Paper ID: 84461
student

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Interactive Presentations - IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (IPB)

Author: Prof. Gong Wang
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China

Ms. Rihan Zhang
University of Chinese Academy of Sciences; Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China
Dr. Tongcai Wang
Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences., China
Mr. Qingfeng Jia
University of Chinese Academy of Sciences; Technology and Engineering Center for Space Utilization, Chinese Academy of Sciences, China

RAPID FORMATION OF LUNAR REGOLITH COMPOSITE VIA COMPRESSION MOLDING AND THERMALCURING METHOD WITH LOW CONTENT OF RESIN-BASED ADDITIVE AND HIGH MECHANICAL PROPERTY

Abstract

This study proposes a rapid prototyping technology for lunar regolith composite building materials based on the compression molding-thermosetting composite molding method. Combining compression molding and thermosetting, this technique achieves low-temperature thermosetting molding of lunar regolith composite building materials with minimal addition of adhesives. It realizes high in-situ utilization, low energy consumption, and rapid preparation of lunar regolith composite building materials, enabling efficient shaping of lunar regolith on the lunar surface, which provides feasibility for future lunar base construction projects.

The article provides a detailed introduction to the application of compression molding in lunar regolith shaping. Through compression molding, lunar regolith obtains specific shapes and structures under controlled conditions, laying the foundation for the molding process of lunar regolith composite building materials. By applying thermosetting resins and other substances, lunar regolith composite building materials can achieve higher strength and durability after thermosetting molding to resist extreme temperature changes and minor impacts on the lunar surface. The optimization methods and results of the thermosetting process with adhesive addition of 1% to 5% are analyzed. It is found that lunar regolith composite building materials molded at 120C for 6 hours with 2% adhesive addition can achieve a compressive strength of 25 MPa, suitable for direct use in lunar construction, while higher strength and better service performance can be achieved after sintering for meeting other construction needs.

In discussing the integration of these two key processes, this study emphasizes the synergistic effect of compression molding-thermosetting composite technology in the shaping of lunar regolith composite building materials. The innovation of this technology lies in obtaining lunar regolith building materials that meet performance requirements with simple mechanical devices, minimal additive substances, and easy-to-operate molding methods, making them reliable construction materials suitable for various applications in lunar base scenarios.