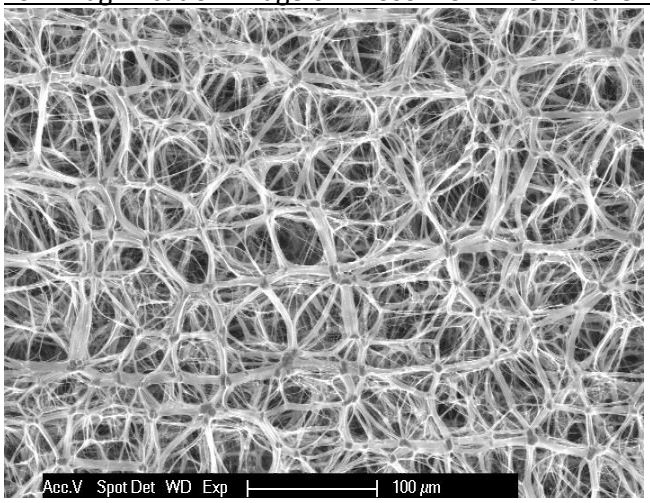
Air Filtration Applications for Membranes

Given their unique performance attributes membranes are finding use in a growing number of high efficiency air filtration applications. One example is in respirators and personal protective equipment. Applications where intense physical demands and risk of exposure to harmful contaminants are present demand the high efficiency / low pressure drop combination of expanded polytetrafluoroethylene (ePTFE) and ultra-high molecular weight polyethylene (UPE) membrane filters. Examples are life saving vocations such as first responders or operators in industrial production in harsh environments. The premium for low breathing resistance is easily justified.

Low Magnification Image of Arioso™ UPE Membrane media

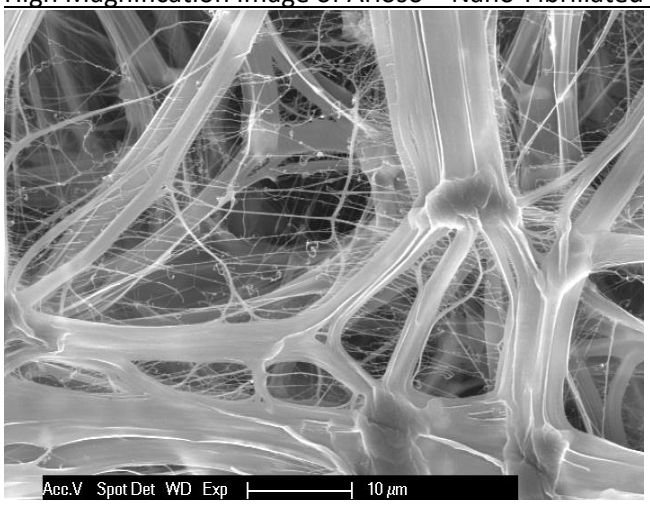


Another set of common applications for membranes is consumer and industrial vacuum cleaners. There are two general types of filters in these applications: those that protect the equipment itself, i.e. the vacuum motor and those that filter the exhaust air. Vacuum cleaner filters run at very high airspeeds when compared to most air filtration applications. Face velocities of 10 to 20 cm/s are common. The ePTFE and UPE membranes provide high efficiency at these higher airspeeds and the low pressure drop enables the high airflow rates with reduced power consumption. A further advantage in vacuum cleaners is derived from the surface loading characteristics and robustness of membranes. After use, the dust cake loaded on the filter surface can be easily cleaned via shaking or water spray, and the membrane filters return to near their original pressure drop and efficiency.

Membrane air filters are ideal in a number of medical and biopharmaceutical applications. The low pressure drop, ULPA efficiency and hydrophobic membrane properties are essential in surgical and hospital airway management, protecting both the patient and equipment. Those same properties are ideal for venting applications such as ostomy bags. The membrane is typically laminated to a carbon impregnated non-woven. The combined filter provides for pressure relief, an absolute barrier to liquid flow through the filter in both directions and odor reduction. Depending upon the particular requirements the membrane may be treated to enhance its oleophobic properties. In biopharmaceutical manufacturing ePTFE and UPE filters are used to vent gases produced during fermentation and cell culture. These vent filters require

absolute barrier to microorganisms in aerosol and to bacteria in the event the filter is wet out. The gamma stable properties of UPE membrane provide significant benefit in single-use applications in the medical and biopharmaceutical fields.

High Magnification Image of Arioso™ Nano-Fibrillated Structure



Cleanrooms and other industrial applications benefit from membranes as well. When combined with suitable support layers, membrane-based filter media has very low off-gassing. This is essential in the critical microelectronic cleanroom environments. The inert ePTFE and UPE membranes are compatible with harsh industrial environments. In cleanrooms HEPA and ULPA filters provide absolute protection. They are designed to be installed for the lifetime of the cleanroom. Pre-filters are used to capture the majority of particles in the airstream and reduce the load on the membrane filters. High Alpha membrane filters lower the pressure drop leading to significant savings in energy consumption during cleanroom operation. Over the typical five-year useable life of a filter the resulting savings easily outweigh the added cost for the membrane filter.

Summary

In high efficiency air filtration applications where performance is critical, microglass and membrane media (i.e. filters that work solely through mechanical means) are the preferred choices. Membrane-based air filtration media offer unique properties that make them suitable for a number of applications. This includes pulse cleaned industrial applications (bag house, airborne pollution control and gas turbine) in addition to the high efficiency applications covered above.

The use of membranes in air filtration continued to grow over the last decade and new UPE based membranes, with their nano-fibrillar structure, bridge the gap between membranes and non-wovens. The inherent structural properties of UPE membranes enable flexible composites, enhanced pleat processing and new high performance filter designs. The combination of proven and new technologies promises for an exciting future in membrane air filtration. Being inert, cleanable and bio-compatible, the advantages of membranes can be employed in nearly any environment. Their high efficiency at low pressure drops translates directly into energy savings, enhanced breathability and lower life cycle costs. The number of applications for membranes will continue to grow as more filter companies design in these advantages.

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Keywords
Membranes
Air Filtration
Nanofiltration