Moisture Control Capacity of Geopolymer Composites: Correlation of the Bulk Composition–Pore Network with the Absorption–Desorption Behavior

Transport in Porous Media

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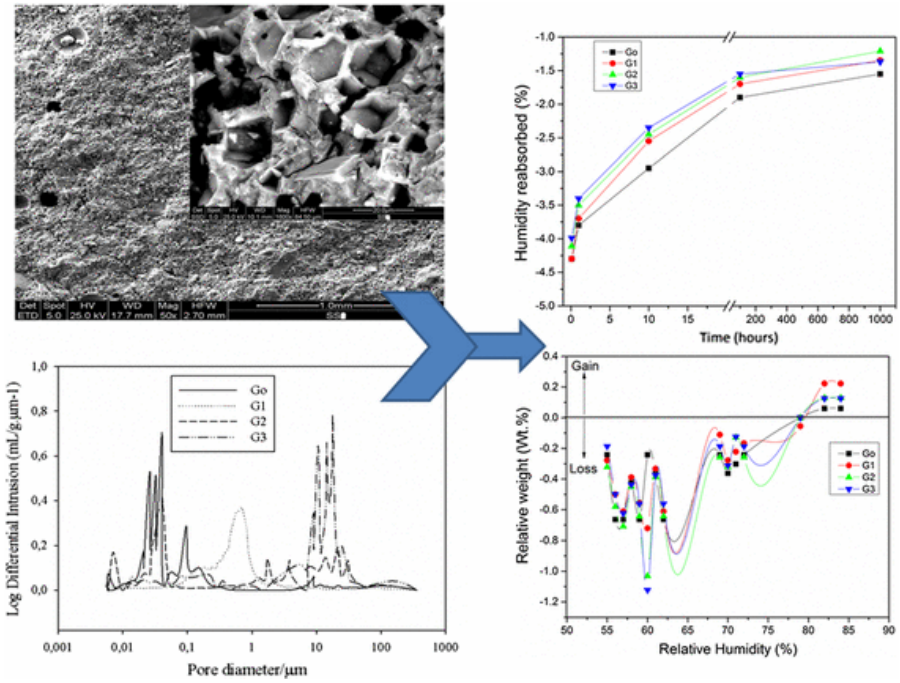
Abstract

Porous composites with the principal class of porosity in the range of those presented in the literature as ideal for the moisture control capacity of building environment are described. In the course of the design of the matrices, micrometric pores are introduced to give to the pore systems a bi- or multimodal characters with the aim of improving the phases percolation during the course of desorption and make the moisture accumulation–desorption behavior of the porous composites essentially function of weather and environment. The porous composites present size of pores in the range $0.001-1\ \mu$m for the gel pores and peak centered at $10\ \mu$m for the micrometric pores which insure the matrices efficiency in moisture control capacity and durability. The results of cycles of moisture absorption–desorption in the course of various seasons of the year permit to identify the activities of gel pores meanly efficient in the extreme environment: absorption when the temperature is under $11\ ^{\circ}$C; relative humidity is $>\ 60\%$ and desorption when the temperature is above $18\ ^{\circ}$C. At ambient conditions, the pores more active are micrometric pores, while gel pores enter in activity only in the extreme environment conditions. The proposed porous geopolymer composites appeared promising candidates for the management of the moisture while improving the thermal insulation of residential building particularly in the regions with important fluctuation of weather. The use of geopolymerization process for the production of those porous composites, the choice of recycling industrial and municipal inorganic wastes appears ideal solution, environmentally friendly, eco-efficient and sustainable for the design of newly materials for the moisture control capacity in building environment.

Graphical Abstract



Keywords

Porous geopolymer composites Gel pores Absorption–desorption Moisture control capacity

Notes

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