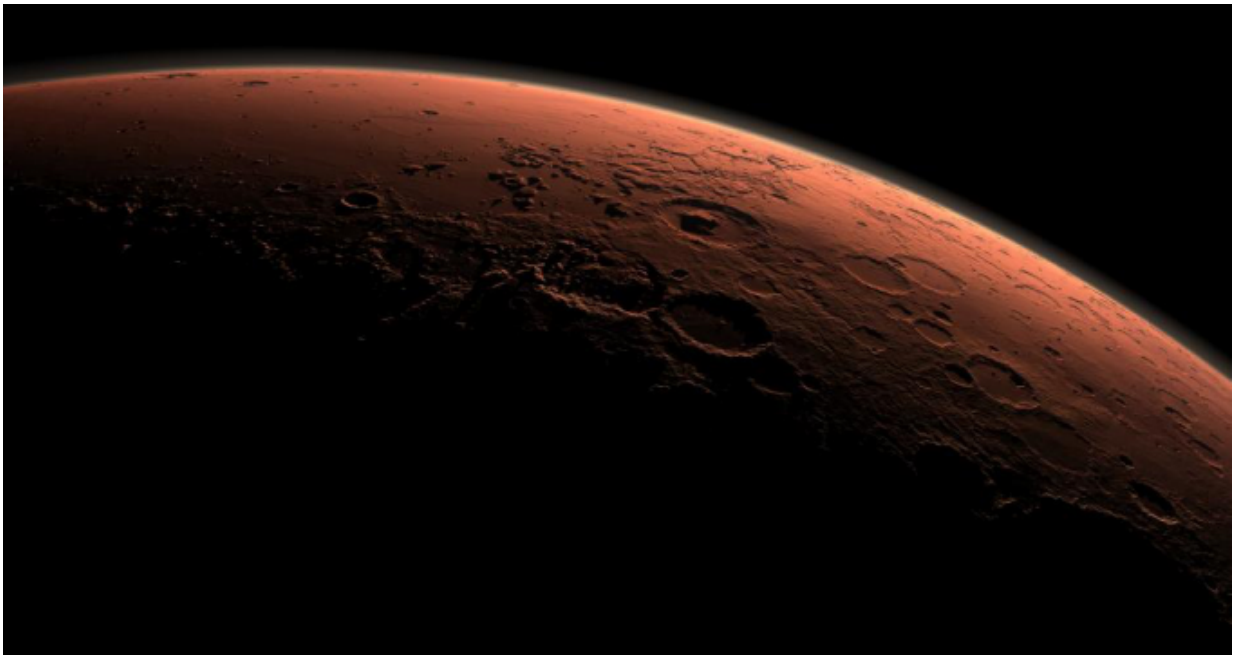
A mission to Mars could make its own oxygen via plasma technology

October 18 2017



Credit: NASA

Plasma technology could hold the key to creating a sustainable oxygen supply on Mars, a new study has found.

It suggests that Mars, with its 96 per cent carbon dioxide atmosphere, has nearly ideal conditions for creating oxygen from CO2 through a process known as decomposition.

Published today in the journal *Plasma Sources Science and Technology*, the research by the universities of Lisbon and Porto, and École Polytechnique in Paris, shows that the pressure and temperature ranges in the Martian atmosphere mean non-thermal (or non-equilibrium) plasma can be used to produce oxygen efficiently.

Lead author Dr Vasco Guerra, from the University of Lisbon, said: "Sending a manned mission to Mars is one of the next major steps in our exploration of space. Creating a breathable environment, however, is a substantial challenge.

"Plasma reforming of CO2 on Earth is a growing field of research, prompted by the problems of climate change and production of solar fuels. Low temperature plasmas are one of the best media for CO2 decomposition – the split-up of the molecule into oxygen and carbon monoxide – both by direct electron impact, and by transferring electron energy into vibrational excitation."

Mars has excellent conditions for In-Situ Resource Utilisation (ISRU) by plasma. As well as its CO2 atmosphere, the cold surrounding atmosphere (on average about 210 Kelvin) may induce a stronger vibrational effect than that achievable on Earth. The low atmospheric temperature also works to slow the reaction, giving additional time for the separation of molecules.

Dr Guerra said: "The low temperature plasma decomposition method offers a twofold solution for a manned mission to Mars. Not only would it provide a stable, reliable supply of oxygen, but as source of fuel as well, as carbon monoxide has been proposed as to be used as a propellant mixture in rocket vehicles.

"This ISRU approach could help significantly simplify the logistics of a mission to Mars. It would allow for increased self-sufficiency, reduce

the risks to the crew, and reduce costs by requiring fewer vehicles to carry out the mission."

More information: Vasco Guerra et al. The case for in situ resource utilisation for oxygen production on Mars by non-equilibrium plasmas, *Plasma Sources Science and Technology* (2017). DOI: 10.1088/1361-6595/aa8dcc

Provided by Institute of Physics