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Thermodynamic Performance Tests for 3D Printed Steel Slag Powder Concrete Walls

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Abstract : The three dimensional (3D) printing technology has undergone rapid development in the last few years and it is possible to print engineering structures. 3D printing buildings use wastes from constructions, industries and mine tailings as “ink”, and mix it with property improved materials, such as cement, fiber etc. This paper presents a study of the Thermodynamic performance of 3D printed walls using cement and steel slag powder. Analyses the thermal simulation regarding 3D printed walls and solid brick wall by the way of the hot-box methods and the infrared technology, and the results were contrasted with theoretical calculation. The results show that the excellent thermodynamic performance of 3D printed concrete wall made it suitable as the partial materials for self-thermal insulation walls in residential buildings. The thermodynamic performance of 3D printed concrete walls depended on the density of materials, distribution of holes, and the filling materials. Decreasing the density of materials, increasing the number of holes or replacing the filling materials with foamed concrete could improve its thermodynamic performance significantly. The average of heat transfer coefficient and thermal inertia index of 3D printed steel slag powder concrete wall all better than the traditional solid brick wall with a thickness of 240mm.

Keywords : concrete, 3D printed walls, thermodynamic performance, steel slag powder
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