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DEVELOPMENT OF A SUSTAINABLE IN-SITU ENERGY GENERATION FOR MARTIAN AUTONOMY

Abstract

For long-term sustainability of human civilization on Mars, there is a need for development of cost-efficient alternative sources of energy other than solar and wind energy to satisfy short term energy needs. Development of such a technology would allow for efficient exploration of the red planet while dramatically reducing mission costs and expenditures. Therefore, development of such a technology is a must. In this paper, we propose a conceptual model utilising in situ resources of the planet, specifically the carbon content of the planet for an alternate source of energy. The proposed model involves using the abundant carbon content of the planet and converting it into chemical compounds which can be synthesised for energy generation. The reaction of solar energy with a suitable semiconductor with band gap energies results in excitation of its molecular structure, generating electron-hole pairs. Through a functionalized design of semiconductor, the excited electrons are made to react with the absorbed carbon dioxide. The reaction produces formic acid, and carbon monoxide as by- products and separated through the technique of some synthetic techniques. Separated gases will be further broken down and synthesised to generate additional energy. Formic acid can be used to power fuel cells through its reaction with oxygen where its end products are energy, carbon dioxide, and water. The mission will help astronauts develop a cost-efficient alternate source of energy, aiming to contribute to the autonomy and long-term presence of human civilization on Mars. This paper, written by a team next generation in our ambitions for the space industry, hopes that this paper is also used for educational purposes for others to gain experience in the form of a comprehensive mission design considering the latest technologies and goals for exploring Mars.