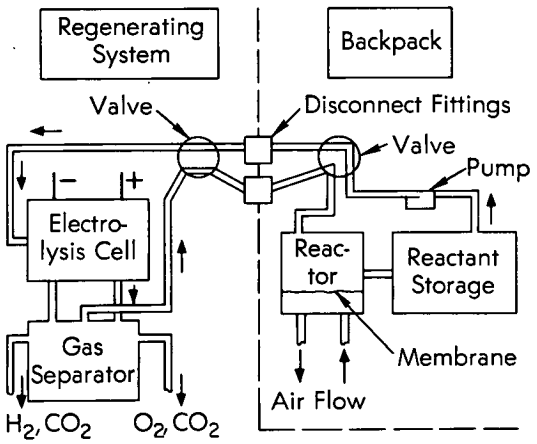
NASA TECH BRIEF
Ames Research Center

Space-Suit Carbon Dioxide Absorption System — A Concept

The problem:

To maintain the partial pressure of carbon dioxide within a space suit at a level which ensures health and safety; ideally, the system must be self-contained, lightweight, regenerable, and able to cope with large releases of carbon dioxide such as occur during periods when the astronaut exercises violently.



The solution:

Absorb carbon dioxide with a solution of potassium hydroxide in a membrane gas reactor; the spent solution is regenerated on board the spacecraft or by portable units.

How it's done:

The absorption system in the backpack of the space suit is depicted schematically in the diagram. It consists simply of an absorber in which a strong solution of potassium hydroxide is circulated by a pump on one side of a gas-permeable membrane while air from the space suit is circulated on the other side. Carbon dioxide reacts with potassium hydroxide to form potassium carbonate; the potassium hydroxide solution containing dissolved potassium carbonate is passed over the membrane at a rate which prevents formation of solid potassium carbonate on the membrane surface.

Regeneration of the backpack is accomplished by connecting it to the regenerating system, which may be on board the spacecraft or in a portable unit if the sphere of operations is at a considerable distance away from the spacecraft. As indicated in the diagram, the spent solution in the backpack is pumped through an electrolysis cell where the concentration of potassium carbonate in the potassium hydroxide circulating solution is reduced by release of carbon dioxide; the hydrogen and oxygen also formed by electrolysis are separated (along with carbon dioxide) and vented or delivered to other spacecraft systems for use. Water must be supplied to the regenerant system to make up losses from electrolysis.

Other systems of regeneration may be employed; for example, the spent solution from the backpack is cooled to precipitate potassium carbonate; the potassium carbonate is filtered off and dissolved in hot potassium hydroxide solution before electrolysis.

Preliminary estimates of the size and weight of the overall system have indicated that it may be significantly smaller than other fully regenerable systems.

Notes:

1. Conditions for the electrolytic separation of carbon dioxide from alkaline solutions have not been established.
2. Solid chemical absorbents, such as lithium hydroxide or potassium superoxide, have been used in

(continued overleaf)

the past, but they are not easily regenerated; consequently, prohibitively large masses of such materials are required to support extended extravehicular activities.

3. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)
   Reference: NASA CR-114321, Advanced Extravehicular Protective Systems (AEPS) Study.

3. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field. California 94035
   Reference: B 72-10168

Patent status:

No patent action is contemplated by NASA.

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