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Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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ELECTROOXIDATION OF AMMONIA UNDER THE INFLUENCE OF MICROGRAVITY IN PARABOLIC FLIGTHS

Abstract

This talk covers the results from the latest microgravity experiments performed at the National Aeronautics and Space Administration (NASA) Johnson Space Center in July 2014. The electrooxidation of ammonia have wide potential for its use in space and on earth as an energy producing reaction in fuel cells and for the safe processing of waste effluents containing urea/ammonia from a system for the recovery of water from urine. Experiments in microgravity were performed in an electrochemical half-cell using platinum micropillars as a working electrodes and in a Direct Ammonia Alkaline Fuel Cell (DAAFC). Three platinum electrodes with different surface characteristics (1 flat and 2 micropillar heights) were used as working electrodes in a half-cell containing ammonia 1M pH 10. A Direct Ammonia Alkaline Fuel Cell with a platinum catalyst was used with a solution of ammonia 1M pH 10 as the fuel on the anode side of the fuel cell and air in the cathode side. The experiments were performed aboard a NASA airplane performing parabolic flights creating a microgravity environment. Chronoamperometric analysis of the electrochemical oxidation of ammonia performed in the ground versus microgravity shows a decrease in performance in microgravity for the flat and the short micropillars (32 m height); for the high micropillars (62 m height) the performance increased versus the ground experiment. For the DAAFC a transient chronoamperometric analysis was performed during 17 parabolic trajectories across the periods of hypergravity (1.7 g) and microgravity (0.02g) which occurs in an alternate sequence. The data collected shows that the decrease in performance in the DAAFC is directly correlated to the changes in gravity between hypergravity and microgravity.