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STRUCTURAL MEMBERS PRODUCED FROM UNREFINED LUNAR REGOLITH, A STRUCTURAL ASSESSMENT

Abstract

The potential of utilizing lunar regolith as the raw material for manufacturing structural members is very appealing for future exploration of the moon. Future lunar missions will depend on in-situ resource utilization (ISRU) for structural components. Manufacturing structural components directly from unrefined lunar regolith would have the advantage of needing less specialized material processing equipment in comparison to refining the lunar regolith for its raw elements. One process that could be used to accomplish this would be sintering the lunar regolith by means of additive manufacturing methods which utilize processes such as selective laser sintering (SLS), electron beam melting (EBM) or microwave methods. Both sintered lunar stimulant and sintered lunar regolith have been studied in the past, but characterizing these materials for structural applications still needs to be investigated.

Utilizing analytical and numerical methods, characterization of simple structures composed of sintered lunar regolith with random material properties has been performed. Previously published data on lunar regolith and its stimulant properties has been used as a source for its material properties. These methods are applied to a plate that is representative of a sintered surface on the moon where the random variations in properties are the characteristics of the sintered regolith. This analysis has been used to examine suitability for lunar roadways and for supporting surface structures. Comparisons are also made to conventional material, as well as material that could be refined out of lunar regolith, such as magnesium. Preliminary results show that a sintered regolith surface may not have sufficient structural strength for all applications. In cases where there is insufficient strength, inserting additives in the sintering process can have a reinforcing effect, making the end product suitable for many structural applications.