Continued Advancement of Supported Liquid Membranes for Carbon Dioxide Control in Extravehicular Activity Applications

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The development of a new, robust, portable life support system (PLSS) is 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 (CO_2) concentration in the suit at acceptable levels. Although the Metal Oxide (MetOx) canister has historically performed very well, it has a finite CO_2 adsorption capacity. Therefore, the size and weight of the unit would have to be increased to extend EVA times. Consequently, new CO_2 control technologies must be developed in order to meet mission objectives without increasing the size of the PLSS. Recent work has centered on sorbents that can be regenerated during the EVA; however, this strategy increases the system complexity and power consumption.

A much simpler approach is to employ a membrane that vents CO_2 to space and retains oxygen (O_2). A membrane has many advantages over current technology: it is a continuous system with no limit on capacity, it requires no consumables, and it does not need any hardware to switch beds between absorption and regeneration. Unfortunately, conventional gas separation membranes do not have the needed selectivity for use in the PLSS. However, the required performance could be obtained with a supported liquid membrane (SLM), which consists of a microporous material filled with a liquid that selectively reacts with CO_2 over O_2. In a recently completed Phase II SBIR project, Reaction Systems, Inc. achieved the required CO_2 permeance and selectivity with an SLM in a flat sheet configuration. This paper describes work to convert the SLM into a more compact form and to scale it up to handle more representative process flow rates.

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