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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies  
(2B)

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CHARACTERIZATION OF THE PHYSICAL AND MECHANICAL PROPERTIES OF COMPACTED  
BASALTIC CEMENTITIOUS COMPOUNDS FOR USE AS AN IN-SITU RESOURCE FOR LUNAR  
INFRASTRUCTURE DEVELOPMENT

**Abstract**

In Situ Resource Utilization, or ISRU, is the use of local natural resources at mission destinations, rather than bringing all needed supplies from Earth, to enhance the capabilities of human exploration. It is a viable and sustainable way to develop settlements on the Moon. As such, lunar regolith stands out as an ISRU building material for future lunar infrastructure, which covers a wide range of applications, from the construction of habitable modules, roads, and landing pads, among others, to a source of essential resources for the survival of lunar explorers, such as oxygen, water, or substrate for growing food. However, construction techniques for ISRU-based materials in low-gravity environments require the replication of favorable conditions that guarantee the achievement of structural solutions with exceptional mechanical and microstructural properties to withstand a variety of environmental hazards, such as galactic cosmic rays (GCRs), solar particle events (SPEs), drastic temperature changes, extreme material stresses, structural and material fatigue, lunar dust, meteoroid impacts, and so on. Therefore, materials on Earth similar to those found on the lunar surface are needed to test and develop a binder-like material as a basic element to enable future lunar construction. In this sense, basalt, whose geological origin is

similar to the regolith widely available on the lunar surface, is a valid candidate for a terrestrial ISRU simulant material to study the properties and feasibility of a basalt-based cementitious compound. In this regard, the research summarizes and presents the results of the analysis and characterization of basaltic cementitious compounds from basaltic rock beds in northwestern Venezuela (Siquisique-Lara State). In this respect, the research summarizes and presents the results of the analysis and characterization of basaltic cementitious compounds from basaltic rock beds in the northwestern of Venezuela (Siquisique-Lara State). In addition, the results obtained show the possibility of ISRU materials as an option for sustainable lunar development and the achievement of the proposed research objectives: a) obtaining a densely compacted matrix; b) improving ultimate strength; c) improving radiation shielding properties; d) decreasing permeability; e) reducing porosities; f) improving abrasion resistance, among others.