21st IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)
Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies
(2B)

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DESIGN AND ASSESSMENT OF AD-1 LUNAR REGOLITH SIMULANTS

Abstract

Lunar exploration has been attracting the attention of global space players from developed countries to emerging economies. To validate the lunar surface testbed and rover prototype design on earth, high-fidelity lunar regolith simulants are needed to prepare a similar environment on the moon. However, due to their high cost, purchasing commercial simulants for large-scale tests is not economically feasible. Thus, designing simulants with locally available materials is a common practice for most lunar exploration programs. In this paper, we present a novel simulant AD-1, the first lunar regolith simulant developed in the Gulf region. AD-1 is produced by mixing the natural pozzolan (volcanic ash) from Saudi Arabia and dried silts in the UAE. The chemical and mineral components analysis suggests a similarity between AD-1 and real lunar soil from the Apollo missions. In addition, several geotechnical properties, including particle size distribution, particle shape, specific gravity, shear strength, compaction, and compressibility, are also measured and compared with Apollo samples and other commercial simulants. The result indicates that AD-1 has desired geo-properties as the lunar regolith simulants and thus is an appropriate choice for large-scale testbed preparation.