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Micro-cable Reinforced Geopolymer Composite for Extrusion-based 3D Printing

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Title: Micro-cable Reinforced Geopolymer Composite for Extrusion-based 3D Printing

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Abstract: Geopolymer has been applied to accommodate the rapid development of 3D printing in civil engineering practice and contribute this technique to reach its maximum eco-friendly potentials by eliminating the use of Portland cement. However, inherent problems with 3D printing concrete lie in the low tensile strength and poor ductility due to non-reinforcement, which greatly limit the application of 3D printing materials and structures. Hence this study experimentally explores the feasibility of directly entraining a continuous micro steel cable (1.2mm) during filaments (12mm) deposition process, forming a reinforced geopolymer composite material. Three different printing path configurations are designed to verify the applicability of micro-cable reinforced geopolymer composite for extrusion-based 3D printing. Flexural bending capacities of the proposed composite is measured and evaluated through four-point bending test. The results prove the well bonding and coordination of the micro-cable and geopolymer. Significant improvement of mechanical strength, toughness and post-cracking deformation of geopolymer composite are demonstrated.

Keywords: 3D concrete printing; Micro-reinforcement; Fiber technology; Deformation and fracture; Geopolymer; Printing path design;

1. Introduction

3D concrete printing has been widely applied in the construction and building fields due to the great potentials to reduce wastage, labor requirements, construction cost, and increase architectural freedom,

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