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DEVELOPMENT OF A SMALL-SCALE ENERGY GENERATION SYSTEM ON MARS USING FORMIC ACID

Abstract

Considering the long-term sustainability of human civilization on Mars, there exists a need for the development of cost-efficient alternate sources of energy other than solar energy. The existence of the same would enable humans to cut down the costs of space missions at the same time providing efficient exploration of the red planet. Therefore, the development of such alternative sources is a must. Here, we propose a synthetic model for an alternative source of energy that uses the carbon content of the Martian atmosphere and converts it into chemical compounds which can further be synthesized for energy generation. The reaction of CO2 results in the generation of formic acid, methanal, and methanol. The catalyst chosen for the reaction is GaP and the light source is a halogen lamp at 365nm. The proposed model consists of a structure that contains a frequency canceling system which only allows the light of wavelength 365 nm to pass. The energy content of the incident light is used as an energy source for the reaction of carbon dioxide with an electrode consisting of a single crystal GaP in 0.05 M K2HPO4/KH2PO4. The end products of the reaction are formic acid, methanol, and formaldehyde. Methanol can be further synthesized to generate energy through inflammation of its content. Formic acid can be further used to power fuel cells through a reaction with oxygen to make energy, carbon dioxide, and water. These fuel cells can be used by society for short-term rover maneuvers, or other small-scale activities.