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Title

A large-scale laboratory demonstrator for the production of oxygen from lunar regolith: Challenges and opportunities

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Abstract

The production of oxygen and water from the lunar regolith has been the focus of significant and growing research interest over the last 20 years. Both water and oxygen can be used as propellant and for life support, and in situ production is seen as being the first critical step towards sustainable space travel, reducing the reliance on materials from Earth. Reduction of the lunar regolith using hydrogen is one of several technologies proposed to extract oxygen bound in the minerals that make up the lunar surface, mainly ilmenite. While it is not new, it has fallen out of favour in comparison with technologies that produce higher oxygen yields, such as molten salt electrolysis. Despite its low yields with raw regolith (typically around 1% O₂ w/w), it continues to be of interest due to its relative simplicity and the potential to enhance yield via regolith beneficiation. A large-scale (1 kg starting mass) demonstrator of a hydrogen reduction system, procured by ESA and hosted at ESRIC, is enhancing our understanding of the complete process by enabling research studies to be carried out from feedstock loading and preparation to water collection. In this talk, we will give an overview of the process, demonstrating specifically some of the challenges associated with running a large-scale demonstrator for space resources utilization application. We will also showcase the ways in which studies on the demonstrator can contribute towards the development of complete space resources systems.