ANOPORE MEMBRANE FILTERS - TECHNICAL SPECIFICATIONS

SPI SUPPLIES

SPI Supplies
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ANOPORE™ Inorganic Aluminum Oxide Membrane Filters

TECHNICAL SPECIFICATIONS

	Anodisc 47 Filter	Anodisc 25 Filter	Anodisc 13
Membrane diameter (mm)	46	21	13
Membrane type	Anopore	Anopore	Anopore
	Aluminum Oxide	Aluminum Oxide	Aluminum Oxide
Support ring material	Polypropylene	Polypropylene	None
Construction process	Thermal Weld	Thermal Weld	
Protein adsorption	Low	Low	Low
Maximum operating pressure	75 psi 15 (vacuum)	75 psi 15 (vacuum)	75 psi 15 (vacuum)
Refractive index when wet with aqueous solution	1.60	1.60	1.60
Average membrane thickness (µm)	60	60	60
Pore size (µm)	0.2	0.1	0.02
Water flow rate at 25° C and 10 psi (mL/min/cm2)	10.2	8.0	4.9

CHEMICAL COMPATIBILITY TABLE

The chemical compatibility table given below is conservatively stated. For those applications for which there are literally no alternatives, we would like to make the point about what we call "marginal applications". For example, note the table lists NaOH as being "not recommended" for use. Indeed, an Anopore membrane filter submerged in 1M NaOH will dissolve in about ten minutes.

Yet in the limit, at infinite dilution, where there will be a pH of 7, we know that the membrane will not dissolve and will in fact work quite well. So the question is where is that "line" up until which one could operate with some element of confidence.

In the case of NaOH, in a 0.1N solution, after about one hour, the membrane is still mostly present. And the main changes have occurred in the membrane thickness, not in the pore size, that is, there has been no collapsing of pores. So the point is, if the filtration can be done fast enough, at lower temperatures, for example, one should be able to, in many instances use the membrane short terms even for some of the "not recommended" environments.

Obviously, the end user has to be the one to do the appropriate testing to confirm that the aluminum oxide membrane filters are indeed appropriate for the intended application.

Chemical compatibility table for 0.02, 0.1 and 0.2µm pore size Anopore membrane	
Acids	
Acetic acid, glacial	R
Acetic acid 5%	R
Boric acid	R
Hydrochloric acid (conc.)	N
Nitric acid	R
Sulphuric acid (conc.)	N
Bases	
Ammonium hydroxide (6M)	N
Sodium hydroxide	N
Solvents	
Acetone	R
Acetonitrile	R
Amyl acetate	L
Amyl alcohol	R
Benzene *	R
Benzyl alcohol	R
Brine	R
Butyl alcohol	R
Butyraldehyde	R
Carbon tetrachloride *	R
Cellosolve (ethyl)	R
Cellosolve (acetate)	R
Chlorobenzene *	R
Chloroform *	R
Cyclohexane	R
Cyclohexanone	R
Dimethyl formamide	L
Dimethyl sulphoxide	L
Dioxane	R
Ethyl acetate	R
Ethyl alcohol	R
Ethyl ether	R
Ethylene glycol	R
Formaldehyde	L
Freon	R
Glycerine (glycerol)	R

Heptane	R
Hexane	R
Hypo (photo)	R
Isobutyl alcohol	R
Isopropyl acetate	R
Isopropyl alcohol	R
Kerosene	R
Methyl alcohol	R
Methylene chloride	R
Methylethyl ketone	R
Methyl formate	R
MIBK	R
Mineral spirits	R
Nitrobenzene	L
Pentane *	R
Perchloroethylene *	R
Petroleum ether	R
Phenol	L
Polyethylene glycol	L
Pyridine	R
Silicone oils	R
Tetrahydrofuran	R
Trichloroethane *	R
Trichloroethylene *	R
Triethylamine	R
Toluene	R
Xylene	R
R = recommended N = not recommended L = limited application (testing prior to use recommended). Recommendations are based on static exposure for 48 hours at 25° C and one atmosphere (14.7psi). pH range 3.5 to 9.5. *Limited application for Anotop syringe filters. Testing prior to use is strongly recommended. Avoid strong acids and alkalis.	

POLYPROPYLENE SUPPORT RING

The 25 and 47 mm diameter Anodisc™ Inorganic Aluminum Oxide Membrane Filters are made with a polypropylene support ring that runs around the circumference of the membrane. Because of the high fragility of the membrane itself, this support ring permits one to pick up the membrane filter with normal membrane filter tweezers (which we highly recommend using for these filters) without fear of damaging the fragile membrane area. Note that the 13 mm diameter membranes come without support ring.

Support ring thickness: 45µm

In most instances, in most holders, the polypropylene support ring is completely isolated from the flowing liquid. Well, it might not be 100% isolated, of course, but the point is, that when used even with liquids normally a solvent for polypropylene, the dissolution rate is so slow that in most instances it can be dissolved.
Note that the membrane itself is 60µm, but the ring is only 45µm. This means that in the area where the support ring is in contact with the membrane there is a greater thickness. Also, the support ring has a slightly larger diameter than the membrane, so there is an area where there is only PP and no membrane (but very small).

We have been asked about how one would remove the polypropylene support ring. Perhaps one might first consider why one would ever want to do this in the first place! We ourselves are not sure, but in a few instances, the inorganic membrane was going into a UHV system and it was required that no organics be in the system. In another case, the membrane was to be heated in a UHV system and it would have been undesirable to have degrading polypropylene coming off in the environment of the UHV system.

So there are instances when one would want to remove the polypropylene support ring.

But we do want to make clear that in use, the main mechanism of membrane failure, without the support ring, is crack propagation from the edge. That is why the elastic polypropylene support ring is so important because it stops this from happening. It also provides a simple and convenient way and place to pick up the membrane with tweezers. We do know for a fact that the membrane without the support ring, when picked up with tweezers, cracks very easily. People who have tried this report a failure rate of 35-50% of the membrane filters.

So we are in fact sometimes asked about making the membranes without the support rings, but there just seem to be too many difficulties just in shipping the product from us to you without its getting broken.

Although we have not tried it ourselves, we have had reports that when solvents for polypropylene are used to dissolve away the polypropylene, surface tension forces, if one is not really careful, can cause damage and break up of the membrane itself. We are eager to hear from anyone who might have solved this problem of liquid dissolution as the method of removal of the support ring.

The only way we know of for sure is the use of dry plasma etching, and for that we recommend our own SPI Plasma Prep™ II plasma etcher. Using oxygen as the etching gas, the polypropylene support ring can be removed in about ten minutes or less. Is this something SPI could do for a customer and then send membranes with the ring already removed? We have considered it, but then there is the challenge of shipping such a fragile sample and having it arrive at the customer's laboratory in one piece! We think it might be possible by using what are called the SPI Membrane Boxes.

INFORMATION ABOUT CUSTOM SHAPES AND CUTTING THE MATERIAL

We have already described the brittle nature of the Anopore aluminum oxide membrane filter material in our discussion about the reasons for the polypropylene support ring on the Anodisc™ membrane filters.

We are frequently asked questions about either a) cutting the Anopore material or cutting of already cut discs and b) providing on a custom cutting basis the Anopore material to specific customer required sizes and shapes. We would now like to address these two issues, but always keeping in mind the brittle nature of the material in its cut form:

- **Customer cutting of the Anopore membrane material**

The membrane material can be cut by a laser cutter, and there are several manufacturers of such equipment but this represents a technology that is beyond this website page. We are also told that a water jet cutter would also work. The important thing is that there is just no point is trying to use a knife based approach, even with the finest surgical scalpel blades; the membrane will just shatter.

Others have reported the use of a precision diamond scribe: The approach is to literally score one side of the Anopore material, just as one would score a fragile glass cover slip they might want to cut down to some smaller size. So after making the "scribed mark", one would just crack it along the induced fault line. Using a glass slide with its relatively sharp edge produces best results.

However, we must emphasize that cutting successfully this material is somewhat of an "art", and like with any other instance where practice makes perfect, patience is also required.

For small scale production, probably the diamond scribe approach is the more practical, but for larger quantities, one would need either a laser or water based system.

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