Keep-in-Touch meeting
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Plasma reforming for oxygen production on Mars

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Mars exploration draws more and more attention nowadays, with new plans from space agencies and private companies announced frequently. Current missions to the surface of the red planet focus only on robotic landers and rovers, but proposals for the first human missions and settlements shall follow soon. Future missions will require the ability to collect resources *in-situ* and transform them into breathable air, water, propellants or food. Mars has resources that can be used for a sustainable settlement, such as carbon dioxide, which is the most abundant (95.9%) component of its atmosphere, with smaller percentages of Ar (1.9%), N_2 (1.9%) and other gases. The local production of oxygen on Mars directly from the atmosphere may help solving some of these challenges, such as manufacturing fuels and creating a breathable environment for a future outpost.

Gaseous CO_2 can be converted into O_2 and CO using different methods. It is believed that plasma-based processes can provide the most efficient way to do so. Even though CO_2 reforming is a widely discussed topic and a vast research is devoted to it in terms of reduction of greenhouse emission, production of solar fuels and chemical materials on Earth, very few studies are available regarding the conditions in Mars atmosphere. Recently the idea of oxygen plasma production on Mars directly from its atmosphere was proposed. Essentially, the atmospheric pressure on Mars is on the correct range for plasma reforming, while the cold atmosphere ($\leq$ 210 K) will significantly freeze the chemistry, quenching back reactions and giving enough time for the separation of products. Furthermore, small additions of the trace gases Ar and N_2 act as energy savers and can only increase efficiency. Although theoretical predictions are very promising, no experimental confirmation was attempted to date.

In this seminar the results of experimental investigation of plasmas created in a simple and reproducible DC glow discharge, are going to be presented. The plasma under study is a mixture of CO_2 with 2% of Ar and 2% of N_2, for pressures in range 1–6 Torr and currents from 10 to 50 mA, both with gas at room (300 K) and Mars-like (220 K) temperatures. The CO_2 and CO vibrational temperatures, the conversion factor and the reduced electric field are measured in these conditions. Experimental results and modelling predictions are compared for pure CO_2 plasma at Earth and Mars-like temperatures.