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ADVANCING SOLAR SINTERING FOR BUILDING A BASE ON THE MOON

Abstract

Lately, different concepts have been investigated in the context of building human tended bases in extra-terrestrial environment through ISRU. Also NASA has conducted a 3D printed habitat challenge which put a focus on the topic on an international scale. Amongst microwave sintering, Contour Crafting and other Additive Manufacturing (AM) technologies using local resources on extra-terrestrial bodies, solar sintering has been the least investigated so far. In this context, the project RegoLight, sintering of lunar regolith with solar light, is evolving.

The project has been funded through the European Commission to advance the Technology Readiness Level (TRL) from 1 to 5 and comprises five partners. Under the lead of the DLR in Cologne, Space Applications Services from Belgium, COMEX from France and LIQUIFER Systems Group and Bollinger

+ Grohmann Ingenieure from Austria collaborate to advance the solar sintering technology in preparation of infrastructure construction on the Moon. The project started in November 2016 and is a two-year project. This paper provides an overview of the specificities and the current status of the project RegoLight with the following objectives:

- Apply AM approach to allow for the automated fabrication of such building elements with a regolith simulant feeder, for usage in the solar furnace under ambient conditions.
- Implement the automatic fabrication of larger structures through a mobile printing head outside the solar furnace and in ambient conditions
- Demonstrate the production of a 'building element' block from lunar regolith simulant by applying the solar sintering additive manufacturing approach, using a solar furnace automated setup, under vacuum conditions
- Produce a 'building element' with a fine structure (resolution 1.4 cm) from lunar regolith simulant without bonding agent, using solarlight source under ambient conditions.
- Design and validate an interlocking building element, which when combined could be used for a variety of space architecture and mission requirements in a modular fashion
- Characterize the building elements produced (materials metrology)
- Study the application of solar sintering element manufacturing in the frame of the larger picture of a lunar base architecture; also by considering concepts such as the ESA "Moon Village"

The ultimate goal of the project is to contribute to paving the way for future long duration sustainable crewed exploration to the moon. Therefore, we need projects such as RegoLight which use local resources to create ecological solutions using only lunar sand and the sun to build protective shelters for humans.