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Title

An Economically Viable Lunar ISRU Process for Oxygen and Metal Production and Related Benefits for Terrestrial Applications

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Abstract

A sustainable exploration of the Solar System will be dependent on the use of local resources, provided that they can be produced very efficiently such that the mass of the locally produced resources exceeds the mass of any needed consumables or spares to sustain the process. Any facility considered for that purpose will therefore need to be as compact and robust as possible, minimize the need for maintenance and spare parts and maximize the efficiency of the process. For the specific case of oxygen and metal production from regolith on the Moon an attractive process would need to have the capability to reduce most constituents of lunar regolith and have a high oxygen yield in order to be largely site-independent. Current trends in process development are reviewed and a new process is proposed that will enable an attractive small, simple, compact and efficient lunar facility design for high-purity oxygen and metals production, and produces a metal product that is well suited for a range of downstream manufacturing processes such as additive manufacturing, and aerosol deposition. With its design for minimum maintenance and mass, maximum compactness and robustness, and zero emissions this process is also very interesting for terrestrial applications in the area of clean metals production, and could be a contribution to lowering the emissions of greenhouse gases associated with metals production.