests to resolve a hygrothermal mathematical model of heat and mass transfers in different porous building materials by a numerical investigation. Thereby, the evolution of temperature and moisture content fields has been processed. So, numerous series of hygrothermal calculation on several cases of wall are exposed. Firstly, a case of monolayer wall of massive wood has been treated. In this part, we have compared the numerical solution of the model on one and two dimensions and the effect of dimensional space has been evaluated. In the second case, three building materials (concrete, wood fiberboard and wooden insulation) are tested separately with the same boundary conditions and their hygrothermal behavior are compared. The evaluation of the exchange of heat and air at the interface between the wall and the interior ambiance is carried.

Keywords : building materials, heat transfer, moisture diffusion, numerical solution

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