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LUNAR ISRU GROUND PROTOTYPE FOR THE DEMONSTRATION OF OXYGEN EXTRACTION FROM LUNAR REGOLITH

Abstract

OHB Italia SpA is leading a project for the European Space Agency together with Politecnico di Milano and OHB System AG aimed at developing and realizing a laboratory reactor demonstrator. The reactor is implementing the Carbo-Thermal Reduction (CTR) process for the extraction of oxygen from lunar regolith. This main process requires heating the solid phase regolith up to 950 C and investing the feedstock with methane flow; the syngas is then subject to a secondary process leading to the production of water vapor. In this paper, technical details about the reactor, the chemical process and its challenges will be presented. In fact, the development poses severe technical challenges onto the reactor design, which must also include valves providing gas tightness and regolith containment. The demonstrator is realized with two parallel testbeds in order to demonstrate both the process feasibility and the technological solutions: one - *COTS*-based - is used to provide fine characterization of the chemical process, including yield, efficiency, duration, mechanical and thermal behavior of the regolith, while the second one - realized using a custom design - is used to verify the capabilities of the main key enabling technologies. The custom reactor is, for this reason, designed to solve issues related to the future implementation of a flight payload capable of operating directly in the lunar environment. In this case, criticalities include dust resistance during valve operation, regolith containment, handling of mechanisms operating in harsh thermal environments, gas collection and recycling.