

SPACE POWER SYMPOSIUM (C3)  
Small and Very Small Advanced Space Power Systems (4)

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MICRO SPACE POWER SYSTEM USING MEMS FUEL CELL FOR NANO SATELLITE

**Abstract**

A micro space power system using MEMS fuel cell was developed for nano satellite. The power system was fabricated using MEMS micro-fabrication technologies. PEM-type fuel cell was selected in consideration of space environment. Sodium borohydride (NaBH<sub>4</sub>) and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) were selected as a hydrogen and oxygen sources for the PEM fuel cell. The micro fuel cell system consists of a microreactor, micro fuel cell, micro pump, and fuel cartridges. The micro fuel cell has a light-weight and corrosion-resistant glass bipolar plates. The microreactor was fabricated to generate hydrogen from NaBH<sub>4</sub> alkaline solution using a catalytic hydrolysis reaction. The microreactor and micro fuel cell were designed using MEMS fabrication technology. All of balance-of-plants (BOP) such as micro pump, fuel cartridges and auxiliary battery were integrated for a complete micro power device. The storability of NaBH<sub>4</sub> solution was evaluated at -25°C. The performance of the micro fuel cell system was measured at various operating conditions. The average hydrogen generation rate was 15.6 ml/min at the feeding rate of 30 l/min. The total amount of generated hydrogen was 1,430 ml for 85 min. The average of conversion efficiency was 93% during the reaction. The microreactor maintained its temperature of 40 °C during the reaction. The continuous power generation from the micro fuel cell system was performed. The electricity generated by micro fuel cell was stored in the auxiliary battery. When the sudden and peak power output is needed, the hybrid power of micro fuel cell and battery was generated through power management system (PMS). The battery was recharged after the micro fuel cell system started to be operated. As increasing the electric-load the battery charging was reduced. The battery initiated to be discharged at the power demand higher than the maximum output of micro fuel cell. The power output of micro fuel cell reasonably followed up the given electric load conditions.