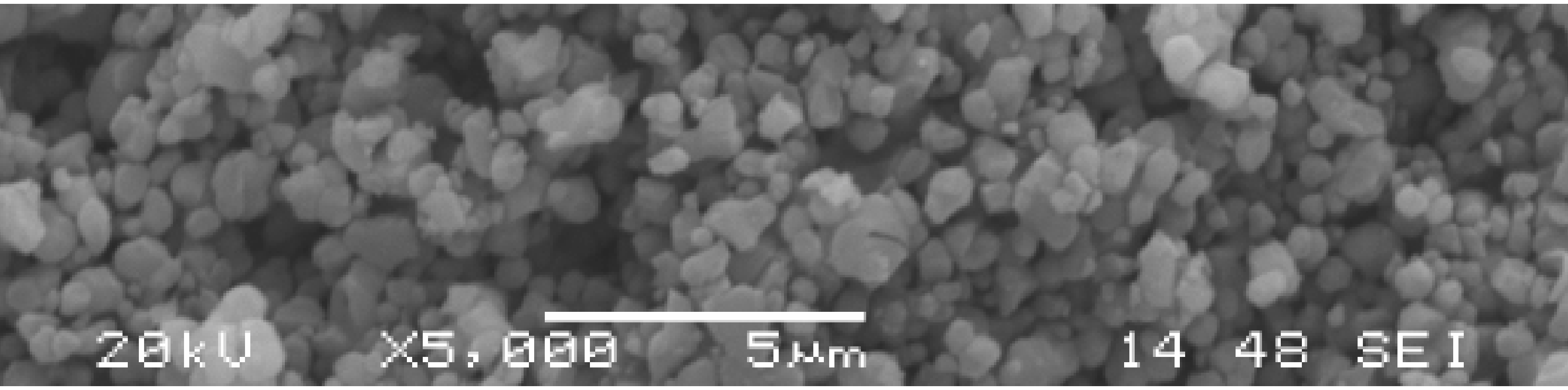
Superior Technical Ceramics

POROUS ALUMINA CERAMICS: ULTRAFILTRATION AND NANOFILTRATION



OVERVIEW

The field of technical porous ceramics is rapidly expanding. As the technology progresses, porous ceramics are joining polymers as the premier porous body for ultra and nanofiltration. They are also finding applications as porous support structures for filtering membranes and as bases for catalysts. Their unique combination of thermal and chemical resistance and long lifespan make them the best solution for demanding applications.

THE STC DIFFERENCE

The strength of Superior Technical Ceramics lies in its ability to produce porous materials with smaller pores and narrower pore size distributions than its competitors. Standard porous ceramics have pore sizes ranging from 1000+ microns down to 0.1 microns (100 nm); any smaller and the development difficulty increases exponentially. However, by utilizing the intrinsic properties of alumina and achieving tight process control, materials scientists at STC have developed porous materials with bubble points (the largest pore size) under 100 nm and an average pore size of just 18 nm. This brings STC's ceramics into the ultrafiltration range without any applied membrane, and it enhances its ability to be used as porous supports for nanofiltration membranes. If larger pores are needed, STC can do that too.

STC POROUS CERAMICS DATA SHEET

Material	A1-1	A1-2	A1-3	A3-1	A3-2
Percent Porosity	47.15%	43.09%	37.41%	42.60%	42.70%
Mean Flow Pore Diameter (micron)	0.123	0.145	0.139	0.018	0.016
Bubble Point Pore Diameter (micron)	0.506	0.502	0.527	0.069	0.085
Std. Dev of Avg. Pore Diameter (micron)	0.1006	0.1184	0.1151	0.019	0.030
Diameter at Max Pore Size Distribution (micron)	0.014	0.0133	0.0132	0.017	0.016
Permeability (Darcy)	0.02	0.022	0.018	0.004	0.0009

COMMON USES

- Ultrafiltration
- Nanofiltration
- Catalyst support structures
- Membrane support structures

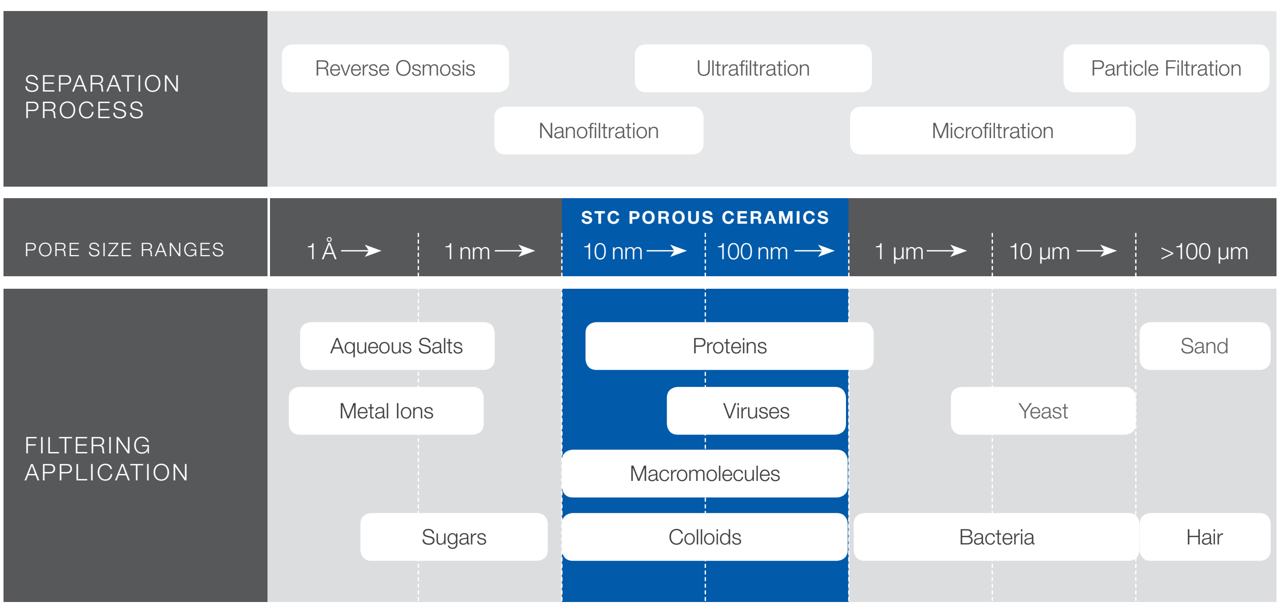


Figure 1: Superior Technical Ceramics' porous alumina is ideal for nanofiltration and ultrafiltration applications.

[1] Application data sourced from public domain sources, www.cerahelix.com, and www.chriwa.de.

DEFINITIONS

Open porosity
STC porous materials have an open cell porosity, as opposed to closed cell, meaning that most of the pores are interconnected, permitting fluid or gas flow. This inherent permeability allows mass to transfer through the material, making it ideal for filtration systems.

Closed porosity
Pores that are not interconnected. Closed porosity ceramics are often used as refractory and for thermal insulation.

High working temperature
STC's processing techniques generate pores that are robust up to 2850 ºF without significant degradation of pore size or percent porosity.

Chemical resistance
STC porous materials are comprised of >99% alumina so they resist both acids and bases. Unlike with polymers, tough chemicals can be used to clean porous ceramics.

Narrow pore distributions
By decreasing the largest pore size, STC fine tunes the pore distribution to ensure customers get only the desired pore sizes.

Ultrafiltration (MWCO 10^3 – 10^6 Da)[2]
Often combined with a membrane, porous ceramics are used in ultrafiltration systems that utilize concentration or pressure gradients for filtration. They are used extensively in the dairy industry to concentrate proteins, and they also have a large role in water filtration at the industrial and personal scale.

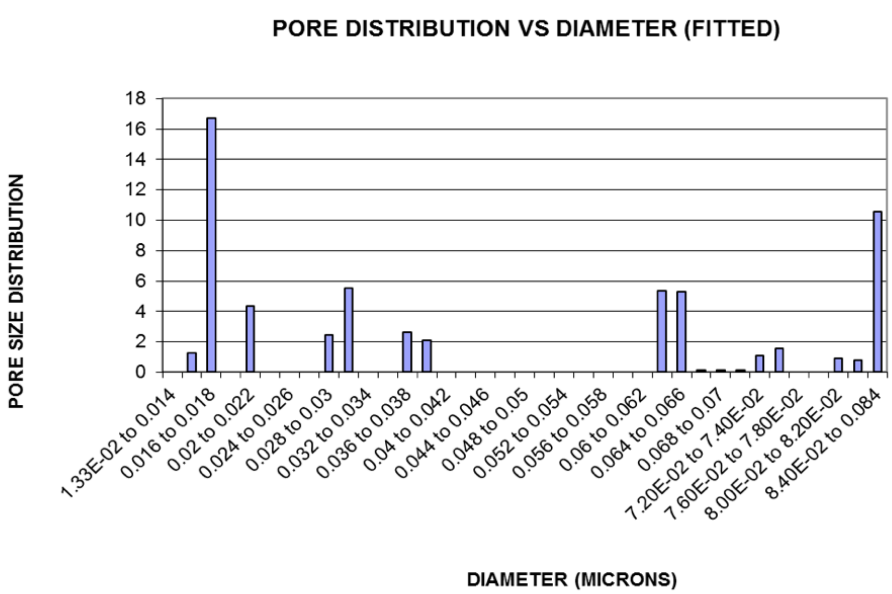


Figure 2: Pore size distribution of Porous A3-2

[2] Filtration systems are defined by their molecular weight cut-off (MWCO) which is the smallest molecular weight (in Daltons) that a filter rejects at a 90% rate.

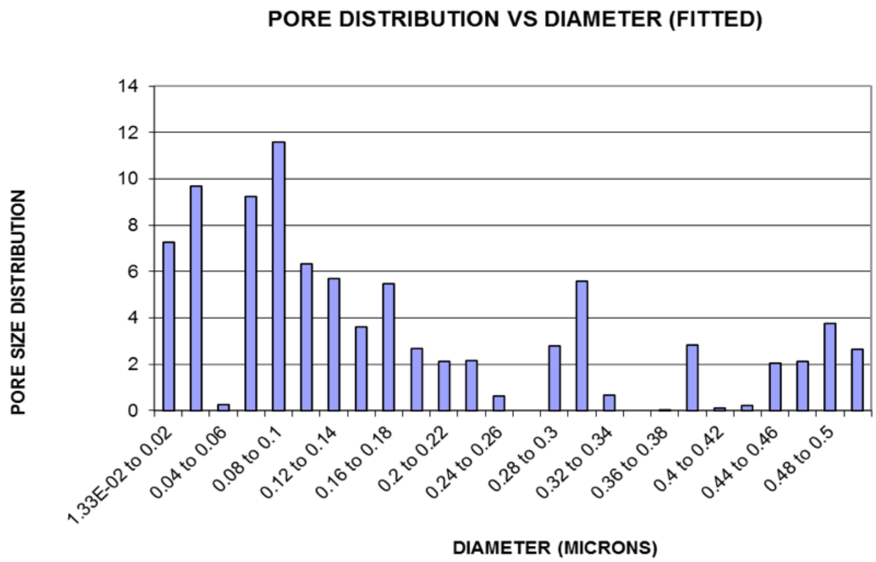


Figure 3: Pore size distribution of Porous A1-1. A similar distribution can be expected for all A1 class materials, albeit with different bubble points.

Nanofiltration (MWCO 10^2 – 10^3 Da)

Unlike reverse osmosis, which is a highly energy intensive method of separating all dissolved salts from an aqueous solution, nanofiltration can make subtle separations while still leaving valuable chemicals in solution. Since it relies more on diffusion through a membrane and less on pressure differentials, it is highly energy efficient. Industrial applications include softening water, lipid and amino acid extraction, room temperature solvent filtration, and numerous other applications in petroleum, pharmaceuticals, chemistry, and alternative energy fields.

Catalyst support structures

The high surface area and thermal resistance of porous ceramics make them ideal for catalyst support structures for filters and carbon dioxide/monoxide analyzers.

CONTACT US

For more information, call or email us. You can also learn more about our extensive capabilities at www.ceramics.net

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