

SPACE POWER SYMPOSIUM (C3)
Advanced Space Power Technologies and Concepts (3)

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A SYNERGETIC USE OF HYDROGEN AND FUEL CELLS IN HUMAN SPACEFLIGHT POWER
SYSTEMS

Abstract

Hydrogen is very flexible in different application fields of energy conversion. By electrolysis it can be generated; stored in tanks it is available for re-electrification by fuel cells. But it is not only the power system, which profits from use of hydrogen, but also the life support system, which can contain hydrogen consuming technologies for recycling management (e.g. carbon dioxide removal and waste combustion processes). The paper points out the various fields of hydrogen use in a human spaceflight system. Depending on mission scenarios, shadow phases, and the need of energy storage, regenerative fuel cell systems can be more efficient than secondary batteries or other electrochemical storage devices. Here, different power concepts are compared by equivalent system mass calculation, thus including impact on the peripheral structure (volume, thermal management, etc.) of the space system. It is also focused on the technical integration aspect, e.g. which peripheral components have to be adapted when hydrogen is also used for life support technologies and what system mass benefit can be expected. Finally, a recommendation is given for the following development steps for a synergetic use of hydrogen and fuel cells in human spaceflight power systems.