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### Title

## Using the CO<sub>2</sub>DGM model to characterize and to diagnose electric thrusters meant for propulsion near Mars or Venus

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### Abstract

The well known CO<sub>2</sub>DGM [1] a detailed global model developed by DEDALOS Ltd specifically for CO<sub>2</sub> fed Electric Thrusters (ET) on the basis of previous work [2], is used here to study the functioning of various types of ETs using CO<sub>2</sub> as propellant. The latter can be harvested in the vicinity of stellar bodies possessing atmospheres composed majoritarily by this molecule. Thus, CO<sub>2</sub> fueled ETs are considered notably for propulsion near Mars and Venus, feeding electric thrusters after atmosphere condensation following *In Situ* Resources Utilization (ISRU) technology [3]. The thrusters are of interest to both low and high orbit satellites of these planets and to spacecraft propulsion in their vicinity. CO<sub>2</sub>DGM provides theoretical thruster characterization for a large domain of parameters. Results are illustrated by diagrams giving the composition of the plasma components and ionization percentages containing isothermal, isobaric and isoenergetic curves which describe the thruster functioning in various regimes.

The model incorporates data of detailed structure and reactions involving oxygen and carbon species and molecules composed from them, including their ions [1,2]. Thus, besides ETs characterization, theoretical evaluation of the main spectral lines intensity of neutral, singly and doubly ionized oxygen species is obtained, allowing for non-perturbing Optical Emission Spectroscopy (OES) diagnostics of prototypes developed for on ground experiments and for in flight monitoring. CO<sub>2</sub>DGM is also important for satellite drag and for re-entry studies. More generally, properties of CO<sub>2</sub> plasma can be analyzed and diagnosed by CO<sub>2</sub>DGM.

Especially for the Mars case, previous studies indicate that the minor presence of nitrogen in its atmosphere have no notable effect in the ISRU technology propulsion [2]. Then, as previously [4], CO<sub>2</sub>DGM excluding nitrogen components is used. In the Conference, modeling and characterization of ETs fed by CO<sub>2</sub> in ISRU technology, their functioning and also the corresponding OES results will be presented and discussed.

### References

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