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BASALT FIBER COMPOSITES FOR THE ROBOTIC FABRICATION OF A LUNAR HABITAT

Abstract

This study investigates the mechanical properties of a novel composite for a lunar space habitat. The research aims to identify a robotically fabricated solution for a high-mechanical strength shell with in-situ resources. We manufactured composites from several basalt fiber types and geopolymer matrices. The effect of the basalt fiber type, chopped, spooled, and long, and fiber percentage, 1 wt%, 5 wt%, and 10 wt%, was investigated. The samples were initially exposed to a maximum lunar environmental temperature (117C) and a medium vacuum (0.01 atm) for 24 hours. Then, they were tested for flexural and compressive strengths until failure occurred. The experiments have proven a successful consolidation between the basalt fibers and the geopolymer matrix. Furthermore, the 10% chopped basalt fiber and the 5% long basalt fiber composite proved to be the most promising combination for mechanical strength. These composites demonstrated an improved compressive and flexural strength for the geopolymer-based cement slurry. Moreover, this study enables the robotic fabrication potential of a mechanically resilient lunar habitat.