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Moon Exploration – Part 3 (2C)

Author: Mr. Stefan Linke
Technische Universität Braunschweig, Institute of Space Systems, Germany, stefan.linke@tu-braunschweig.de

Ms. Lisa Windisch
Technische Universität Braunschweig, Germany, l.windisch@tu-braunschweig.de
Mr. Nico Küter
ETHZ, Switzerland, nico.kueter@erdw.ethz.ch
Ms. Anna Voß
TU Braunschweig, Institute of Space Systems, Germany, a.voss@tu-bs.de
Mr. Paul Prziwara
Technische Universität Braunschweig, Germany, p.prziwara@tu-braunschweig.de
Mr. Michael Grasshoff
Germany, mi.grasshoff@hbk-bs.de
Prof. Enrico Stoll
TU Braunschweig, Institute of Space Systems, Germany, e.stoll@tu-braunschweig.de
Prof. Carsten Schilde
Technische Universität Braunschweig, Germany, c.schilde@tu-braunschweig.de
Prof. Arno Kwade
Technische Universität Braunschweig, Germany, a.kwade@tu-braunschweig.de

TUBS-M AND TUBS-T - NEW LUNAR REGOLITH SIMULANTS ADAPTABLE TO LOCAL SURFACE CHARACTERISTICS

Abstract

Current discussions within the international space community show a growing interest in a return to the Moon to enable long-term robotic and manned activities on the surface and in lunar orbit. To allow a cost effective exploration and utilization of the lunar surface, processing of local resources (ISRU) is the key to lower transport needs and costs in a noticeable way.

The resource, which can be found on the entire lunar surface and which can be extracted with low effort, is the powdery upper layer of the Moon called regolith. Processing of that mineral material enables to build large and heavy infrastructures like habitats, streets, and fundaments. Due to a lack of lunar regolith on Earth, it is necessary to use so called regolith simulants for the development of such processing technologies.

The Institute of Space Systems (IRAS) at TU Braunschweig develops additive manufacturing technologies for regolith processing like MIRA3D, a mobile robotic-arm-prototype with a printing head. To investigate the printing process and terramechanic rover-surface interaction, a new lunar regolith simulant is currently under development in cooperation with the Institute for Particle Technology (iPAT) of TU Braunschweig (TUBS). The simulant consists of two basic types, one for the plagioclase-rich lunar highlands (terrae) called TUBS-T, and the other for the basaltic lunar plains (maria) called TUBS-M.

If necessary for a selected area, such as for a rover mission, installation of scientific equipment, or a lunar base, additional components can be added to the basic simulants to create a material which fits very well to the on-site regolith. These components can be agglomerates, volcanic glass, or special minerals

like Ilmenite and Olivine. Further, parameters like particle size distribution and particle morphology can be adapted by mixing the needed particle fractions with the basic simulants.

By the help of that approach, it is possible to create an adapted simulant type for nearly every location on the Moon without the need of creating a completely new simulant production line for every new mission. That makes TUBS-T and TUBS-M interesting for other scientific and commercial institutions which are working on lunar science and exploration.

The current state of work will be presented in this paper. It contains the properties of TUBS-T and TUBS-M, characteristics of the raw materials, results of first processing tests, and steps to increase the simulant production quantity. Moreover, opportunities for scientific cooperation will be discussed.