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OPTIMIZING LUNAR REGOLITH SINTERING THROUGH MAGNETIC BENEFICIATION

Abstract

On lunar exploration, the identification of lunar regolith as an inherent resource proves to be a straightforward endeavor. The employment of lunar regolith for In-Situ Resource Utilization (ISRU) stands as a pragmatic choice in realizing a lasting habitation on the Moon. Additive manufacturing, employing lunar regolith, has surfaced as an auspicious ISRU methodology, presenting the potential to facilitate the sustainable production of lunar settlements, tools, and components on the lunar surface. Nevertheless, certain materials requisite for this technology must be transported from Earth, and the exact mineral composition of the regolith utilized in the process significantly influences the resultant outcome. This study examined the evolution of properties of highland lunar regolith simulants after magnetic beneficiation, which is the process of varying the content of basalt from the original 25 wt.% found in highland lunar regolith. The study focused on the effect of regolith beneficiation on properties of press-formed ceramics, relevant to Digital Light Processing (DLP)-based additive manufacturing, such as relative density, compression strength, flexural strength, hardness, and shrinkage. The results showed that the degree of beneficiation, particularly basalt content, strongly influences the physical properties of lunar regolith ceramics. It was found that beneficiation helps to increase the ceramics' relative density up to 10%. The study determined that according to the achieved regolith ceramics density values, the desired basalt content to be reached with beneficiationis1to5wt.%.