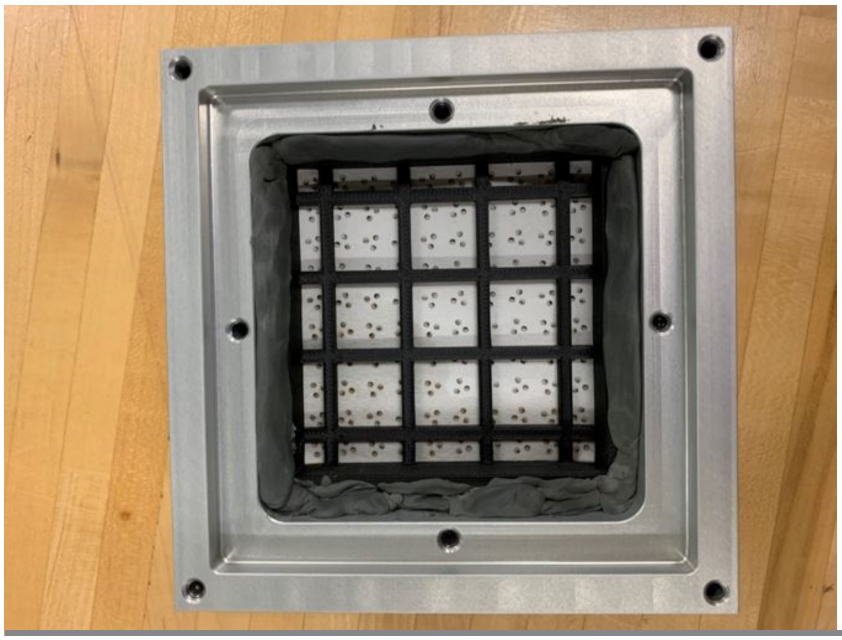


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Environment

Corkscrew Filter Extracts Liquid From Air Charge

Removes liquids and particulates from a saturated air charge without impinging upon flow

Innovators at NASA Johnson Space Center in collaboration with IRPI, LLC, have developed a compact inline filter that utilizes a unique multi-phase flow method to separate liquid from an incoming air charge. The filter also traps particulate matter and does so without significantly impinging upon flow velocity.

Unique to the filter is a multitude of helical (corkscrew-shaped) open flow channels that are impregnated into the filter element. Due to the constant curvature of the channels, the liquid and particulates from the incoming air charge are inertially dispersed onto the channel walls using centrifugal force. Wicking material holds the liquid in place, while stepped contours within the channels also help trap particulates.

Development of the filter was performed to provide the Orion Spacecraft with a method to absorb liquid water and particulates from the cabin atmosphere after a fire event and discharge of a water-based fire extinguisher. However, applications here on Earth have commercial viability for this high-flow phase separation technology. These applications may include vehicle or laboratory fire safety systems, petrochemical refining, water filtration, municipal solid waste derivatives, and wet/dry vacuum systems.

BENEFITS

- Compact size for a multi-phase filter
- Filters water and particulates from a gas charge
- Does not significantly impinge upon flow velocity
- Filtering element separates liquid
- Inexpensive to construct compared to other variants
- Can be constructed using commercial off-the-shelf materials
- Can function in gravity or microgravity environments

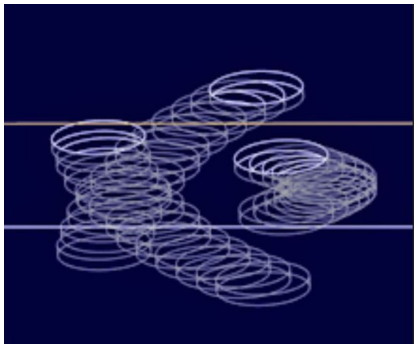
THE TECHNOLOGY

In the event of a fire aboard the Orion Spacecraft, the Portable Fire Extinguisher (PFE) can introduce up to three pounds of water into the cabin to extinguish a fire. A filter was needed to work in conjunction with the Orion Fire Safety System (OFSS) to filter water out of the cabin atmosphere after dispersal from the PFE. Airflow introduced to the smoke filter of the OFSS must be dry and free of large particulates for the sorbent material to effectively extract smoke generated by a fire.

These moisture and particulate concerns prompted a re-design of the original filter, especially a filter that could be tested in Earth's gravity and yielding results that would transfer to a microgravity environment. The newly designed filter uses a multi-phase flow separation method that allows the airflow to develop fully in a helical flow path. This flow path resides within a wicking material used to separate the liquid from the gas (air) while also trapping particulate matter.

Helical flow paths implemented in the filter impart a centrifugal force upon the incoming gas/liquid mixture that develops an asymmetric liquid film on the inner contour of the helix. Upon active airflow, the larger water droplets are inertially forced into the inner contour flow path wall. The flow path walls are made from a wicking material, and all liquid film and liquid droplets that are inertially deposited onto the walls are adsorbed into the filter material. The resulting output flow from the filter is 100% gas.

The Corkscrew Filter has a technology readiness level (TRL) of 5 (component and/or breadboard validation in relevant environment) and is now available for patent licensing. Please note that NASA does not manufacture products itself for commercial sale.



Shown: A CAD model of the Layered Triple Helix Flow Paths that reside inside the filter.

APPLICATIONS

The technology has several potential applications:

- Spaceflight systems
- Petrochemical refining
- Water filtration
- Solid waste processing
- Wet/dry vacuums
- Building and site construction
- Fire safety systems
- Clean rooms

PUBLICATIONS

Patent No: 11779869

Patent Pending

technology.nasa.gov

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