

Life Support Catalyst Regeneration Using Ionic Liquids and In Situ Resources

Oxygen recovery from metabolic carbon dioxide is an enabling capability for long-duration manned space flight. Complete recovery of oxygen (100%) involves the production of solid carbon. Catalytic approaches for this purpose, such as Bosch technology, have been limited in trade analyses due in part to the mass penalty for high catalyst resupply caused by carbon fouling of the iron or nickel catalyst. In an effort to mitigate this challenge, several technology approaches have been proposed. These approaches have included methods to prolong the life of the catalysts by increasing the total carbon mass loading per mass catalyst, methods for simplified catalyst introduction and removal to limit the resupply container mass, methods of using *in situ* resources, and methods to regenerate catalyst material. Research and development into these methods is ongoing, but only use of *in situ* resources and/or complete regeneration of catalyst material has the potential to entirely eliminate the need for resupply. The use of ionic liquids provides an opportunity to combine these methods in a technology approach designed to eliminate the need for resupply of oxygen recovery catalyst. Here we describe the results of an initial feasibility study using ionic liquids and *in situ* resources for life support catalyst regeneration, we discuss the key challenges with the approach, and we propose future efforts to advance the technology.