

SOLID OXIDE ELECTROLYSIS CALIBRATION AND CHARACTERIZATION PLAN FOR THE MARS OXYGEN IN-SITU RESOURCE UTILIZATION EXPERIMENT (MOXIE). F. E. Meyen¹, G. E. Voecks², D. Rapp³, J. A. Hoffman⁴, M. Hecht⁵, and the MOXIE Team. ¹Draper, 555 Technology Square, Cambridge, MA 02139, fmeyen@draper.com ²NASA Jet Propulsion Laboratory, 4800 Oak Grove Dr. Pasadena, CA 91109 ³Independent contractor, drdrapp@earthlink.net, ⁴Massachusetts Institute of Technology, Cambridge, MA 02139, jhoffma1@mit.edu. ⁵MIT Haystack Observatory, 99 Millstone Rd, Westford, MA 01886 mhecht@haystack.mit.edu.

Abstract: NASA aims to make history during the Mars 2020 mission by performing the first demonstration of In-Situ Resource Utilization (ISRU) on another planet. ISRU is the science of extracting, transforming, and consuming resources in space. Local utilization of space resources unlocks new destinations and enhances space mission sustainability by significantly reducing the burden of providing material support from Earth.

Carbon dioxide, which comprises nearly 96% of the Martian atmosphere, is an example of a space resource that can be utilized to produce oxygen for propulsion and life support. The Mars Oxygen ISRU Experiment (MOXIE) payload, developed by MIT and NASA JPL, will demonstrate oxygen production from the Martian atmosphere. The toaster-sized device will use a solid oxide electrolyzer (SOXE) to electrochemically strip oxygen from atmospheric carbon dioxide. The experiment will prove the SOXE technology needed to supply oxidizer for a future Mars Ascent Vehicle that would return astronauts to Earth after an expedition on Mars.

A characterization and calibration plan for the SOXE has been written to guide the process for understanding the function, behavior, and performance of the SOXE. Calibration activities focus quantifying data on individual test and flight units. Characterization activities are designed to understand generalizable SOXE behavior. This presentation summarizes the plan and preliminary results. The plan covers SOXE related activities at all phases of development: from the laboratory through MOXIE's operation on Mars. Separate plans are in development for other MOXIE subsystems.