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WATER ELECTROLYSIS UNDER ZERO-G

Abstract

To be able to replace over the time degrading batteries by a fully regenerative solution, a closed-loop O2/H2 system seems to be one of the most promising alternatives for the future. While fuel cells are already space-proven the electrolysis process still has to be translated to the space environment.

Unlike on Earth, where the lifting force applies, the absence of hydrostatic pressure in space leads to no natural separation of gases and liquids. The basic equation describing the process is the Navier-Stokes equation for Hydrodynamics. In the examined case, both the body force acting on the fluid and - resulting from that - the pressure equal 0, thus no velocity flow occurs. Related to water electrolysis this means that the produced hydrogen/oxygen-gas stays on the electrodes.

To part fluids of different densities in space, at this point, a system consisting of pumps and centrifuges is used, introducing an additional inertial force. While this method could be integrated into the electrolytic process, two characteristics count against it: The relatively large, additional equipment and the need to reroute the fluid, which slows down the procedure. Instead of focusing on body forces the envisioned solution will substitute the hydrostatic pressure p by sending sound waves, produced by underwater-speakers, through the gas/liquid mixture to induce a directed flow. Implementing this technology would require only small additional equipment and could easily be integrated into a reversible fuel cell, consuming much less space than the in-use system. Variables to be investigated are the most efficient frequency and amplitude for the sound waves, depending e.g. on the assembly or the gas, and the time-interval respectively the size of the bubbles to avoid oscillation, described by Rayleigh and Plesset.