Microwave extraction of oxygen from lunar simulants

Supervision team Andrew Morse, Simon Sheridan and Mahesh Anand

Lead contact: Andrew Morse – andrew.morse@open.ac.uk

Description:
It has been nearly 50 years since humans first set foot on the Moon. However, there has been no return since the Apollo missions because of the expense. One limiting factor is the cost of transport; every kg of material transported to the Moon requires 600 kg of propellant. In-Situ Resource Utilisation (ISRU) is the collection, processing and storage of indigenous materials instead of transporting material from Earth to reduce overall mission cost and risk (1). Oxygen is a particularly important resource as it is essential for life-support and can be used as a propellant.

The project uses two features of lunar regolith (lunar soil); first, oxygen (in the form of water) can be extracted from the common lunar mineral ilmenite, by reduction with hydrogen at 900°C (2); second, lunar regolith is efficiently heated by microwaves (3). Working with the Spacecraft Instrument Development team at The Open University the successful candidate will be using the vacuum microwave facility to heat lunar simulants to release volatiles, investigating the coupling of microwave energy to the sample. The experiments will determine the optimum reaction conditions required to extract water from ilmenite. The detection and yield of water will be determined by a mass spectrometer, building on research for the ProSPA instrument at The Open University (4). The project is laboratory-based and the successful candidate will need a hands-on approach adapting the experiment as results are gathered.

The Spacecraft Instrument Development team has over 15 years of experience developing space flight mass spectrometer systems. It built the Ptolemy mass spectrometer which was on the Philae lander Rosetta mission and successfully operated and returned results to Earth (5). The group is currently developing the ProSPA instrument for the Luna-27 mission to measure the composition and concentration of lunar volatiles (6). The results from this project will help determine the feasibility of extracting oxygen from lunar regolith using microwaves which would then feed into future lunar mission proposals.

References:


**Qualifications required:** BSc Physics/engineering or similar