World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:10, No:06, 2016

Localized Analysis of Cellulosic Fibrous Insulation Materials

Authors : Chady El Hachem, Pan Ye, Kamilia Abahri, Rachid Bennacer

Abstract : Considered as a building construction material, and regarding its environmental benefits, wood fiber insulation is the material of interest in this work. The definition of adequate elementary representative volume that guarantees reliable understanding of the hygrothermal macroscopic phenomena is very critical. At the microscopic scale, when subjected to hygric solicitations, fibers undergo local dimensionless variations. It is therefore necessary to master this behavior, which affects the global response of the material. This study consists of an experimental procedure using the non-destructive method, X-ray tomography, followed by morphological post-processing analysis using ImageJ software. A refine investigation took place in order to identify the representative elementary volume and the sufficient resolution for accurate structural analysis. The second part of this work was to evaluate the microscopic hygric behavior of the studied material. Many parameters were taken into consideration, like the evolution of the fiber diameters, distribution along the sorption cycle and the porosity, and the water content evolution. In addition, heat transfer simulations based on the energy equation resolution were achieved on the real structure. Further, the problematic of representative elementary volume was elaborated for such heterogeneous material. Moreover, the material's porosity and its fibers' thicknesses show very big correlation with the water content. These results provide the literature with very good understanding of wood fiber insulation's behavior.

Keywords : hygric behavior, morphological characterization, wood fiber insulation material, x-ray tomography
Conference Title : ICCBM 2016 : International Conference on Construction and Building Materials
Conference Location : Copenhagen, Denmark
Conference Dates : June 27-28, 2016