Paper ID: 85878
student

22nd IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Contribution of Moon Village to Solving Global Societal Issues (2)

Author: Ms. Yashika Mudgil
University of Petroleum and Energy Studies, India

Mr. AMAN RAJ
University of Petroleum and Energy Studies, India

UTILIZING LUNAR REGOLITH FOR 3D PRINTING: TOWARDS SUSTAINABLE LUNAR INFRASTRUCTURE DEVELOPMENT

Abstract

This paper proposes the use of lunar regolith, the layer of manufacturing loose, fragmented material covering the lunar surface, as a raw material for manufacturing through 3D printing and Composite Filament Fabrication (CFF) techniques using lunar regolith as the primary material feedstock with continuous reinforcement materials, offering a versatile approach for producing robust and lightweight components suitable for lunar infrastructure. To create three-dimensional structures, a method has been proposed that involves mixing lunar regolith simulants with reinforcing fibers and extruding the composite material through a nozzle. The method takes advantage of the abundance of lunar regolith and the potential of reinforcement fibers. By optimizing the material composition, including the ratio of regolith to fibers and the orientation of the fibers within the printed structures, the desired performance characteristics can be achieved. This is important for enhancing the mechanical strength and durability of the components manufactured. Our study will investigate how various parameters impact the mechanical strength, thermal stability, and other important properties of lunar regolith simulant. We will evaluate factors such as nozzle temperature, printing speed, and layer thickness to ensure the quality of fabricated structures. Additionally, we will investigate the effect of particle size distribution, binder composition, and the mechanical properties and structural integrity of printed components under various loading conditions. The utilization of lunar regolith offers several advantages. It reduces the need for transporting bulky materials from Earth, thereby lowering mission costs and logistical complexities. Furthermore, it facilitates the rapid prototyping of designs. Moreover, utilizing promotes sustainability and self-sufficiency in lunar exploration endeavors. Overall, this study represents a critical step toward unlocking the full potential of the lunar regolith as a valuable resource for in-situ manufacturing and construction activities on the Moon. Through the integration of CFF technology with lunar regolith simulants, insights gained from this research will inform the design and implementation of future lunar exploration missions and pave the way for sustainable human presence beyond Earth's orbit.