Hybrid Filter Membrane

Uses for this device include battle tanks, remote command centers, field hospitals, and nuclear power plants.

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Cabin environmental control is an important issue for a successful Moon mission. Due to the unique environment of the Moon, lunar dust control is one of the main problems that significantly diminishes the air quality inside spacecraft cabins. Therefore, this innovation was motivated by NASA's need to minimize the negative health impact that air-suspended lunar dust particles have on astronauts in spacecraft cabins.

It is based on fabrication of a hybrid filter comprising nanofiber nonwoven layers coated on porous polymer membranes with uniform cylindrical pores. This design results in a high-efficiency gas particulate filter with low pressure drop and the ability to be easily regenerated to restore filtration performance.

A hybrid filter was developed consisting of a porous membrane with uniform, micron-sized, cylindrical pore channels coated with a thin nanofiber layer. Compared to conventional filter media such as a high-efficiency particulate air (HEPA) filter, this filter is designed to provide high particle efficiency, low pressure drop, and the ability to be regenerated. These membranes have well-defined micron-sized pores and can be used independently as air filters with discreet particle size cut-off, or coated with nanofiber layers for filtration of ultrafine nanoscale particles. The filter consists of a thin design intended to facilitate filter regeneration by localized air pulsing.

The two main features of this invention are the concept of combining a micro-engineered straight-pore membrane with nanofibers. The micro-engineered straight pore membrane can be prepared with extremely high precision. Because the resulting membrane pores are straight and not tortuous like those found in conventional filters, the pressure drop across the filter is significantly reduced. The nanofiber layer is applied as a very thin coating to enhance filtration efficiency for fine nanoscale particles. Additionally, the thin nanofiber coating is designed to promote capture of dust particles on the filter surface and to facilitate dust removal with pulse or back airflow.

This work was done by Castro Laicer, Brian Rasimick, and Zachary Green of Giner Electrochemical Systems, LLC for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18922-1.