NASA TECH BRIEF

Ames Research Center

Regenerable Metallic Oxide Systems for Removal of Carbon Dioxide — A Concept

Carbon dioxide is absorbed readily by certain metallic oxides, such as zinc oxide or magnesium oxide. Moreover, in the presence of water vapor the capability to absorb carbon dioxide and the rate of reaction are improved considerably. Thus, a suitably packaged cartridge containing a metallic oxide has potential applications for absorption of carbon dioxide in the life support systems such as may be used in high-altitude aircraft, spacecraft, submarine vessels, or incubator systems. Additionally, the sorbent metallic oxide systems are regenerable at elevated temperatures in vacuum; in closed-cycle systems, desorbed carbon dioxide can be collected and then processed to provide breathing oxygen.

Two designs for portable canisters containing metallic oxides have been suggested. One is a "screen-pack" configuration which consists of a brazed rectangular canister into which are inserted four metal oxide screen packs containing the metal oxide. The canister is a five-sided assembly which has inlet and outlet oxygen headers, water coolant coils supported by perforated sheets, and supports for the metal oxide packs. Additionally, an access cover for the metal oxide pack is clamped and hinged to the open side of the canister; the oxygen inlet header is mounted on the access cover. Preloaded rubber padding holds the metal oxide packs firmly in place. The metal oxide packs are of a sandwich-type construction consisting of fine mesh screen, felt padding to prevent dusting, and a channel enclosure to hold the assembly together. Gas flow is both through and around the screen pack of metal oxide. For flow around the screen packs, carbon dioxide is removed by diffusion into the metal oxide bed. For flow through screen packs, carbon dioxide is removed by direct contact with the metal oxide bed. Although cooling water coils are preferably included in this configuration, cooling requirements may be low because heat is generated slowly.

The other concept utilizes a radial flow canister. The canister is a cylindrical welded assembly consisting of a shell, a bolt flange for mounting the cartridge end-cap, and manifolds for water and oxygen inlets and outlets. Air enters the cartridge through a central perforated tube and then flows radially through a particulate filter, the metal oxide bed, another particulate filter, a mesh screen, and the canister outlet. The particulate filters provide an even flow distribution and prevent dust from being entrained in the exit air. Coolant tubes are brazed to the cartridge coolant manifold; cooling of the metal oxide bed is provided by a combination of conduction through the bed and gas convection.

Note:

Requests for further information may be directed to:

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Reference: TSP 72-10420

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

Source: James G. Sutton, Philip F. Heimlich, and Edward H. Tepper of United Aircraft/Hamilton Standard Division under contract to Ames Research Center (ARC-10570)