SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

Author: Mr. Francesco Spina
ESA european space agency, Germany, aerospina@gmail.com

Mr. Alberto Canals Pou
European Space Agency (ESA), Spain, amcanalsp@gmail.com
Mr. Marc Villa Montero
Alpha STAR Corporation, United States, marcvillamontero@gmail.com
Dr. Aidan Cowley
ESA european space agency, Germany, aidan.cowley@esa.int
Mr. Leo Teeney
ESA, Germany, leo.teeney@gmail.com
Mr. Alexandre Meurisse
Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, alexandre.meurisse@dlr.de

A NOVEL CONCEPT FOR IN-SITU MANUFACTURE OF REINFORCED SINTERED CONSTRUCTION ELEMENTS AND A NUMERICAL ASSESSMENT OF MATERIAL PROPERTIES

Abstract

Reduction of future mission payload mass by exploiting In-Situ Resource Utilization (ISRU) approaches is vital to build sustainable extra-terrestrial bases. The sintering of planetary regolith has been proposed by many researchers as an ISRU test case with architectural or structural applications (landing pads, micrometeorite protection, etc.). However, research with terrestrial regolith simulants has shown that sintered regolith does not have a high tensile strength, potentially reducing its use to applications with low tensile loads. This paper details a conceptual system designed to exploit Lunar regolith and convert it into structural elements for future planetary exploration missions. It has been previously shown that fiberglass can be produced by using extrusive igneous basalt soil. Therefore, it could be used as reinforcement for sintered regolith blocks. We outline a novel yet simple process to fabricate reinforced blocks with multiple use case scenarios as well as realistic Technology Readiness Level (TRL) requirements to implement such a system. Using information derived experimentally and available in literature, computational simulations have been carried out, showing significant material enhancement properties for building elements fabricated using our proposed fiberglass approach. It has been determined that using a [0/90] configuration for the fibers, the longitudinal strength of the composite would increase by a factor of six.