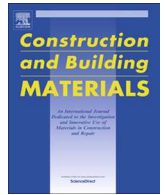




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Mechanical performance of fiber-reinforced alkali activated un-calcined earth-based composites

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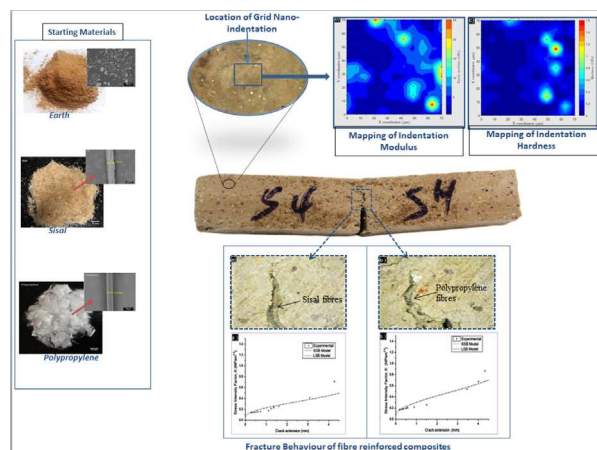
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HIGHLIGHTS

- Inclusion of fibres into alkali activated soil improved flexural strength by 47%.
- Strengthening mechanism associated with sisal fibres was via elastic stress transfer.
- Polypropylene fibres strengthened the matrix in the post-crack region via frictional slip.
- Resistance curve behavior was rationalized using crack bridging micromechanical models.

GRAPHICAL ABSTRACT



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ABSTRACT

This paper presents the results of a multi-scale study of the mechanical properties of model earth-based composites. The composites are produced by the alkali activation of *in-situ* clay minerals within an earth-based matrix that is reinforced with two different fibers (sisal and polypropylene). The local mechanical properties of the fibers, binder and matrix materials are characterized at the nano- and micro-scales using nano-indentation and statistical deconvolution techniques. The macro-mechanical properties are also elucidated using a combination of flexural strength testing, and resistance-curve experiments. The underlying strengthening and toughening mechanisms are explored using a combination of *in-situ/ex-situ* observations and micro-mechanical models. The implications of the results are then discussed for the design of strengthened and toughened earth-based composites that are reinforced with natural fibers (such as sisal) and synthetic fibers (such as polypropylene fibers).

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