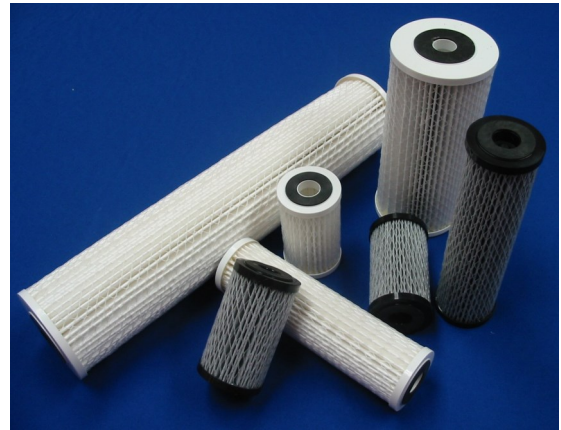


NanoCeram® & NanoCeram® PAC Filters

Bacteria, Virus, and Cysts Removal

Key Media Features

- NSF/ANSI 53 Certified
- Reduces or Removes Bacteria, Virus, and Cysts
- NASA-derived technology
- Available with Powdered Activated Carbon (PAC) and antimicrobial Agion
- Pleated construction yields high flow rates and low pressure drop.
- Fits standard residential and industrial housings



What is NanoCeram®

Argonide's NanoCeram® & PAC Series of Pleated Filter Cartridges act as a **Broad Spectrum Particle Magnet**. They feature a thermally bonded blend of microglass fibers & cellulose infused with Nanoalumina fibers in a non-woven matrix. By using the scientific principle of electropositive attraction / capture, NanoCeram® NASA-derived technology leads to a rapid and highly efficient adsorption of virtually all particle sizes. When assembled into a pleated cartridge, NanoCeram® offers a unique combination of efficiency, capacity, flow rate & low pressure drop at levels unmatched in today's filtration marketplace.

All NanoCeram® filter cartridges are assembled using only FDA-compliant materials.



Applications / Markets

- Potable Water
 - Residential Point of Use / Under Counter / Counter Top Water Filtration Systems
 - Point of Entry (POE)
- Food & Beverage
- RO Prefiltration (SDI reduction)
- Process Water (turbidity, particulate, colloidal suspensions)
- Waste Water (biologicals, proteins, dyes)
- Cooling Towers, Chill Water Loops (iron removal)

Media Retention Characteristics

- Silt Density Index (SDI) 0.5– 1.0
- >99.99% Efficiency at 0.2 microns (latex spheres)
- >3 LRV Cyst Retention
- >5 LRV Klebsiella terrigena Retention
- <0.01 NTU until Terminal ΔP: 35 psid (2.4 bar)
- Dirt Holding Capacity: 82 g/ft²
 - Superior to microglass, meltblown, and membrane media.
- >99.95% Endotoxin Removal
- Effective at High / Low pH and in Presence of Salt Water



All NanoCeram® Standard products have been tested and certified by IAPMO R & T to meet NSF/ANSI std. 53 for Material Safety only.



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NanoCeram® & NanoCeram® PAC Filters

Virus Removal Comparison

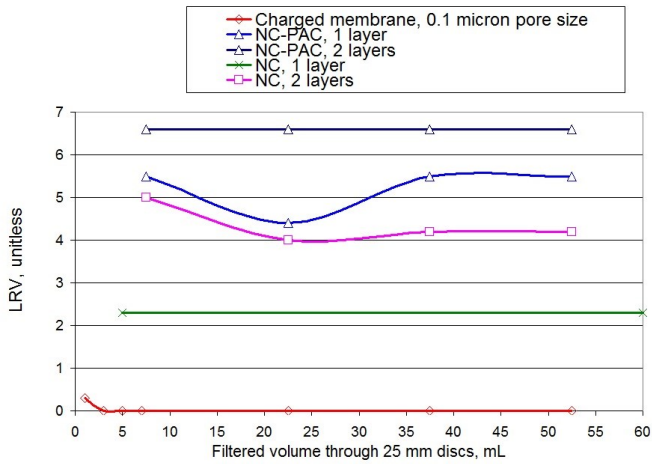
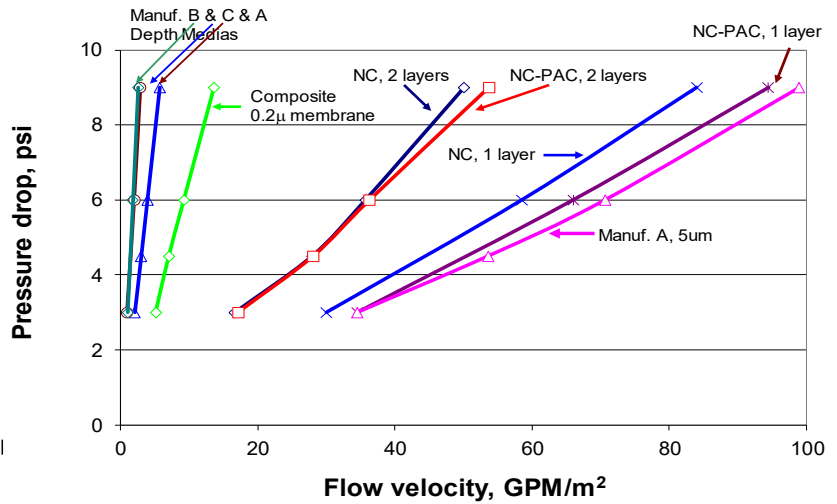


Figure – LRV values for MS2 removal by NC-PAC and 0.1 micron pore size charged membrane

Flowrate Comparison



SDI Comparison

Competitive Comparison - Turbidity and Silt Density Index (SDI ₃₀) - 10" cartridges (except where noted)						
Manufacturer	Type	Flow Rate (gpm)	Type of Water	Turbidity In	Turbidity Out	SDI ₃₀ ^A
NanoCeram	P2.5-10	4	A2 dust ^B in RO water	252.00	<0.01	0.2 ± 0.3^C
			Municipal Tap Water	0.87	<0.01	0.5 ± 0.1^D
A	1µ absolute	4	A2 dust ^B in RO water	239.00	60.00	Failed^E
			Municipal Tap Water	0.54	0.10	4.4 ± 0.2 ^F
	0.35µ absolute	4	A2 dust ^B in RO water	239.00	55.00	Failed^E
			Municipal Tap Water	0.57	0.14	4.6 ± 0.2 ^F
B	1µ nominal (20")	4	Municipal Tap Water	1.3 ± 0.1 ^G	0.4 ± 0.1 ^H	Failed^E
	1µ absolute	4	A2 dust ^B in RO water	243.00	23.00	Failed^E
		4	Municipal Tap Water	1.3 ± 0.3 ^G	<0.01 ^H	5.5 ± 0.2 ^F
	5µ nominal (20")	4	Municipal Tap Water	1.5 ± 0.7 ^G	1.1 ± 0.4 ^G	Failed^E

Notes: A) Silt Density Index (SDI₃₀); B) ISO121030-1 A2 Fine Test Dust; C) Average of 6 measurements; D) Average of 4 measurements; E) Failed -Turbidity of filtered water too high; F) Average of 3 measurements; G) Average over 3 hour test; H) During first 30 minutes of run.

Materials of Construction

Media : NanoCeram® Media
Support: Polypropylene, Hot Melt

Flow Rate*	Nominal	Maximum
2.5 - 10	4	10
2.5 - 20	8	20
4.5 - 10	10	25
4.5 -20	20	50

* For maximum CTO efficiency flow rate for PAC unit is reduced.

Operating Conditions

Temperature: 39-140°F (4-60°C)
High Temp: 39-190°F (4-88°C)
pH Range: 5 to 10
Terminal Pressure Drop: 35psi (2.4 bar)
Maximum Salinity: 200,000 ppm



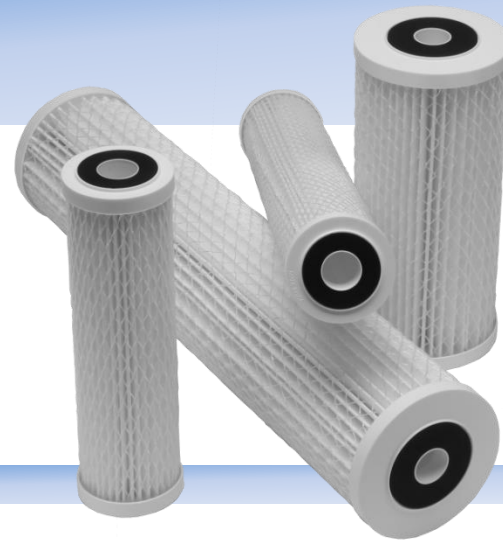
NanoCeram® cartridges also available with Power Activated Carbon (PAC) and Carbon Block Media.

Cartridges available in Single Open End, Double Open End and custom configurations.

All NanoCeram® Standard products have been tested and certified by IAPMO R&T to meet NSF/ANSI std. 53 for Material Safety only.

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Understanding the NanoCeram® Advantage



POWERED BY
NANO CERAM
FILTERING SOLUTIONS

Electropositive Filters

NanoCeram® is an electropositive fibrous filter media with high particle removal efficiency as well as high dirt holding capacity. When incorporated into a pleated filter, its flow rate is equivalent to, or higher than pleated filters that are rated at 1-2 microns even though NanoCeram®'s nominal rating is 0.2 micron. As a "broad spectrum" particle "magnet", the NanoCeram® cartridge removes both coarse and fine particulates.

Most filters separate particles by the mechanisms of sieving, inertial impaction, interception and diffusion. This is true for most membranes as well as fibrous depth filters. Electropositive filters principally use **adsorption** (electro-adhesion) as the filtering mechanism. Unlike NanoCeram® filters, electropositive membranes have a very low dirt holding capacity and a tendency to foul quickly. They also have low reliability and high costs for materials, maintenance and actual operation.

	Part No.	P2.5-5 or PAC2.5-5 2.5" x 5"	P2.5-10 or PAC2.5-10 2.5" X 10"	P2.5-20 or PAC2.5-20 2.5" X 20"	P2.5-30 or PAC2.5-30 2.5" X 30"	P2.5-40 or PAC2.5-40 2.5" X 40"	P4.5-10 or PAC4.5-10 4.5" x 10"	P4.5-20 or PAC4.5-20 4.5" x 20"
Suggested Flow Rate	(GPM)	2	4	8	12	16	10	20
	(LPM)	8	15	30	45	60	38	76
Peak Flow Rate*	(GPM)	5	10	20	30	40	25	50
	(LPM)	19	38	76	114	151	95	189

*Peak Flow rate based on initial flow using new filter cartridge and clean water during laboratory testing.

Advantages

Enhanced Operations - by removing fines in addition to the coarser particulate in a water stream, many industries will see dramatically improved performances.

DHC – Capacity that can be hundreds of times greater than conventional filters.

- Fewer replacement elements
- Lower maintenance costs
- Less system downtime

ΔP – A lower pressure drop

- Less energy consumed in forcing fluids through a "tight" filter media
- Less wear & tear on other system components

Reduced Operational Costs – no ongoing operational costs of membranes.

- Capital intensive backflush systems and chemicals
- Energy consumption during backflush cycles
- Water waste
- Labor costs for cleaning operations
- Hazardous waste disposal from the back flushing cycles

How Does Electro-Adhesion Work?

The Technical Explanation:

Electro-adhesion utilizes the difference in charge that may exist between a surface (or fiber) and a particle in an aqueous solution, where a charge is built up by the double layer effect. Most bacteria and most other particles are electronegative in water. Smaller particles also tend to become more electronegative. So, an electropositive fixed surface would be far more effective at attracting and retaining particles than one that is electronegative.

The NanoCeram® Advantage:

The electroadsorptive ingredient in the NanoCeram® filter is a nano alumina fiber that has a surface area from 350-500 m²/g, with virtually all of that on the outside surface of the fiber and exposed to the entire spectrum of particulate in an aqueous stream. Such high surface areas are unattainable either in a membrane or in a fibrous filter even where nanofibers are being used. Nanofibers are very difficult to manufacture much below a 100nm diameter versus a 2nm diameter in the case of nano alumina.

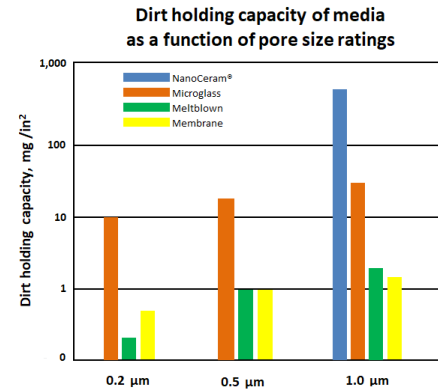
And even if a nanoalumina fiber with a 2nm diameter were commercially available, this fiber (and virtually every other nanomaterial) would have a very strong tendency to agglomerate with the other nanofibers. Once this agglomeration occurs, the advantage of that huge surface area is lost. The key to NanoCeram®'s advantage is that we have developed a novel method of grafting these submicron alumina fibers permanently to a scaffold. This serves to keep the fibers separate from one another so that each fiber can do what it is optimized to do . . . attract and capture submicron particles.

Dirt Holding Capacity

Dirt holding capacity (DHC) generally refers to the capacity of a filter cartridge to retain a given weight of particles before the cartridge plugs. Logic dictates that for a given pore size, the larger particle challenging that filter, the greater the DHC. Smaller particles would simply pass through the larger pores.

Much like a standard filter, the NanoCeram® electropositive fibrous media sieves particles larger than its average pore size. However, the NanoCeram® filter also adsorbs smaller particles resulting in DHC levels many times greater than standard filter cartridges.

In many applications, removing sub-micron particles is vital. They are responsible for much of the fouling of reverse osmosis (RO) membranes and would degrade the efficiency of ultraviolet (UV) and ozone disinfection systems. Membranes are surface filters with very little DHC and while their efficiency might be high, their capacity for holding dirt will often lead to premature fouling resulting in frequent cleaning cycles and increased operational costs.



How long will my NanoCeram® Cartridge Last?

Several factors can affect the life of your cartridge, but the overriding factor is the load and type of particulate being filtered. New US EPA regulations require that the turbidity (defined as a cloudy condition in water due to suspended silt or organic matter) of municipal water must be reduced to less than 1 NTU (Nephelometric Turbidity Units).

Filter Life in Municipally-Treated Water for NanoCeram® & NanoCeram® PAC Filter Cartridges (estimated)

Contaminant	Part No.	P2.5-5 or	P2.5-10 or	P2.5-20 or	P4.5-10 or	P4.5-20 or
		PAC2.5-5 2.5" x 5"	PAC2.5-10 2.5" X 10"	PAC2.5-20 2.5" X 20"	PAC4.5-10 4.5" x 10"	PAC4.5-20 4.5" x 20"
Capacity before significant Turbidity removal performance degradation when challenged by local municipal water @ 1.0 NTU						
Virus: MS2 bacteriophage	Gallons	4,500	10,000	22,000	34,000	68,000
	Liters	17,034	37,854	83,279	128,704	257,408
Endotoxin: E.coli O113:h10	Gallons	15,000	33,000	71,000	120,000	240,000
	Liters	56,781	124,919	268,764	454,249	908,499

Argonide Experimental Data

When discussing soluble contaminants such as chlorine, the flow velocity is a very important metric. All carbon-based products require "residence time" for contact between the contaminant and the carbon itself. The longer the contact time, the greater the dynamic adsorption rate of the carbon for soluble contaminants. This is where NanoCeram® PAC offers such an advantage.

Chlorine Reduction Capacity of NanoCeram® PAC Filter Cartridges (estimated)

Part No.	PAC2.5-5 2.5" x 5"	PAC2.5-10 2.5" X 10"	PAC2.5-20 2.5" X 20"	PAC2.5-30 2.5" X 30"	PAC2.5-10 2.5" X 40"	PAC4.5-10 4.5" x 10"	PAC4.5-20 4.5" x 20"
Capacity for > 50% Reduction of Chlorine (from 2ppm to <1ppm)*							
Gallons	2,100	5200*	10,800	16,000	21,600	12,700	26,000
Liters	7,950	19,500	41,000	60,500	82,000	48,000	98,250

*2.5-10 Flowrate = 1 gpm

What is NanoCeram® PAC?

NanoCeram® PAC represents a paradigm shift in carbon filtration in that fine activated carbon powder can now be utilized in filter media as it is held within the structure by electroadhesive forces, without using adhesives or starches that would blind or possibly deactivate the carbon. PAC offers a much greater external surface area, resulting in much more rapid adsorption of soluble contaminants.

NanoCeram® P & PAC series filters reduce or remove bacteria, virus, and cysts. Additionally, PAC reduces chlorine, iodine and soluble organics that may be highly toxic or may cause unpalatable taste and odor. The PAC filter is best used in those applications where a combination of fouling-resistant soluble contaminant removal and particulate reduction is desired.

For drinking water applications, the entire Argonide line of standard-sized NanoCeram and NanoCeram PAC filter cartridges have been certified to the NSF/ANSI Std. 53 for material safety only. Additional testing by the International Association of Plumbers and Mechanical Officials (IAPMO) has determined that these filter cartridges reduced cysts by at least 99.98%.

