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Industrial Dust & Fume Control: Ordinary Nanofiber Proven Inferior to Ultra-Web®

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Recent technical analysis has uncovered significant performance differences between ordinary nanofiber cartridge filters and cartridge filters with proven Ultra-Web® technology. Tests show that ordinary nanofiber filters are measurably less effective than Ultra-Web® filters: the tests conducted on the most recent introduction to the nanofiber filter field reveal high susceptibility to moderate heat and normal humidity. In these typical ambient conditions, tests showed that ordinary nanofibers degrade — essentially melt away—and dramatically decrease the performance and life of the cartridge filter. The bottom line: the only assurance of cleaner plant air is proven Ultra-Web® technology, truly advanced and perfected over 25 years in the field to perform in all ambient conditions.

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When Donaldson® Torit® first introduced Ultra-Web nanofiber cartridge filters for dust collection in manufacturing plants in 1982, it was a breakthrough technology compared to the industrial air filters then available (commodity cellulose media for cartridge collectors and woven fabrics for baghouses.) Engineered with a fine, continuous nanofiber layer that captured submicron dust particles on the surface of the media, Ultra-Web introduced the concept of a filter that allowed dust to be more easily released through pulse cleaning and promoted self-cleaning in the collector. Ultra-Web cleaned better and therefore lasted longer than commodity filters. This was truly a paradigm shift in industrial dust collection.

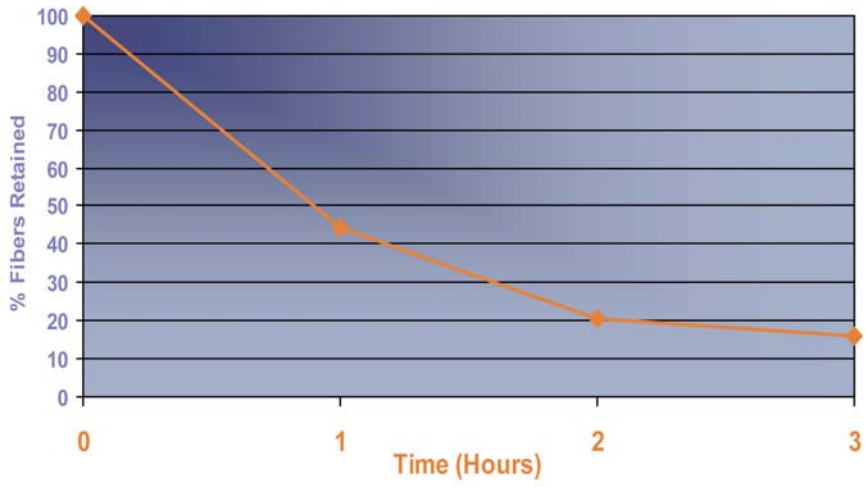
Early Refinements

However, today's proven Ultra-Web technology is not the same Ultra-Web introduced in the early 80's— and for good reason. There are typically refinements made to any new technology and Ultra-Web was no exception. The first generation of Ultra-Web filters developed by Donaldson 25 years ago encountered similar issues now facing new ordinary nanofiber filters.

The nanofiber layer of ordinary nanofiber filters degrades in moderate heat and humidity because the fibers are fragile. While in principle smaller is better, these ordinary nanofibers have been taken too far and are less than 25% of the cross-sectional area of Ultra-Web fibers today, making the nanofibers too delicate to withstand the rigors of a wide range of operating conditions. While marketed as a comparable product, ordinary nanofiber filters have actually only caught up to where Ultra-Web was 25 years ago with the first generation of nanofiber technology.

In the early 1990's, another filter media comprised of a blend of 80% synthetic and 20% cellulose fibers came to market in an effort to simulate Ultra-Web technology. While Ultra-Web is a layered media comprised of a cellulose substrate and synthetic nanofibers, the 80/20 blends are made of cellulose and synthetic fibers blended together. It is a depth-loading media, whereas the layers of Ultra-Web enable the surface-loading capabilities.

Ordinary Nanofiber Tested in Heat & Humidity



In numerous accelerated lab tests in a temperature/ humidity chamber, ordinary nanofiber filters degraded rapidly by as much as 83% in a matter of hours when subjected to temperatures ranging from 90°F to 160°F (32°C to 71°C) and various levels of relative humidity. It's reasonable to assume that in industrial environments at high temperatures and humidity, degradation will occur.

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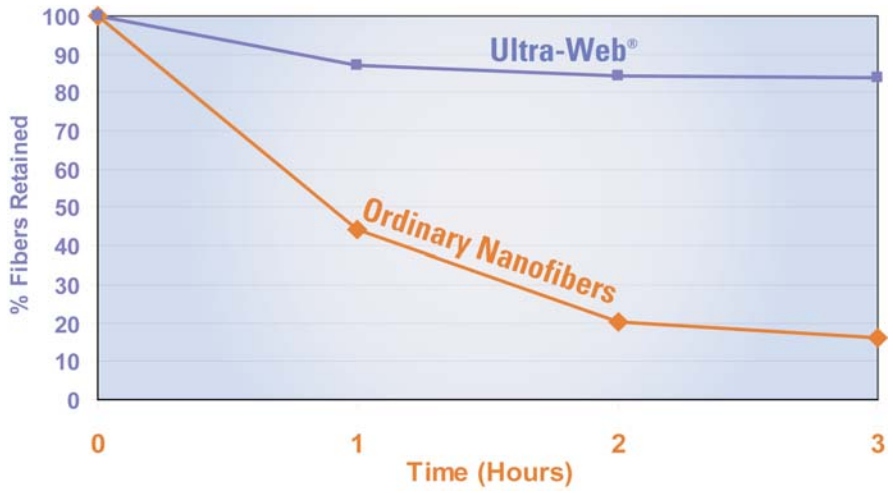
Beyond Season or Region

While a 90° F (32°C) temperature might initially trigger thoughts of potential problems in warmer climates or the height of summer, many manufacturing environments, including those that are temperature-controlled, can experience 90°+ ambient conditions in any season because processing equipment can generate heat and moisture. Heat is one factor that can degrade the ordinary nanofiber layer – but humidity is actually the bigger culprit, since 40% relative humidity is normal for most environments in any region, at any time of the year.

Ordinary Nanofiber -- D.O.A.

Since ordinary nanofiber filters are susceptible to warm conditions and humidity, whether in the plant or during transit, there's also the likelihood that the nanofiber layer will degrade even before the filters reach their final installation destination. Moderate heat and humidity experienced during shipment could potentially remove the nanofibers from ordinary nanofiber filters. That means users are likely to receive the equivalent of commodity type filters with little to no remaining nanofiber. And depending on the storage heat and humidity conditions at the plant, the nanofibers could disintegrate while sitting on the shelf before the filters are installed in the cartridge dust collector.



Degraded Nanofiber = Degraded Performance

Once the ordinary nanofiber layer has deteriorated, the media effectively reverts to being a commodity cellulose depth-loading media. Two consequences could result: (**1**) The protection against sub-micron particulate would be gone. The cellulose media will, of course, continue to filter out the larger particulate by capturing it in the depth of the media mat, but the nanofiber layer that collects the very fine particles would be absent. (**2**) Without the surface-loading qualities of the nanofiber layer, the pulse mechanism in the dust collector will have to pulse more often to clean the filters.

More pulsing….more compressed air usage….more energy consumption.

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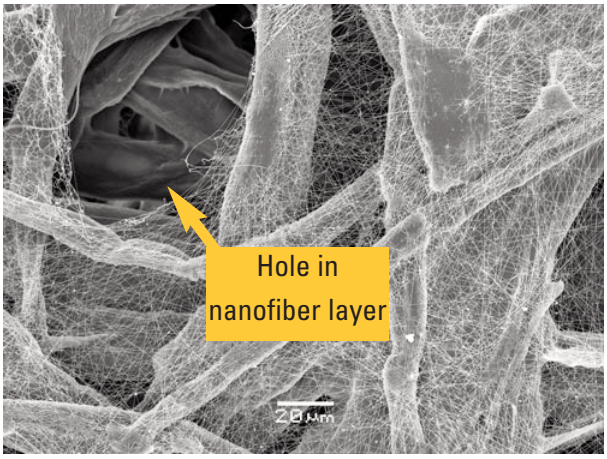
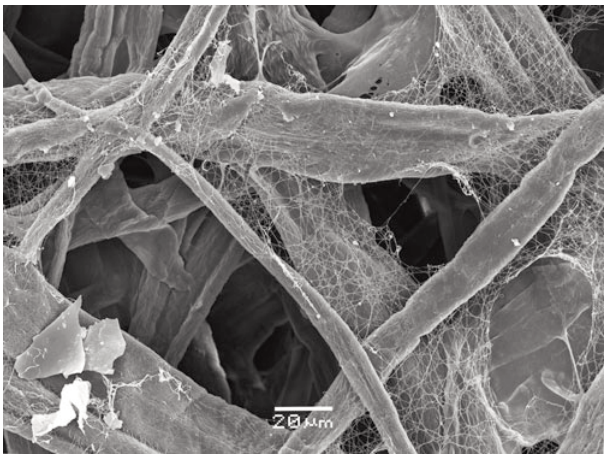
Take a Closer Look ... Under the Microscope

Ordinary Nanofibers magnified 600X in the Scanning Electron Microscope

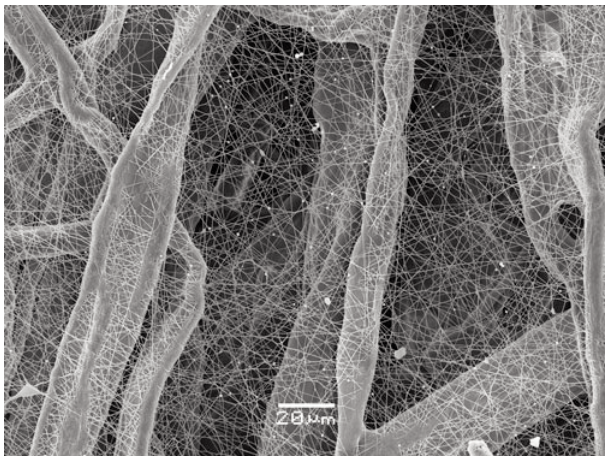


A) Straight out of the box: ordinary nanofibers show damage upon arrival

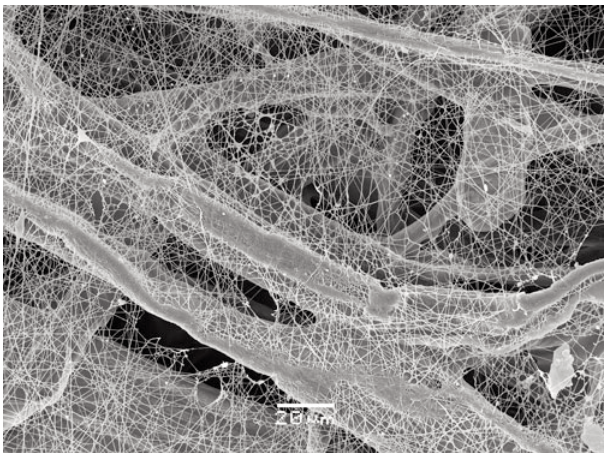


B) After testing: ordinary nanofibers have almost disappeared after only a few hours of heat/humidity testing

Ultra-Web® magnified 600X in the Scanning Electron Microscope



A) Straight out of the box: **Ultra-Web** is fully in tact upon arrival



B) After testing: **Ultra-Web** is still strong and robust after heat/humidity testing

Ultra-Web -- Proven and Perfected

Precisely how is Ultra-Web superior to ordinary nanofiber filters? Ultra-Web began more than 25 years ago just like ordinary nanofiber has today—with 50% finer fibers that were more fragile and delicate than today's more robust Ultra-Web fibers.

During the last 25 years, Donaldson Torit has advanced and perfected Ultra-Web technology to optimize fiber structure and fiber diameter so that it is **stronger and lasts longer** in all environmental conditions. Ultra-Web performs in conditions ranging from -20° F to 180° F (-29° C to 82° C).

Donaldson Torit®

By extensively testing and enlisting our more than 90 years of filtration expertise, Donaldson Torit developed better subsequent generations of Ultra-Web filters with the right size fibers that provide the best combination of longer filter life, cleaner air and lower pressure drop. This superior generation of Ultra-Web technology is backed by 80 issued and pending patents worldwide and proven in the field for more than two decades.

Today's Ultra-Web technology is made with an electrospinning process that applies a continuous strand of microscopic polymer of 0.2-0.3 µ in diameter. This forms a web-like net, with very fine interfiber spaces, that keeps dust on the filter surface so it can be easily pulsed off during cleaning. By comparison, today's commodity cellulose and blended media have fibers at least 10 microns in diameter and large pores between fibers (up to 60 microns) that allow dust to penetrate deep into the media, quickly plugging and reducing filter life.

Are You Paying Nanofiber Prices for Commodity Filter Performance?

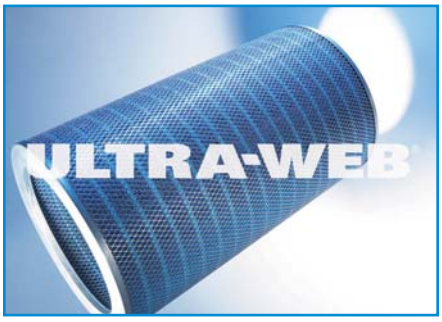
Ordinary nanofiber filters claim a higher MERV 15 rating (Minimum Efficiency Reporting Value) than standard Ultra-Web MERV 13 filters, although variations of Ultra-Web filters come with MERV 13, 14, and 15 efficiency ratings depending on the application needs. In theory a higher MERV rating indicates higher efficiency in capturing submicron dust particles in the 0.3 to 1.0 micron range; however, there is a substantial difference in efficiency if the ordinary nanofiber layer degrades during shipping, storage or use in heat & humidity.

In warm, humid, ambient conditions, ordinary nanofibers melt away leaving the commodity type depth-loading cellulose media underneath unable to effectively capture submicron particles. Cellulose media typically ranges in efficiency from MERV 8 to MERV 10, which is not rated to filter submicron dust particles. In short, you'll experience higher pressure drop, shorter filter life, greater compressed air use to clean the filters, and higher energy consumption—all at a higher nanofiber filter price.

Think Extraordinary, Not Ordinary

Ultra-Web is often imitated but never replicated. Backed and protected by our patents, Ultra-Web technology is only available from Donaldson Torit. Don't be confused by ordinary nanofiber filters that claim to offer the same performance advantages as Ultra-Web. Only Ultra-Web is proven and perfected to provide higher filtration efficiency, longer filter life and greater energy savings.

For case studies and additional technical articles on Ultra-Web, visit www.UltraWebisAlwaysBetter.com



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