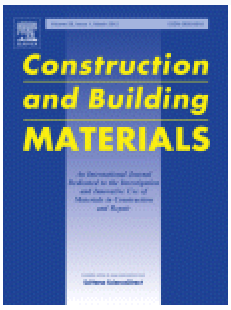
Construction and Building Materials

Volume 36, November 2012, Pages 188–195



A geopolymer mortar for wood and earth structures

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Received 16 October 2011. Revised 28 February 2012. Accepted 24 April 2012. Available online 23 June 2012.

http://dx.doi.org/10.1016/j.conbuildmat.2012.04.009, How to Cite or Link Using DOI

Abstract

In building construction, because of the hygroscopic nature of wood and earth brick and the low adhesion between these materials, cracks are formed at their interface when they are assembled. Geopolymer binder has been show to create strong bonds between wood and earth brick. Assemblies of wood and extruded earth brick with geopolymer binder were manufacture and tested. Double shear tests at two scales were carried out that provided evidence of good adhesion and information about the influence of the type of brick on shear behavior. The workability of the binder was improved by adding siliceous aggregates. The mortar obtained has an improved compressive strength, ranging from 3 to 8 MPa, depending on the aggregate size. FTIR measurements and thermal analysis were performed to determine the reaction mechanism.

Highlights

► Possibility to use a geopolymer binder to make a stable assembly of wood and earth brick.

► Role played by the nature of the brick is determinant.

► The aggregates addition to geopolymer binder facilitates a mortar suitable for construction.

Keywords

Mortar; Metakaolin; Double shear test; Geopolymer; Infrared spectroscopy; Extruded earth brick.

Figures and tables from this article:

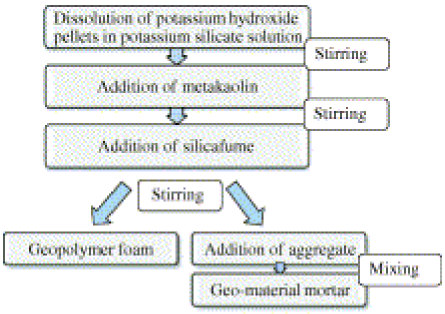

Fig. 1. Synthesis protocol for geomaterial foams and geomaterial mortars.

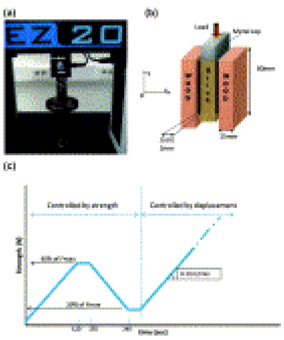

Fig. 2. (a) Compression testing apparatus; (b) double shear test set-up in accordance with the EN 1052/3 norm; (c) experimental double shear test protocol.

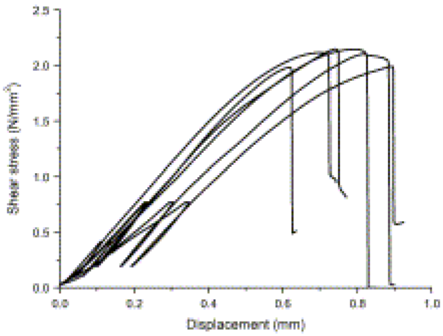

Fig. 3. Various values of shear stress as a function of displacement for the SB2 sample.

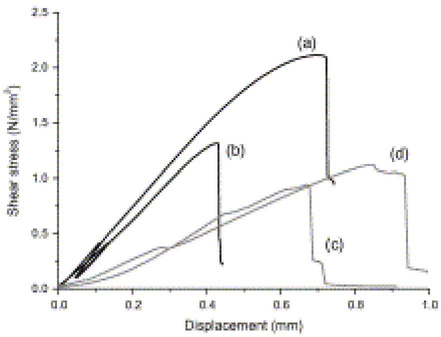

Fig. 4. Shear stress as a function of displacement for (a) SB2, (b) SB1, (c) HB2-90% and (d) HB2-40% samples.

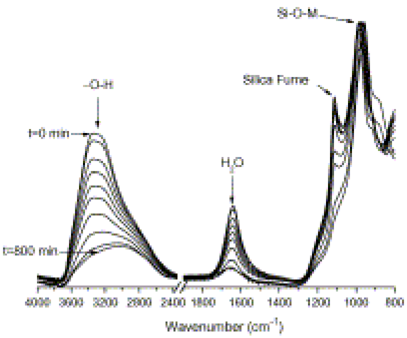

Fig. 5. FTIR in situ experiments of F_{63S2} sample over 800 min at room temperature.

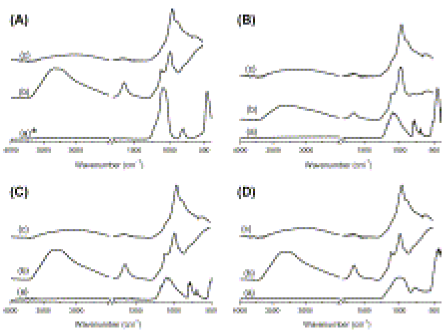

Fig. 6. FTIR spectra of foam (A) and mortars (B) F_{63SN}, (C) F_{63S2}, (D) $F_{63Glass}$, the pure additive (a), at *t* = 0 min (b), and *t* = 800 min (c). (*(A) (a) silica fume spectrum).

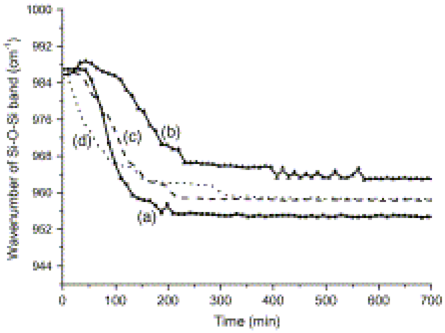

Fig. 7. Displacement of FTIR Si–O–M (M = Si, Al or K) peak position for (a) foam, (b) F63SN, (c) F63S2 and (d) F63Glass samples.

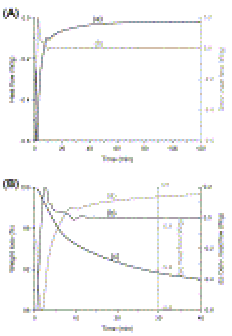

Fig. 8. (A) thermal analysis F63S2 sample, (B) enlargement in function of time; (a) heat flow, (b) deriv. heat flow, (c) weight loss.

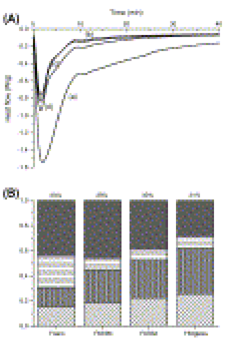

Fig. 9. (A) Heat flow of (a) foam, (b) F_{63SN}, (c) F_{63S2} and (d) $F_{63Glass}$ samples, (B) loss of water per area determined on weight loss curves (see Table 2) first area, second area, third area, fourth area.

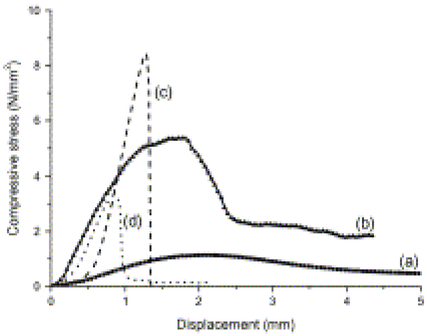

Fig. 10. Compressive stress value in function of displacement for (a) —■— Foam, (b) —▲— F_{63SN}, (c) --- F_{63S2} and (d) .... $F_{63Glass}$ samples.

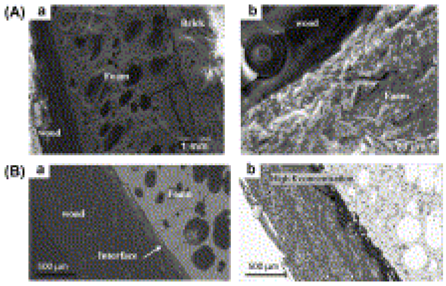

Fig. 11. SEM images (A) (a) fracture assembly, (b) wood/foam interface, (B) (a) wood/foam interface (b) wood/foam interface with potassium analyze.

Table 1. Details of samples (nomenclature, weight percent, mixture).

Table 2. Values of weight loss of each area determined from thermal analysis experiments ATG-ATD analysis.

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