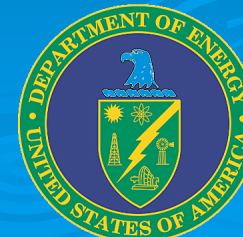


NANOCERAM[®] FILTERS

Winner of 2005 Space Foundation Hall of Fame Award



Argonide Corporation, Sanford, Florida
www.argonide.com



DTRA

About Argonide

- **Founded in 1994 to develop nano powders using technology developed in former USSR – we make and sell nanopowders for several developing applications**
- **In 2000 we invented the NanoCeram[®] filter media based on a nano alumina fiber**
- **Supported by NASA SBIR for purifying recycled water in space, as well as the Depart. Energy, Air Force and EPA**
- **We have a U S and EU patent and others in process**
- **Our water filter got the 2005 Hall of Fame award from the Space Foundation**
- **An arsenic sorbent will be available in 2007**
- **Air filters are in development**

NanoCeram[®] Electrostatic Filters

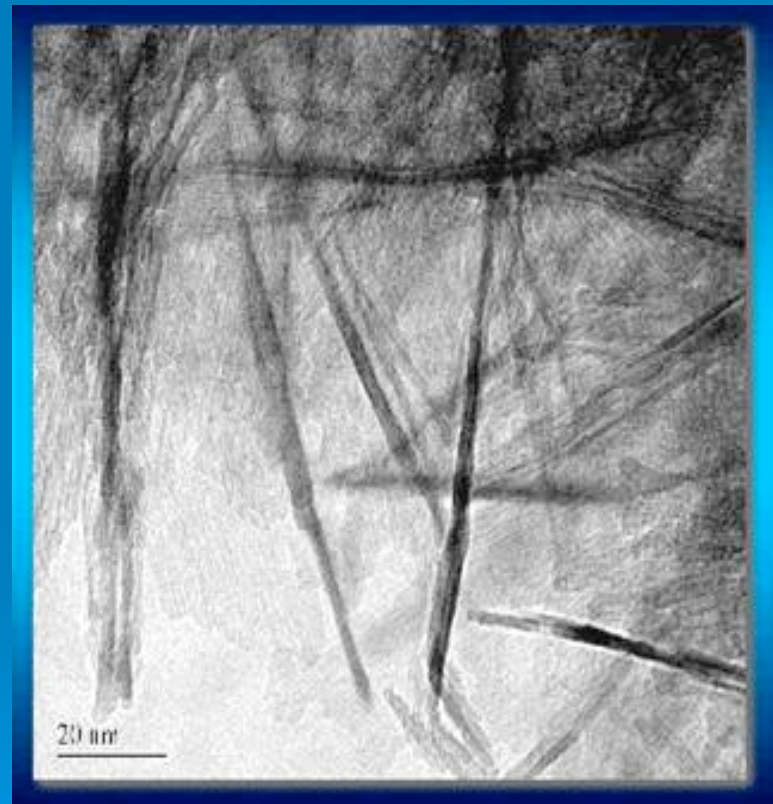
- Filters sub-micron particles with high efficiency, and at a high flowrate
- Its active ingredient is a nano alumina fiber that is charged and attracts particles like a magnet
- Retains all types of particles including silica, natural organic matter, metals, carbon, bacteria, DNA and virus.
- Pleated filter cartridges are now being sold for industrial, commercial and residential applications
- Thicker filter developed for filter/sterilizing drinking water
- A high capacity air filter, capable of HEPA/ULPA rating, is under development

Electron Microscopic Image

NanoCeram[®] Fibers

The nano alumina (AlOOH) fiber is only 2 nanometers in diameter, smaller than a carbon tube and about the size of a DNA molecule.

The nano fibers are highly electropositive.




Pilot Lot Of Nanoceram Media




A major cost barrier was overcome when we produced our media at a paper mill

Features and Benefits

- **Flow rates tens to hundreds of times greater than membranes**
 - **Separates sub-micron particles by charge rather than size**
 - **Higher filtration efficiency than membrane filters**
 - **Resistant to clogging by fine and ultra fine particles**
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- The bottom right corner of the slide features a decorative graphic of several concentric, light blue circles that resemble ripples on water, set against the solid blue background.

Zeta Potential & Virus Removal

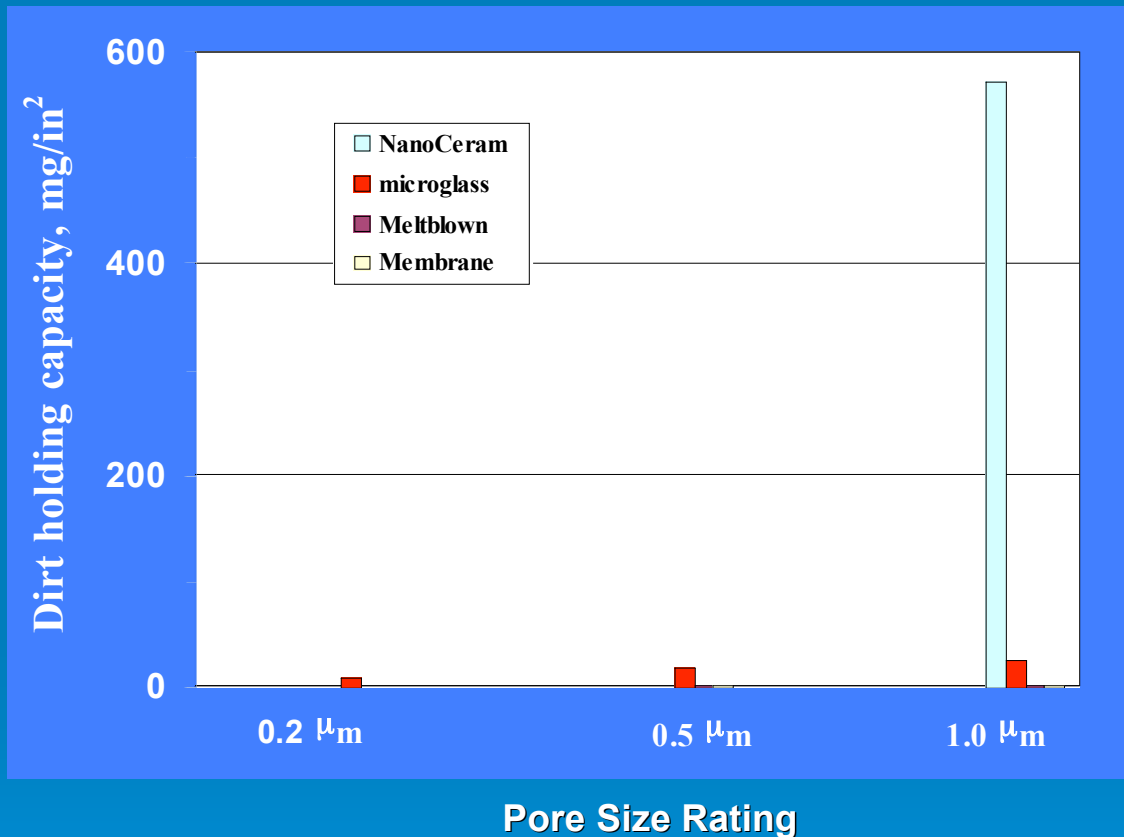
NanoCeram® Wt % on Supporting Fiber	Potential, mV	Virus Retention (%)
0	-35	8
5	-10	29
10	7	94
15	12	>99.9999
25	32	>99.9999
40	29	>99.9999
50	23	>99.9999



Zeta potential becomes positive with increasing nano alumina and this causes a marked increase in virus (MS2) retention

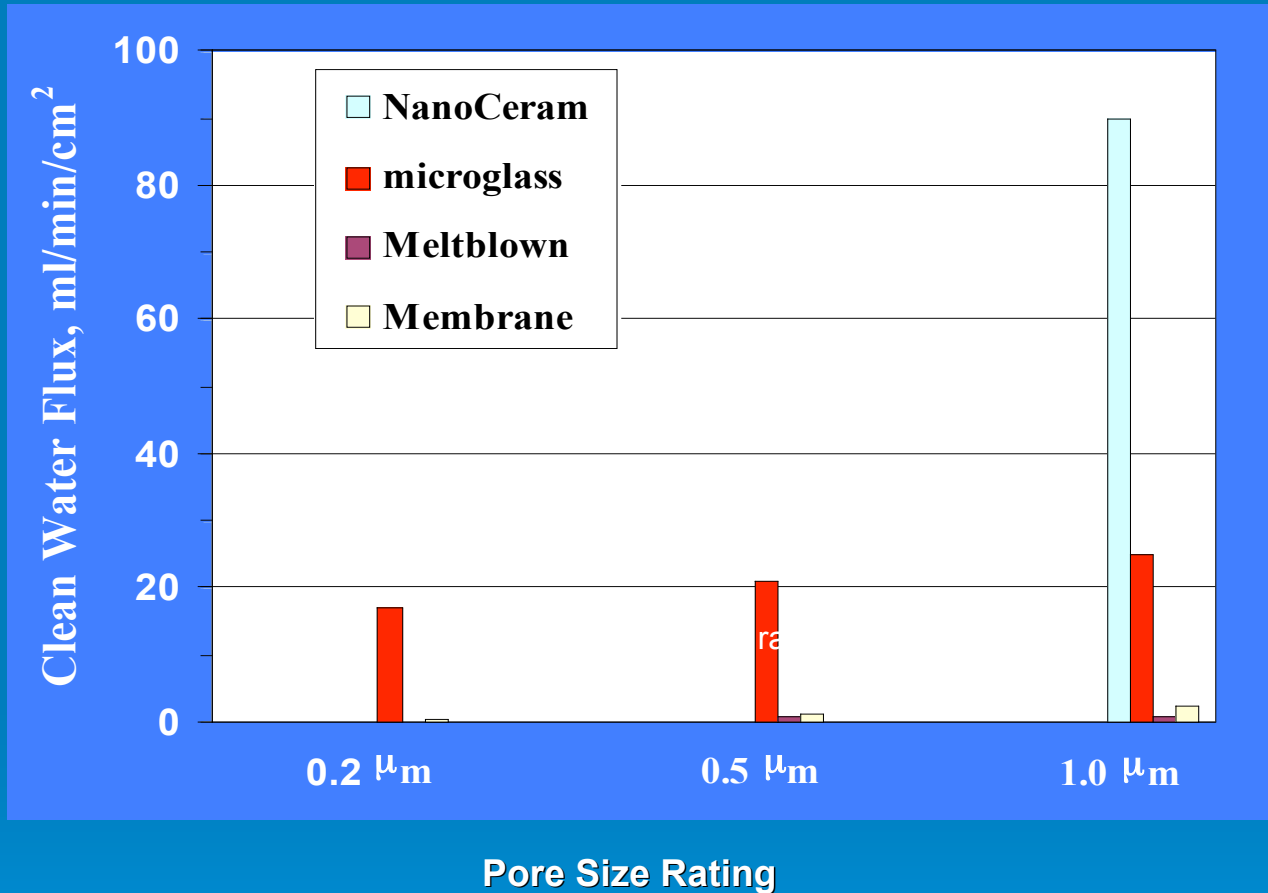
Filtering Dirt Particles

(A2 Fine Test Dust)



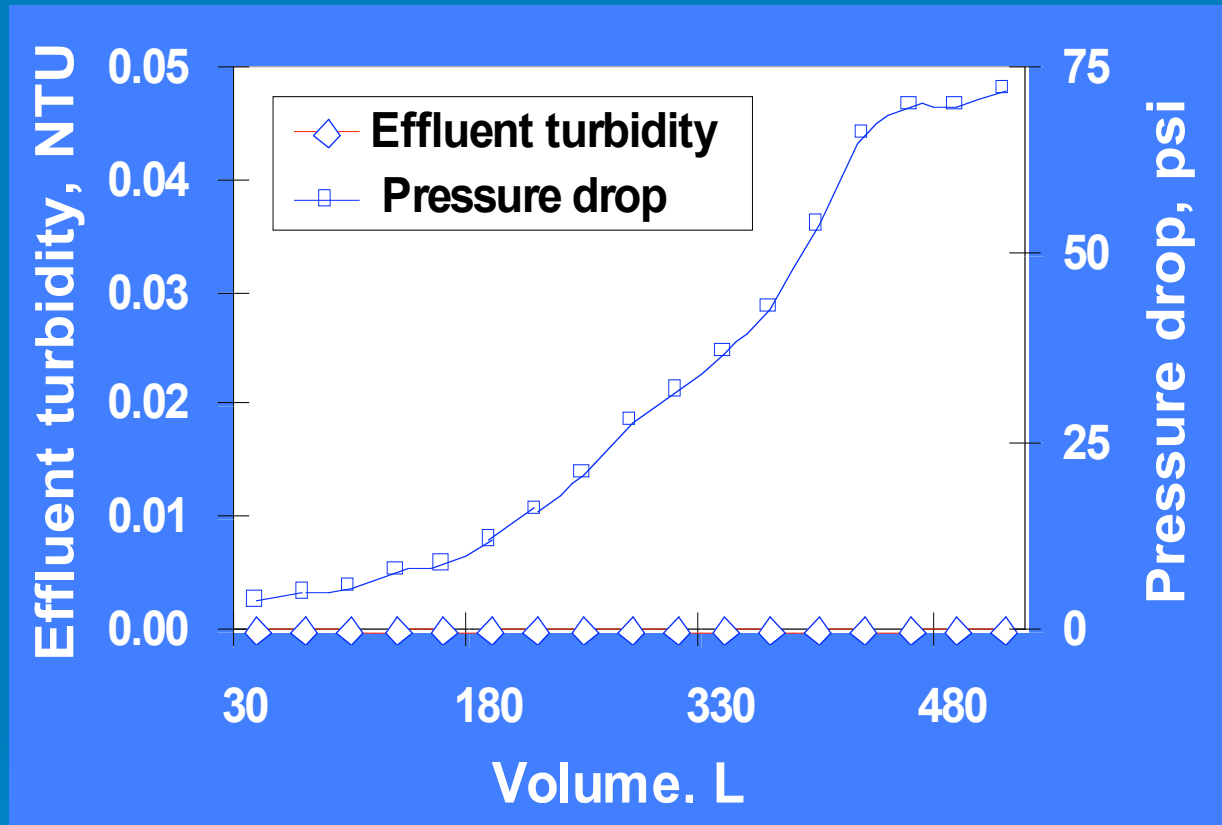
Its dirt holding capacity (life) is almost twenty times greater than microglass filter media and 300 times greater than either meltblown or membrane media. This results in remarkable savings when filtering colloids.

Comparison of Flow Capacity



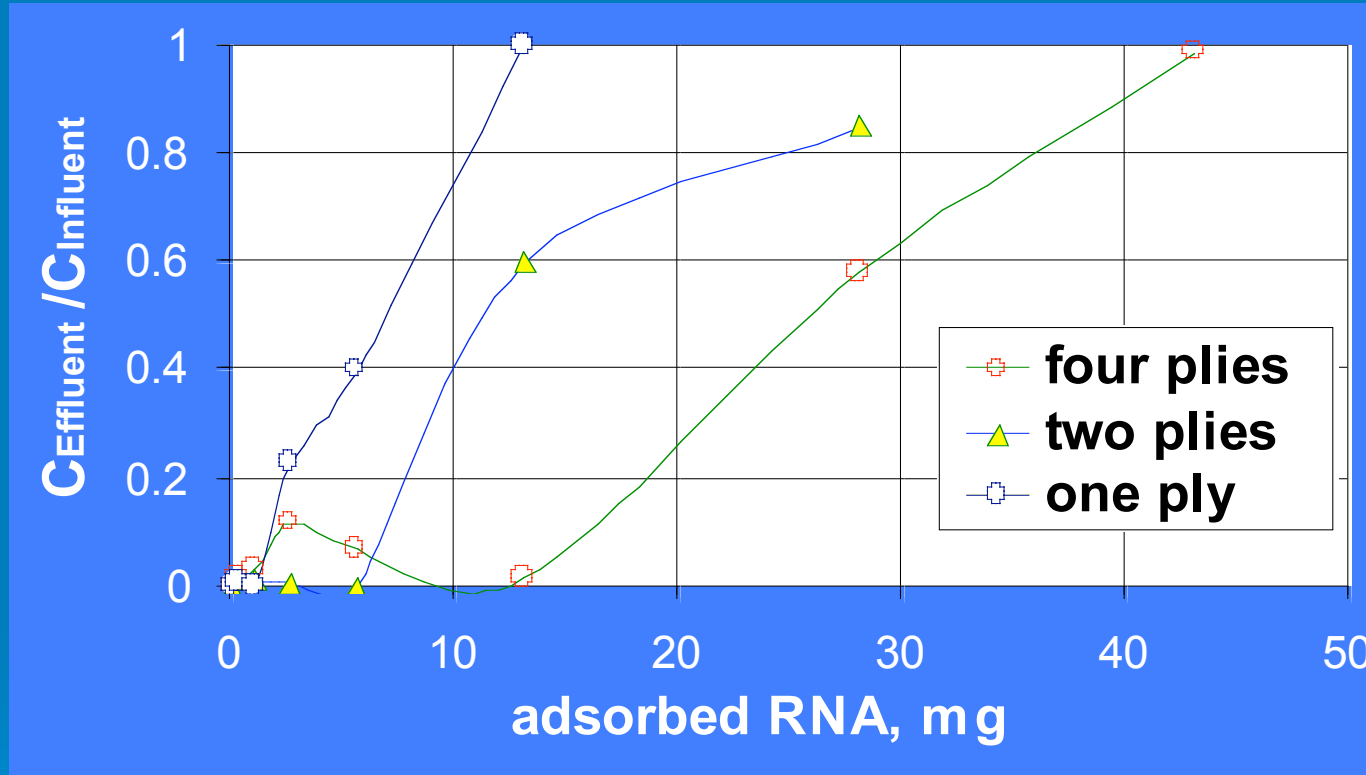
NanoCeram® can support a much higher flowrate than those filters rated at 1μm pore size or less

Filtration Efficiency



A 5" cartridge was challenged by 250 NTU of fine test dust (equivalent to a very muddy river) at 1.5 gallons/min. At end of test it had filtered out ¼ pound of dust, removing it all (>99.996%). A significant application is the sampling of municipal, well water and seawater for virus contamination

RNA Filtration



DNA and RNA are filtered much like virus. The thicker the filter, the higher is its filtration efficiency.

Nano ink adsorption – Slide # 1



A pigment nano-ink with a particle size of about 2 nm was diluted until it was transparent.

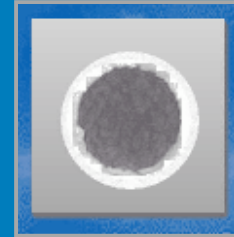
Ink Test - #2

When forced through a 25 nm ultraporous (UP) membrane (Millipore VS), the back pressure was very high. The small amount of ink that passed through the membrane was as colored as the influent.



After the test, the UP filter showed very little color change

Ink Test - #3



When the ink was injected through the NanoCeram® filter, the back pressure was low and filtration was easy. Yet the effluent came out water white. The filter (above) was intensely colored, proving that it retained the nano ink.

Pleated Nanoceram[®] Cartridges



2.5" diameter cartridges – 5" and 10" long (P2.5-5 and P2.5-10) are shown.

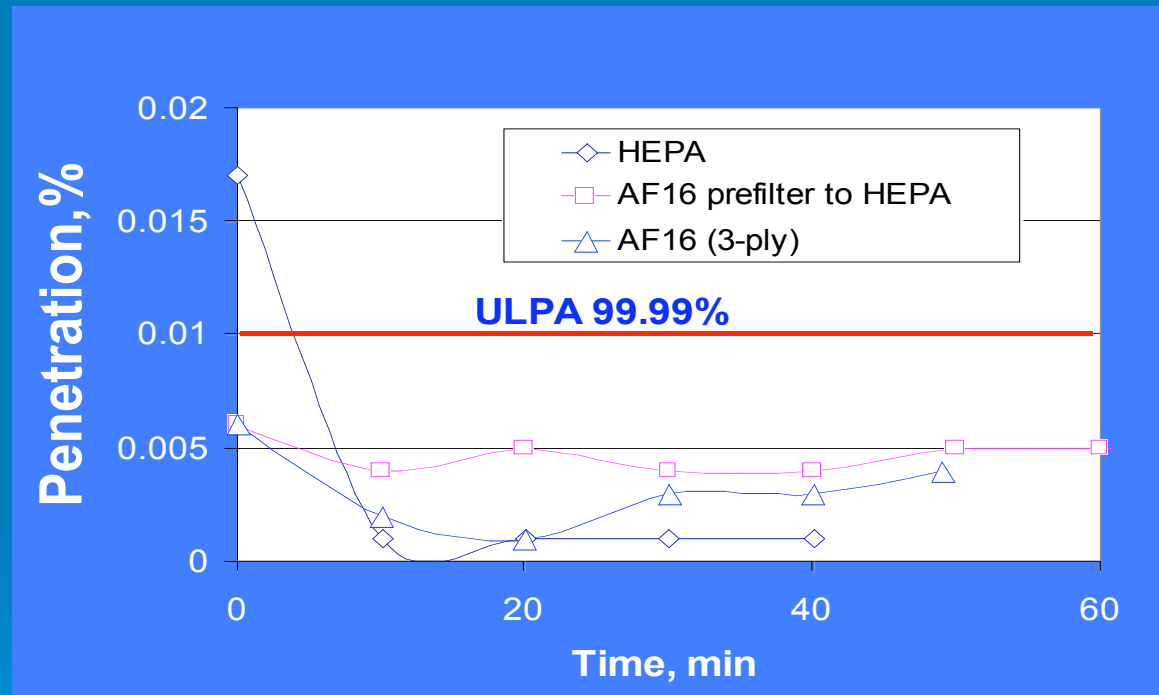
4.5" diameter X 10" long (P4.5-10) is also shown

The smallest unit is a prototype

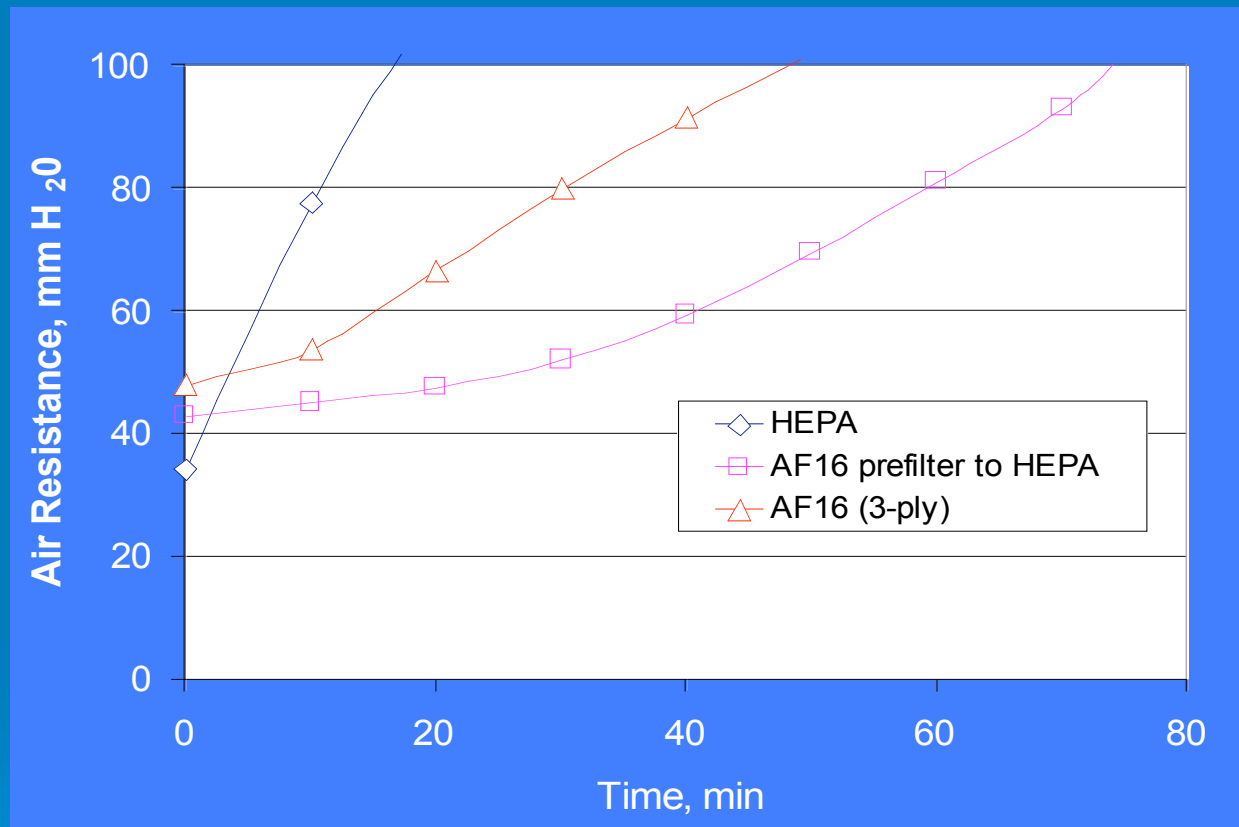
Air Filtration vs. HEPA

We can improve on HEPA two ways.

We can achieve ULPA rating, either by substituting NanoCeram (AF 16) or by adding it as a pre filter to a HEPA filter.



Life of NanoCeram vs HEPA

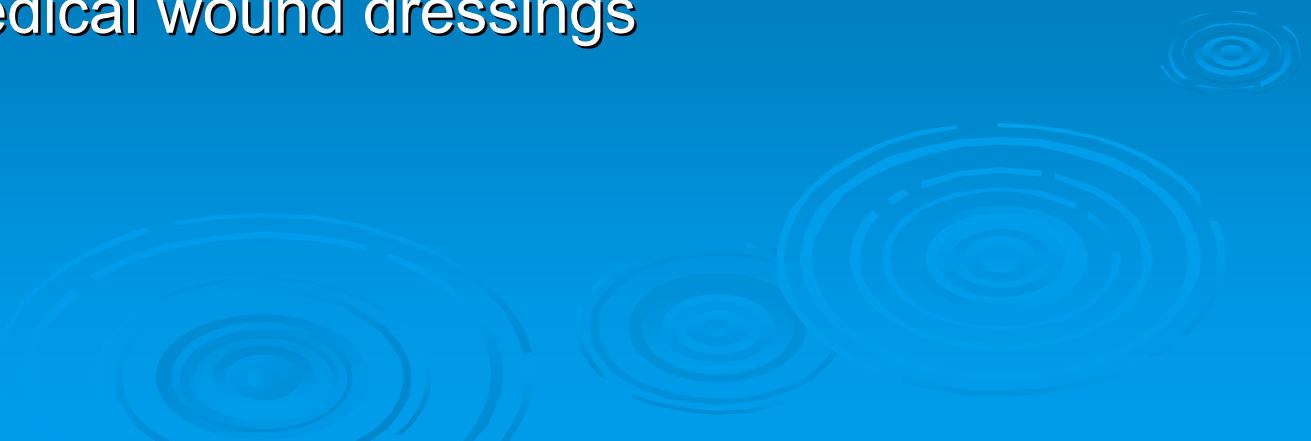


The life under load is also many times greater than HEPA

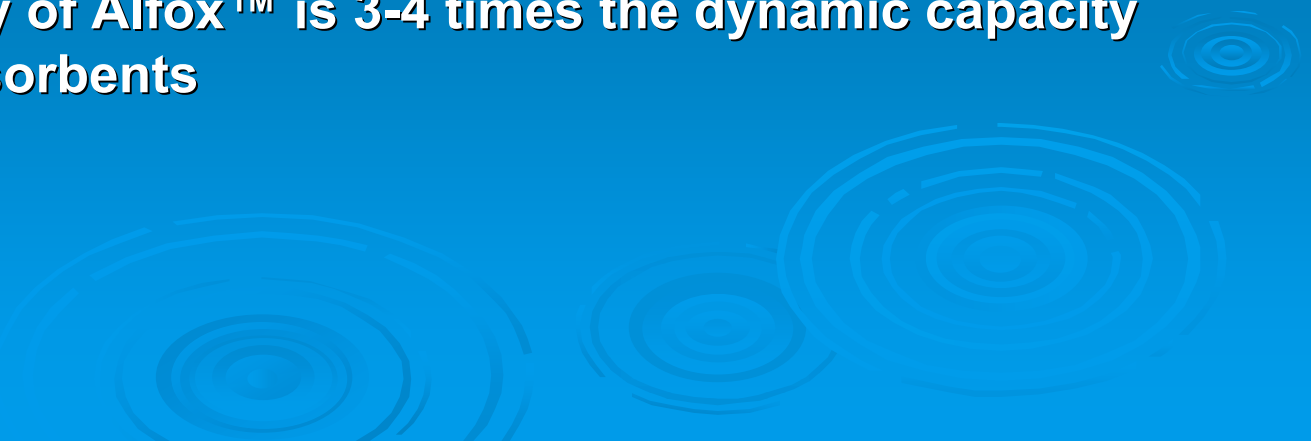
Applications

- **Drinking water**
 - Portable hand held for campers, military, emergency water
 - Point of Use (at kitchen sink, pitcher, refrigerator)
 - Point of Entry
 - Emergency water systems
 - 3rd World (village wells)
- **Pre filter for reverse osmosis, ultraviolet and ozone water purifiers**
- **Purifying coolants**
 - Removing Legionella from HVAC
 - Filtering metal working coolants
- **Purification of bio/pharma fluids – removal of endotoxin, virus, etc**
- **Separation of proteins**


Other Applications

- Swimming pools and spas
 - Processing food and drink
 - Biological and virus detection schemes (SBIR program in progress)
 - Biological warfare filters
 - Improved air filter (SBIR in progress) with 10 times HEPA life
 - Proprietary medical wound dressings
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Alfox™ Arsenic Filter Media

- New EPA regulations reduces arsenic level from 50 to 10 ppb effective Jan 06
 - 11+ million U S households affected
 - Ecological disaster in S E Asia affecting tens of millions
 - Under EPA SBIR we developed granular (nano) media
 - Arsenic capacity of Alfox™ is 3-4 times the dynamic capacity vs competitive sorbents
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Business Plan

- **Develop distribution partners for industrial (pleated) filters**
 - **Obtain NSF certification of POU (virus) filter**
 - **Scale up POU manufacture**
 - **Develop POE, refrigerator, pitcher, portable drinking water filters**
 - **Develop distribution partners in the diverse markets**
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