

## Evaluation of mechanical and hydric performances of masonry walls composed of earth bricks, geopolymer binder and wood

FOUCHAL FAZIA <sup>1</sup>, GOUNY FABRICE <sup>2,3</sup>, MAILLARD PASCAL <sup>3</sup>, ULMET LAURENT <sup>1</sup> and ROSSIGNOL SYLVIE <sup>2</sup>.

### ABSTRACT:

The present study discusses the development of a new geopolymer binder able to better bond the earth to wood while respecting the construction and comfort requirements of building. This work is particularly focused on the understanding of mechanical behavior and hydric transfers in a new construction system composed with geopolymer binder, wood and extruded earth brick. First, the double shear and pullout tests are performed on samples made with two different types of extrusion-manufactured industrial earth bricks in order to describe the interface mechanical behavior between earth brick -binder and wood. Secondly, a wall at real scale (2.40 x 2.50 m<sup>2</sup>) is tested in double climatic chamber under several humidity conditions in the aim to determine its hydric performances.

*Keywords:* Masonry, earth brick, geopolymer binder, wood, Interface, mechanical and hydric behavior.

### 1 INTRODUCTION

The construction building field use more of energy [1] and contributes to much discharges for cement produce which present 5 % of CO<sub>2</sub> emission and consume about 1,6% of energy requirements through the world [1]. A new global approach in building construction is essential and must focus on materials at different scales: raw materials, materials as bricks, structure element (wall) and building.

Earth is one the oldest building material still in use, and the interest in traditional earth construction has grown in France in recent years. One of the reasons is the low impact of this material on the environment and its capacity to regulate the hygrothermal conditions inside building [2, 3, 4, 5].

The assembly of wood and earth brick is appropriate for construction systems and used in many existing structure [6]. The mechanical properties of wood gives good strength and its lightweight, brick earth provides a thermal inertia and a moisture storage [7,8]. Often combined with wood, as timber frame, the masonry walls made of earth brick can show cracks at the interfaces due to humidity and temperature variations. These cracks lead to sealing defects, insulation and aesthetics incompatible with the user's requirement. Substitution of traditional mortar with new material is a

<sup>1</sup>) Université de Limoges- Groupe d'Etude des Matériaux Hétérogènes (GEMH -MMGD), Boulevard Jacques Derche, 19300 Egletons, France, [fazia.fouchal@unilim.fr](mailto:fazia.fouchal@unilim.fr), [laurent.ulmet@unilim.fr](mailto:laurent.ulmet@unilim.fr)

<sup>2</sup>) Ecole Nationale Supérieure de Céramique Industrielle - Groupe d'Etude des Matériaux Hétérogènes (GEMH -MMGD), 12 rue Atlantis, 87068 Limoges, France. [Fabrice.gouny@unilim.fr](mailto:Fabrice.gouny@unilim.fr), [Sylvie.rossignol@unilim.fr](mailto:Sylvie.rossignol@unilim.fr)

<sup>3</sup>) Centre Technique de Matériaux Naturels de Construction (CTMNC), Research and development department, Ester Technopole BP 26929 87069 Limoges Cedex. [p.maillard@ctmnc.fr](mailto:p.maillard@ctmnc.fr)