CHOOSING A POROUS MATERIAL
ADVANTAGES OF SOILMOISTURE PRECISION POROUS CERAMICS

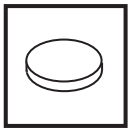
Porous Plastic sheet and stock

These materials, generally available in small rod or sheet form, are fabricated from one of several plastic materials. The most common are products formed by beads of Polyethylene or Polypropylene joined together or, in other cases, an expanded Teflon product. Generally the pores created are rather large, having discontinuities and bubbling pressures in the 1-5 psi range. To achieve a wetted surface takes special etchants to chemically etch the surface (usually hydrofluoric acids) and surface additives to achieve a reasonable capillary capacity. The life of these artificial hydrophilic coatings can substantially vary with use and are not generally guaranteed for extended use. Newer PVC extrusions or injected products that employ naturally porous additives result in a product with a wettable surface but rather moderate flow rates and, again, limited selection of low bubbling pressures. One might question these types of materials in any long term applications or projects requiring pressures or extraction differentials exceeding 5 psi, where the capillarity and flow characteristics must remain constant.

Porous Plastic Films

Special porous films can be purchased in a wide range of thicknesses and pore sizes. Some are naturally wettable, while others require special coatings to assure wet ability. The films themselves are, unfortunately, quite flimsy and almost always require supportive backing materials and mechanical support to assure stability. The thinness of these materials also leaves them vulnerable to tearing and scratching. In the lab these film materials and devices work well in the filtering of solutions. Applying this technology, however, to in-situ work associated with soils, agricultural, and earth sciences applications would cause one to question their practicality. For instance, real hazards exist at the time of installation into soils for tearing, scratching, or pitting of the thin films or subsequent adequate and uniform surface by a contact highly flexible film. Then there are the other long term problems of loss or disassociation of the backing materials and supporting structures from the films that cause significant concerns.

Porous Metals



Generally found in disk form and occasionally in tubes, porous metals are comprised of small particles (soot size) pressed under high pressures and temperatures into a finished product. Most porous metal products are naturally wettable having a high ratio of pores, some of very large size. The result is that the products often have small amounts of leakage at bubbling pressures under 3 psi making them unsuitable for high pressures or extended extraction work. If the porous metals are fabricated from ferric metals, the product will quickly oxidize, “rusting” closed all possible pore pathways.

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POROUS CERAMICS

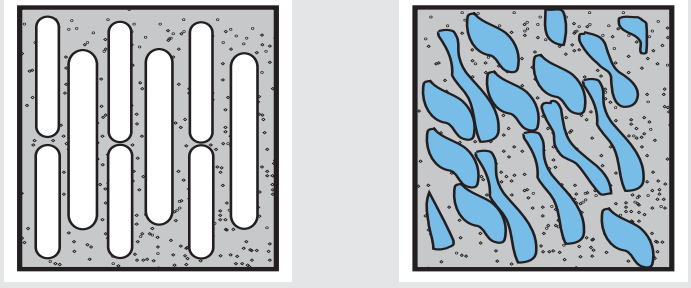
Precision Porous Ceramics

Unlike porous materials developed from plastics that are hydrophobic (water hating), ceramics are naturally wettable and hydrophilic (water loving). The tough durable nature of a fired porous ceramic makes it the preferential material of choice in the field of in-situ measurements, sampling or processing. Unlike porous metals that may oxidize or leak, porous ceramics are generally inert and can be produced with very consistent and uniform pore structures. Structures and devices fabricated from thick-walled porous ceramics can take the punishment of mechanical installation. With a wide selection of pore sizes, our precision porous ceramics can meet the most demanding pressure differential or suction values without leaks. The porous ceramic products we have available today have been proven for more than 40 years in all types of real world use. Each ceramic production batch and many individual ceramic products are individually tested for hydraulic properties and bubbling pressures. Our specialized knowledge of ceramics, glazing, assembly, or slip casting techniques allow us to meet your needs with creativity and value.

UNDERSTANDING POROUS CERAMICS

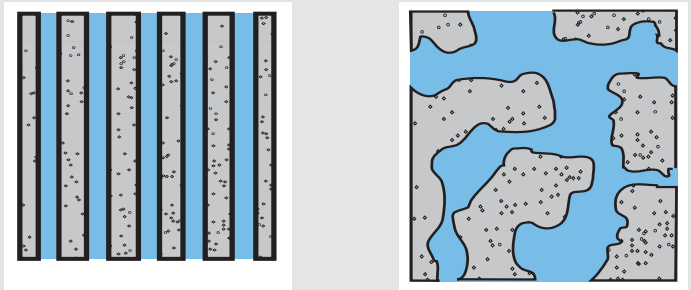
POROUS MATERIALS : Materials containing a passage or channel, a small opening for absorbing or discharging fluids.

The Closed Pore Structures



As the name would imply, this is a material in which the pathways or channels are blocked and do not provide the fluid a continuous and interconnected network of channels to connect one surface of the material to an opposing surface.

The Open Pore Structures



An open pore structure denotes a material that permits a fluid to move from one surface to an opposing surface in the material through a convoluted pathway of interconnecting networked channels. Soilmoisture ceramics are an example of an open pore structured material.

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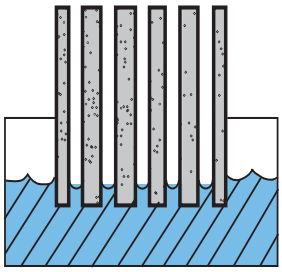
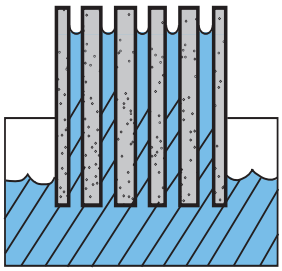
Hydrophobic Material - Water repelling



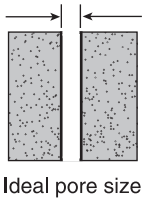
This term refers to materials such as porous plastics that have no affinity to wetting by water. These substances may have pores and channels but have no surface ability to wick water into the pores by the action of capillarity. Such materials are generally made from long chain organic molecules which have no substantial surface charges. Without a charged surface, there is no attractive or bonding effects on the polar molecules of water, and such substances must be specially treated.

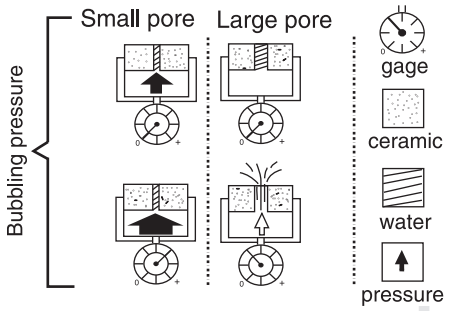
Hydrophilic Material- Water accepting



This term refers to those materials, such as porous ceramics and metals, that have a natural ability to fill pores by capillary action. This means the pores and channels of a ceramic have a highly charged pore surface that attracts and bonds the polar molecules of water and other polar fluids. The net effect is called “wicking” --- the ability to pull fluids into the material and transport that fluid by capillary forces. Soilmoisture ceramics are all hydrophilic.

Pore Size





The pore size of a porous ceramic is of critical importance because it directly affects the ceramic’s air entry value or “bubbling pressure” and hydraulic conductivity. The air entry value is the pressure at which air will break through a wetted pore channel. The hydraulic (liquid) conductivity of a porous ceramic is a measure of the rate at which a ceramic material of known thickness may conduct liquid from one surface to an opposing surface under a known pressure. The hydraulic conductivity will vary with the type of pore fluid used which is generally water, but can be oils or other natural and artificial liquids. The effective pore size is determined by the minimum orifice within a channel or pore. These properties that are determined by pore size are intrinsic to ceramics and to all other porous materials. How a porous material behaves in any application is directly related to these pore properties and the material from which it is made. Soilmoisture assures consistent pore sizing by testing each batch and many individual porous products. See Table #1 that describes these properties.

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