

Advanced Supported Liquid Membranes for CO₂ Control in Extravehicular Activity Applications

David T. Wickham,¹ Kevin J. Gleason,² and Jeffrey R. Engel³
Reaction Systems, LLC, Golden, Colorado, 80401

Scott W. Cowley⁴
Colorado School of Mines, Golden, Colorado, 80401

and

Cinda Chullen⁵
NASA Johnson Space Center, Houston, Texas, 77058

Developing a new, robust, portable life support system (PLSS) is currently a high priority for NASA in order to support longer and safer extravehicular activity (EVA) missions. One of the critical PLSS functions is maintaining the carbon dioxide (CO₂) concentration in the suit at acceptable levels. Although the Metal Oxide (MetOx) canister has worked well, it has a finite CO₂ adsorption capacity. Consequently, the unit would have to be larger and heavier to extend EVA times. Therefore, new CO₂ control technologies must be developed to meet mission objectives without increasing the size of the PLSS. Although recent work has centered on sorbents that can be regenerated during the EVA, this strategy increases the system complexity and power consumption.

A simpler approach is to use a membrane that selectively vents CO₂ to space. A membrane has many advantages over current technology: it is a continuous system with no theoretical capacity limit, it requires no consumables, and it requires no hardware for switching beds between absorption and regeneration. Unfortunately, conventional gas separation membranes do not have adequate selectivity for use in the PLSS. However, the required performance could be obtained with a supported liquid membrane (SLM), which consists of a micro porous material filled with a liquid that selectively reacts with CO₂ over oxygen (O₂). In a current Phase II SBIR project, Reaction Systems has developed a new reactive liquid, which has effectively zero vapor pressure making it an ideal candidate for use in an SLM. The SLM function has been demonstrated with representative pressures of CO₂, O₂, and water (H₂O). In addition to being effective for CO₂ control, the SLM also vents moisture to space. Therefore, this project has demonstrated the feasibility of using an SLM to control CO₂ in an EVA application.

¹ President and Principal Investigator, 17301 W. Colfax Ave, Suite 405, Golden, CO, 80401.

² Senior Engineer, 17301 W. Colfax Ave, Suite 405, Golden, CO, 80401.

³ Senior Engineer, 17301 W. Colfax Ave, Suite 405, Golden, CO, 80401.

⁴ Professor of Chemistry, Department of Chemistry and Geochemistry, Golden, CO, 80401.

⁵ Project Engineer, Space Suit and Crew Survival Systems Branch, Crew and Thermal Systems Division, 2101 NASA Parkway/EC5.