Paper ID: 81614
oral
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. Asher Perez
University of Central Florida (UCF), United States

Prof. Ranajay Ghosh
University of Central Florida (UCF), United States

EFFECT OF REACTIVE BINDERS ON REGOLITH MANUFACTURING PROCESSES

Abstract

Long term inhabitation and exploration of the lunar surface requires the creation of infrastructure. Regolith utilization via sustainable in-situ resource utilization (ISRU) is a keystone manufacturing technology in this regard. Many different manufacturing approaches are currently being explored using regolith feedstock such as selective laser sintering (SLS), stereolithography, Solar 3D printing, oven sintering, etc. However, severe challenges still exist due to the morphology of regolith itself which results in poor quality finished products. We will investigate the effectiveness of mixing regolith feedstock with reactive binders and the properties of the resulting ceramic material after heat treatment protocols. To avoid the issues that arise from lifting extra materials to the moon, the binders chosen are inorganic and can be potentially synthesized from in-situ materials. Our preliminary lab scale experiments have shown promise, leading us to believe that the use of reactive binders will allow for common, low-energy ceramic manufacturing techniques to be applied to lunar regolith. For these preliminary experiments, we have cast a regolith-binder mix into cylindrical samples, sintered, and tested compression resistance. Our initial binder choice was salt water, which allowed the regolith to sinter at 1150 degrees Celsius resulting in an ultimate compressive strength of 26 MPa. We continued this investigation on multiple regolith simulants, unique to different regions of the lunar surface. After some investigation into the underlying reactions, we chose to move forward using sodium silicate as a binder. We expect that the new binding method will allow for easy and accurate use of the SLS printing method, Resulting in a strong and high-resolution material. In this talk we will discuss the findings of our research in regard to both binders, as well as the manufacturing methods and applications of the new lunar-ceramic material.