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CONCEPTUAL DESIGN OF HYBRID SYSTEM FOR LONG-TERM SPACE MISSION BY USING MEOH-H2O2

Abstract

The advanced countries in space technology such as the U.S., China has consistently tried to explore space including Moon, Mars exploration. The representative propulsion and power system for space exploration are rocket engine system, fuel cell system, and solar cell system. Moreover, life support system is required for astronauts. LOX, LH2 and Kerosene have been considered as the representative fuels for space exploration. However, it is difficult to secure the liquefied- and cryogenic storage technology for long term space missions. In this research, a hybrid system was introduced for them. It was more suitable method by using methanol and hydrogen peroxide. These fuels exist as a liquid phase at room temperature. It is possible to increase fuels storage period. First, hydrogen and oxygen for fuel cell were supplied by using MeOH-H2O2 reforming and decomposition of H2O2. MeOH reforming method is commonly used for supplying hydrogen. But, the existing reforming methods have demerits. Hence, more compact reforming system was designed by using oxygen, steam, and heat which is obtained by decomposition of H2O2. It doesn't need the equipment such as the additional heat source, oxygen tank, and vaporizer etc. Moreover, it can control quantities of the required fuel and the obtained water by selecting operation modes. The obtained water, which is the by-product of fuel cell, would be used for life support system. Quantities of fuels and water were compared as assuming when operating 1kW PEM fuel cell. The operation conditions were the following; liquefied fuels, 1 bar, 300 bar, 700 bar, and MeOH-80As a result, it was possible to decrease system volume and increased fuels storage period. Hence, it is more suitable method for long-term space missions.