



**micropore**

**Creating Shared Value through  
Porous Ceramics Technology !**

# micropore co.,ltd.

# INTRODUCTION

## Company History

Micropore Co., Ltd. has been commercializing ceramic vacuum chucks, backlight vacuum chucks, non-contact transfer units, insulation materials for heat treatment equipment, gas filters for semiconductors, and air permeable crucibles for anode materials for the localization of semiconductor/display parts materials. In the future, we will realize the dream of innovative growth as a mecca of the parts and materials industry that leads the 4th industrial revolution in Korea.

2000.	12.	Established Environmental Materials Research Institute	2018.	02.	Production facilities completed (firing room, processing room)
		Hanyang University Lab Startup	2019.	03.	Established an affiliated research institute
2001.	08.	Changed corporate name to Micropore Co., Ltd.	05.		Supplied insulation materials for 8th generation glass panel heat treatment equipment
2002.	06.	Selected as a technology innovation development project by the Small and Medium Business Administration			
2005.	12.	Certified antibacterial ceramic beads for water treatment	08.		Certified as a company specializing in parts and materials (Ministry of Trade, Industry and Energy)
2006.	08.	Development of ceramic foam materials for fuel cells	2020.	03.	Development of a permeable crucible
2008.	01.	Supplied high-temperature ceramic insulation for hydrogen furnace	06.		Selected as an excellent company through technology evaluation TI-2
2010.	02.	Development of catalytic filter for removing VOC and formaldehyde			Selected as a material component technology development project by the Ministry of Trade, Industry and Energy
2013.	12.	Delivery of dust collection ceramic filter	2021.	12.	Expansion and relocation of Hwaseong, Gyeonggi-do plant
2016.	10.	Development of thermal insulation materials for display heat treatment equipment	2022.	05.	Development of backlight vacuum chuck for the first time
2017.	09.	Relocation of factory to Asan, Cheonan	08.		First delivery of backlight vacuum chuck and full-scale production
	12.	Certified as a venture business (Small and Medium Business Corporation)	2023.	05.	Large area vacuum chuck (1550 mm x 1950 mm) for ITO film laser patterning



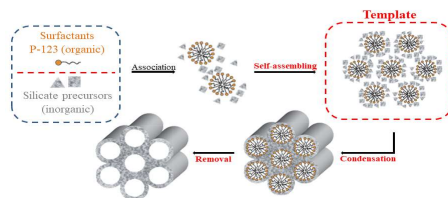
## Porous ceramic material technology innovation company

- ✓ Korea's only specialized porous ceramic company
- ✓ Ceramic vacuum chuck · Backlight vacuum chuck · Non-contact flotation unit
- Heat treatment equipment insulator · Gas filter for semiconductors, etc.

## Ceramic internal pore formation technology

### □ Nano pore, < 30 nm

Micropores of less than 10 nm (100 Å) are manufactured by the surfactant self-assembly reaction method (refer to the figure). For example, in the case of nanoporous silica, the space occupied by the surfactant is made into pores by heat-treating the template formed by the self-assembly reaction of silicate ions and surfactants in the solution (hydrothermal synthesis method). Nanoporous materials in this section are used as separation membranes and nanocatalysts.



[Preparation of Nano-porous silica by hydrothermal synthesis]

### □ Micro pore, < 30 μm

Pores in this section can be manufactured by combustion of combustible materials inside ceramics or by sintering using filled voids between particles. The micropore vacuum chuck family has high permeability and has a pore size of 7 ~ 15 μm. The pores of the filtration membrane on the surface of the ceramic filter are also included in this area.

### □ Macro pore, < 300 μm

It is manufactured using Micropore's proprietary slurry foaming technology. In other words, tiny bubbles formed by introducing outside air into the dispersed slurry remain as pores in the product. In the case of porous ceramics, the space occupied by the internal pores has very low thermal conduction compared to the solid part, so it has insulation properties. Among the micropore products, heat treatment equipment insulation materials and gas filter support layer pores for semiconductors belong to this area.

## Product classification according to pore size

Product	Pore Image	Pore Size	Application	Reference
<ul style="list-style-type: none"> <li>· Nano catalyst</li> <li>· Separator film</li> </ul>		Nano Pore ( 2-30 nm )	<ul style="list-style-type: none"> <li>· Catalyst support</li> <li>· Secondary battery separator</li> </ul>	Catalog 12 p
<ul style="list-style-type: none"> <li>· Back-light vacuum chuck</li> <li>· Ceramic vacuum chuck</li> <li>· Non-contact transfer unit</li> </ul>		Micro Pore ( 7 – 15 μm )	<ul style="list-style-type: none"> <li>· Semiconductor/PCB Inspection Equipment</li> <li>· Laser processing equipment</li> <li>· OLED, glass transfer equipment</li> <li>· Semiconductor gas filter</li> </ul>	Catalog 4 - 6 p
<ul style="list-style-type: none"> <li>· Insulation for heat treatment equipment</li> <li>· Gas filter for semiconductor</li> <li>· Crucible for cathode material manufacturing</li> </ul>		Macro Pore ( 30 – 120 μm )	<ul style="list-style-type: none"> <li>· Display heat treatment equipment</li> <li>· NOX, SOX dust removal</li> <li>· Crucible for cathode material manufacturing</li> </ul>	Catalog 7 - 11 p

## Ceramic vacuum chuck

Ceramic vacuum chuck replaces the existing metal suction plate with ceramic pad of micropores. Compared to other products, it has a very high transmittance and uniform adhesion. In addition, it can be manufactured in a large area of 500 mm × 500 mm or more, and special vacuum chucks such as light-transmitting vacuum chucks and thermal shock vacuum chucks are also manufactured.

### Product Features

- Micropore's unique molding technology can produce large sizes of 500mm x 500 mm or more.
- Not only uniform adhesion across the entire surface, but also no partial distortion when attached.
- There is no generation of static electricity during the process by selecting materials with appropriate surface resistance values.
- In the case of white color, ceramic pads that are resistant to laser light and have high fracture toughness can be manufactured.

### Application

- Used in wafer, film and PCB auto-inspection
- Processing equipment such as polishing, printing, cleaning, etc.
- Protective film attachment and detachment equipment
- Laser patterning equipment



### Key Specs

Specifications		Value	Unit	Remark
Ceramic pad Properties	Bulk density	2.0	[g/cm <sup>3</sup> ]	Primary material : Alumina
	Bending strength	86	[MPa]	
	Surface resistance	10 <sup>6</sup> ~ 10 <sup>9</sup>	[Ω/sq]	
	Surface roughness	1 ~ 2	[μm]	Ra 기준
	Surface hardness	> 95	[HS]	
	Pore size	5 ~ 15	[μm]	
	Porosity	45 ~ 47	[%]	
	Color	Black, White	[-]	



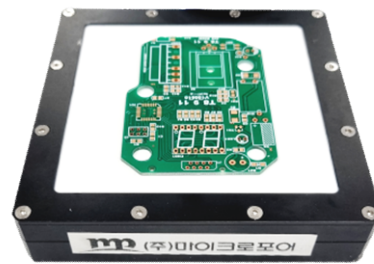
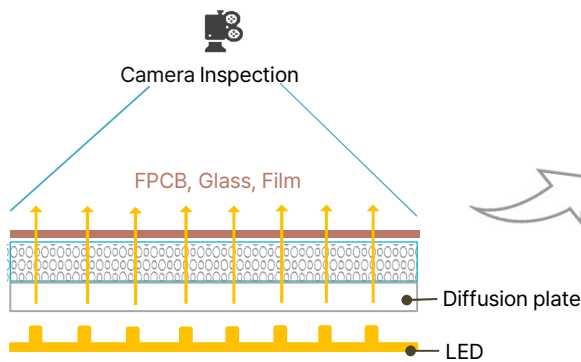
# Back light vacuum chuck

The backlight vacuum chuck is a new type of ceramic vacuum chuck. It was probably developed for the first time in the world. It is a backlight vacuum chuck with light transmission and fixing functions at the same time. It is a component module applied to transparent film, glass, PCB inspection alignment equipment.

## Product Features

- It has high light transmittance of 10% level.
- It has backlight diffusion effect and air permeability effect at the same time.
- Prevents scratches by adsorbents by managing surface roughness with special polishing.
- Not only can it be fixed by the total area, but it can also be fixed by the partial area.

## Product principle



[Backlight Vacuum Chuck for PCB Inspection]

## Application

- Wafer, glass, film and PCB via hole inspection equipment
- Edge inspection equipment through vision

## Key Specs

Specifications		Value	Unit	Remark
Light transmittance		> 10	[%]	3t
Ceramic pad Properties	Bulk density	1.5 ~ 2.0	[g/cm <sup>3</sup> ]	
	Bending strength	32	[MPa]	
	Surface roughness	< 3	[μm]	Ra 기준
	Pore size	7 ~ 15	[μm]	
	Porosity	40 ~ 50	[%]	
	Color	White	[-]	

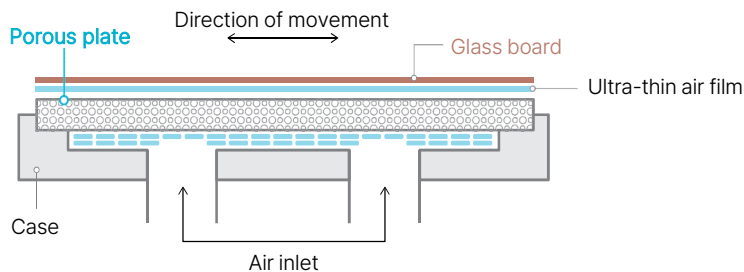
# Non-contact transfer unit

Air floating units using porous ceramics can be manufactured in materials and shapes to the purpose of use. In particular, by controlling the pore structure according to the weight of the object to be floated, the internal air pressure, flow rate, and floatation distance are adjusted. In addition, since it is based on sintered ceramic materials, it has a feature that it does not generate scattering fine particles compared to existing products by using carbon materials.

## Product Features

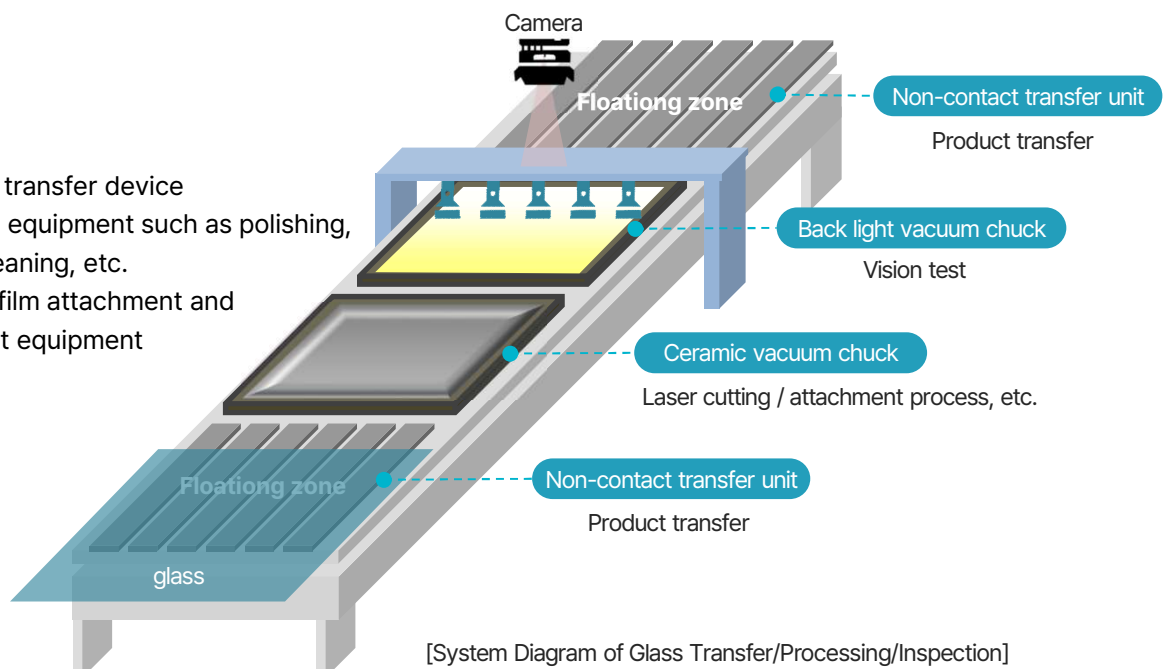
- Material and shape can be selected according to the purpose of use.
- Air floating device enables non-contact movement.
- This equipment can respond with Glass, film transfer – inspection equipment system.

## Product principle



## Application

- Wafer, film transfer device
- Processing equipment such as polishing, printing, cleaning, etc.
- Protective film attachment and detachment equipment



[System Diagram of Glass Transfer/Processing/Inspection]

## Ceramic Foam 3H<sub>x</sub>

3H<sub>x</sub> refers to porous ceramics based on ceramic foam developed only in Korea. 3H<sub>x</sub> is not only capable of various types of ceramics, but also has a uniform internal pore structure and high durability, so it is applied to various fields such as heat insulation materials for heat treatment equipment, gas filters for semiconductors, air-permeable crucibles for manufacturing anode materials, and catalyst carriers.

### 3HX product naming example

**3H<sub>s</sub>, 400k**

3H-Cellite

Bulk density

Main raw material

### Abbreviation of main ingredient

- S** Silica (SiO<sub>2</sub>)
- A** Alumina (Al<sub>2</sub>O<sub>3</sub>)
- C** Silicon Carbide (SiC)
- M** Mullite (3Al<sub>2</sub>O<sub>3</sub>·2SiO<sub>2</sub>)
- Z** Zirconia (ZrO<sub>2</sub>)

### 3H<sub>x</sub> Series

3H<sub>x</sub> products are manufactured using various inorganic materials such as silica, alumina, mullite, silicon carbide, and zirconia as raw materials. In addition, we manufacture products that meet customer needs by adjusting the pore structure such as porosity, pore size, and pore shape.

### Scope of Application of Ceramic Foam 3H<sub>x</sub> (X = S, A, M, C, Z)

Model	Chemical formula	Application	Max. applicable temp.	Bulk density❖	Porosity
3H <sub>S</sub>	SiO <sub>2</sub>	Ceramic insulation	1,200 °C	300k	90%
				400k	85%
				500k	80%
				600k	75%
				700k	70%
3H <sub>A</sub>	Al <sub>2</sub> O <sub>3</sub>	High temp. insulation, Ceramic vacuum chuck	1,800 °C	700k	85%
				800k	80%
				1,000k	75%
				1,300k	70%
3H <sub>M</sub>	3Al <sub>2</sub> O <sub>3</sub> ·2SiO <sub>2</sub>	Crucible, Sagger	1,600 °C	500k	85%
				600k	80%
				800k	75%
				1,000k	70%
3H <sub>C</sub>	SiC	Parts material for semiconductor	2,000 °C	500k	85%
				600k	80%
				800k	75%
				1,000k	70%
3H <sub>Z</sub>	ZrO <sub>2</sub>	Ultra high temp. insulation	2,200 °C	1,000k	85%
				1,100k	80%
				1,400k	75%

❖ 400k refers to 0.4 g/cm<sup>3</sup>, 500k refers to 0.5 g/cm<sup>3</sup>. (100k = 0.1 g/cm<sup>3</sup>)

# Insulation for heat treatment equipment

## 3H<sub>S</sub> / 3H<sub>A</sub>

The porosity of ceramic foam insulation is up to 90%, and in the case of 3H<sub>S</sub>, the thermal conductivity is 0.06~0.17 W/mK in the range of 200°C~800°C, showing high insulation effect. In particular, it can be used in precision material production processes because it does not generate particles.

### Product Features

- 3H<sub>S</sub> insulation material can be manufactured according to the pore structure desired by the customer.
- Classified into 3H<sub>S,200k</sub> / 3H<sub>S,400k</sub> / 3H<sub>S,600k</sub> / 3H<sub>S,800k</sub> product groups according to the density of the insulation (1,000k = 1 g/cm<sup>3</sup>)
- The higher the porosity of the product, the smaller the solid part, which is the heat medium, and the better the insulation effect.
- 3H<sub>A</sub> is being manufactured as a high-temperature ceramic foam product group.

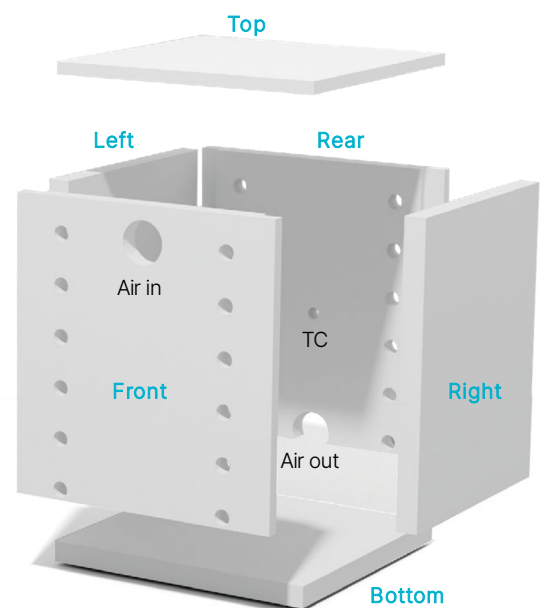
### Application

- Display panel heat treatment equipment
- Semiconductor heat treatment equipment
- High temperature vacuum furnace

### 3H<sub>S</sub> Features

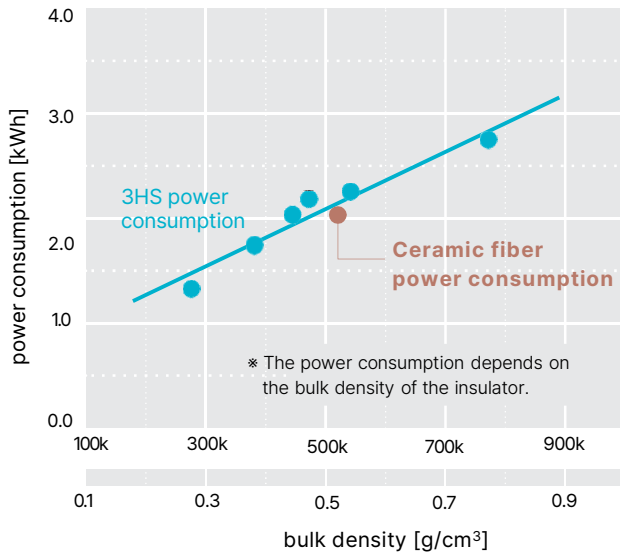
Total porosity	35 ~ 90 %
Bulk density <sup>①</sup>	200k ~ 800k
Pore shape	Spherical
Pore size	30 ~ 70 μm
Bending strength <sup>②</sup>	12 Mpa
Shore hardness (D) <sup>②</sup>	75
Thermal conductivity (400°C) <sup>②</sup>	0.13 W/mK
Thermal expansion (200°C~600°C) <sup>②</sup>	2.5 μm/m·°C

① 1,000k = 1.0 g/cm<sup>3</sup>    ② 3H<sub>S,400k</sub> criterion



[Test Furnace Insulation Composition]

## Insulation properties



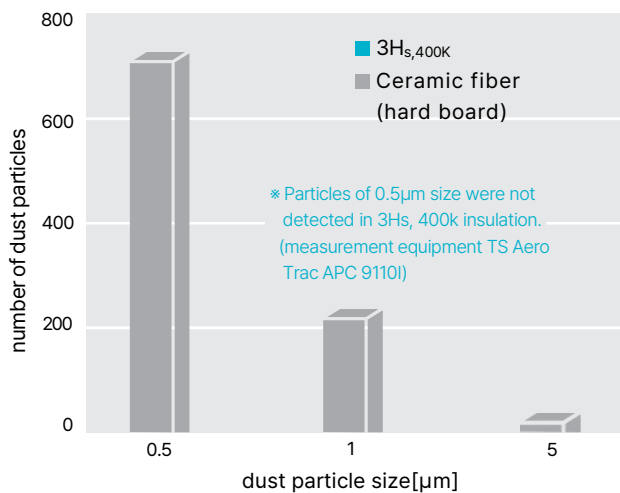
## Comparison with other insulation materials

Division	Ceramic Foam 3HS	Glass Ceramic N11	Ceramic Fiber
Insulation properties <sup>①</sup>	◎	×	◎
Dust generation <sup>②</sup>	◎	◎	×
Bending strength	○	◎	○
Machinability <sup>③</sup>	◎	×	○
Surface roughness <sup>④</sup>	○	◎	×
Surface hardness	○	◎	○

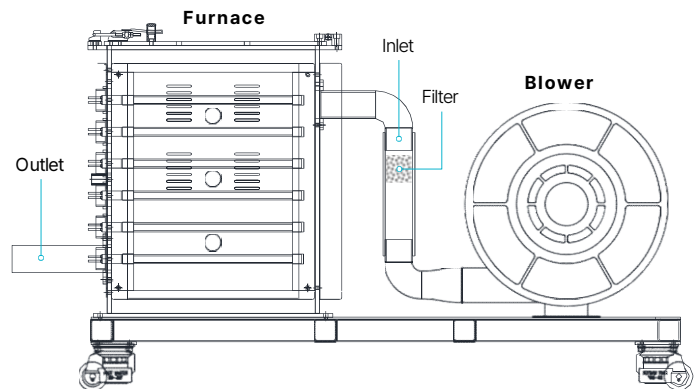
- ① Refer to the power consumption comparison graph  
 ② Refer to the dust generation comparison graph  
 ③ Degree of shape processing ④ Smoothness of the surface

## Amount of dust

[Comparison of dust generation with ceramic fiber]



[Electric power/dust generation measuring device]



- Detect the number of particles of inlet gas and outlet gas and measure the amount of dust generated by the insulation from the difference.
- H12 filter is used at the front of the inlet gas. (blocks over 99.5% of particles over 0.5μm)



## Gas filters for semiconductors 3H<sub>A</sub>

Our ceramic gas filter not only has excellent back washing ability compared to existing fibrous or particulate filters, but also has excellent fluid permeability characteristics. 99.9% high-purity alumina is used as raw material, and chemical resistance and durability are excellent because it undergoes a high-temperature firing process of 1,630 °C or higher. It can be manufactured in various shapes such as discs and tubes.

### Product Feature

- High purity alumina ( $\text{Al}_2\text{O}_3$  99.9%)
- Permeability
  - Support layer  $900\sim1,000\times10^{-3} \text{ m}^2$
  - Surface filtration membrane  $200\times10^{-13} \text{ m}^2$

### Application

- Gas filter for semiconductor
- Fine dust filter
- Filter for removing NOX/SOX





# Permeable crucible for anode materials 3H<sub>M</sub>

This is a permeable crucible made of Mullite Ceramic Foam. Due to the lightness of ceramic foam, it is resistant to thermal shock, can be used in high temperature conditions, and has excellent permeability and corrosion resistance.

## Product Feature

- It is made of raw materials with low reactivity and has excellent anti-corrosion properties.
- Possible to process reactants inside the container due to high air permeability.
- By reducing the weight load during stacking, a large amount of work can be processed at one time.
- It can be used in high temperature conditions by using materials that are resistant to thermal shock.

## Application

- Saggars/crucibles for secondary battery
- Lightweight permeable saggars/crucibles



## Catalyst support 3H<sub>A</sub>

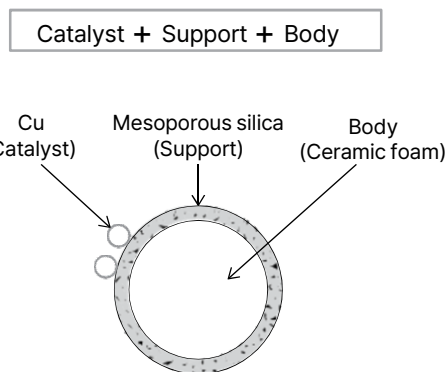
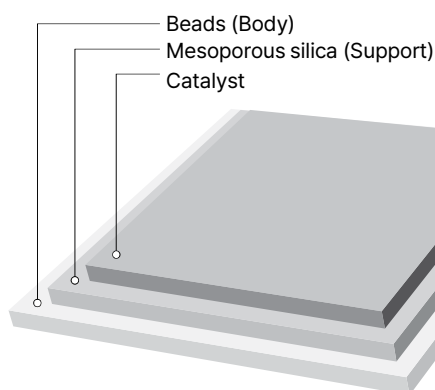
A ceramic foam support (primary catalyst carrier) with pores of several tens of  $\mu\text{m}$  is surface treated with mesoporous silica (secondary catalyst carrier) with pores of several nanometer. Therefore, it has a very high specific surface area and can support several nanometer nanocatalysts.

### Product Features

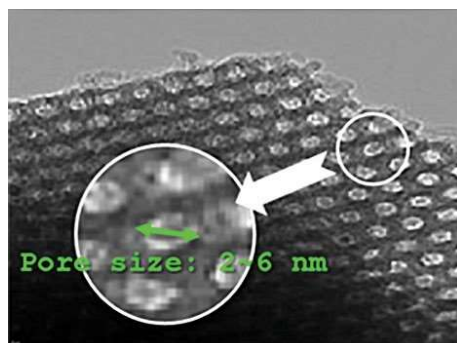
- Bead-type catalyst carrier with high porosity manufactured by proprietary molding technology.
- 2 ~ 6 nm mesoporous silica catalyst carrier.
- Specific surface area: 400 to 800  $\text{m}^2/\text{g}$  (Nitrogen gas adsorption method applied)

### Application

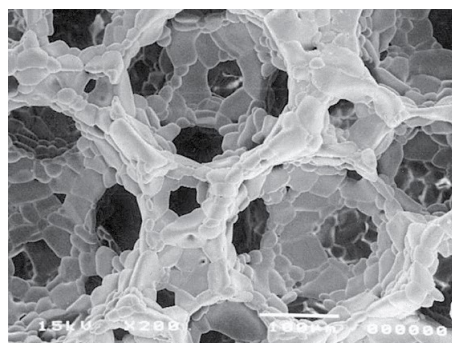
- Silver nano, photocatalyst  $\text{TiO}_2$  catalyst carrier (air purification, drinking water treatment)
- Catalyst carrier (chemical, energy)
- Biofilter (wastewater, waste)



[Schematic diagram of mesoporous catalyst support]



[ Support-Mesoporous silica ]

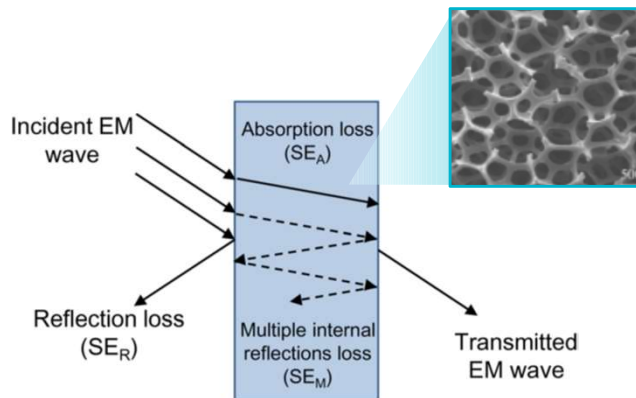


[ Body-Ceramic foam ]

## Research & Development Center

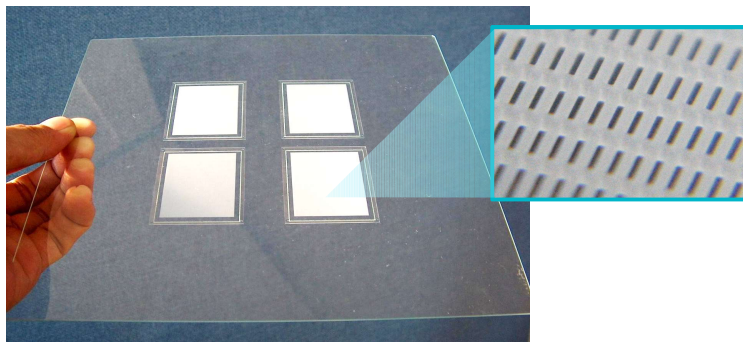
### | Potential Technology for Micropore., Ltd.

- Development of electromagnetic shielding materials using porous ceramic



[ Electromagnetic shielding material mechanism ]

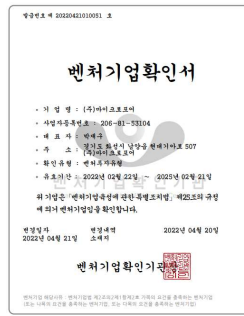
- Negative photosensitive glass material synthesis and application technology  
: Etching technology using photosensitive glass



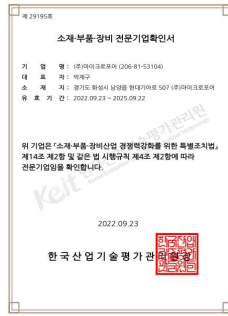
[Glass + laminate (line width 30 μm shadow mask)]

- Development of porous package substrate of low loss- high frequency for 6G communication
- Development of sagger for synthesizing cathode active material of secondary cell
- Recovery of precious metal from waste-lithium ion battery

## CERTIFICATE



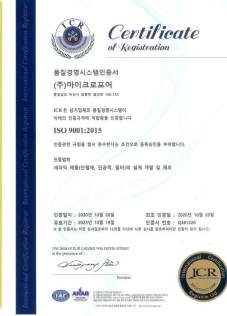
Venture company confirmation



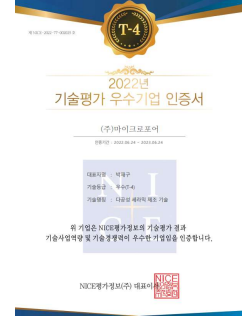
Material parts equipment specialized company confirmation



Company affiliated research institute certificate



ISO9001 Certificate



Excellent technology evaluation company certificate

## Patent

- Manufacturing method of ceramic foam [10-2400768]
- Ceramic foam and its manufacturing method [10-2255668]
- Ceramic foam [10-2456933]
- Manufacturing method of porous ceramic pellets using double emulsion method [10-0005380]
- Manufacturing method of porous ceramic filter media for dust collection [10-0005381]
- Optical inspection device [10-2022-0065633]
- Dust-free insulation and its manufacturing method [10-2021-0120334]

## Research Paper

Control of pore size in ceramic foams: influence of surfactant concentration.  
2009, Materials Chemistry and Physics, 113(1), 441-444.

Preparation of sizable and uniform-sized spherical ceramic foams: drop-in-oil and agar gelation.  
2011, Journal of the American Ceramic Society, 94(9), 2742-2745.

Fabrication and characterization of macroporous flyash ceramic pellets.  
2011, Materials characterization, 62(9), 817-824.

Millimeter-sized spherical ion-sieve foams with hierarchical pore structure for recovery of lithium from seawater.  
2012, Chemical engineering journal, 210, 482-489.





## Equipments

Micropore Co., Ltd. handles the entire ceramic product process, from molding, drying, sintering, and machining, on its own. By the entire process within its own facilities and minimizing outsourcing services, it is possible to reduce production costs, manage quality, and respond quickly to customer needs.

### List of major facilities

- Molding room : dispersing/mixing device, foaming device, etc.
- Constant temperature and humidity room: 3 rooms of 100 m<sup>2</sup>
- Sintering room : 1,400°C SiC furnace (2 units of 3m<sup>3</sup>, 2 units of 2m<sup>3</sup>), 1,600°C high-temperature furnace (1 unit of 1m<sup>3</sup>, 1 unit of 0.3m<sup>3</sup>)
- Machining room : flat grinding machines, CNC processing machine



mixing disperser



Various molding equipment



medium/high temp. electric furnace

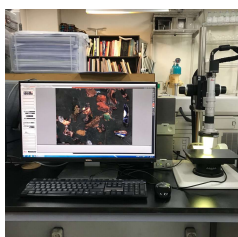


CNC surface grinding machine, MCT



Image analysis device, flatness measuring device

We use various equipment such as particle size analyzer, density analyzer, specific surface area analyzer, thermogravimetric analyzer, strength tester, and image analysis device to evaluate ceramic materials.



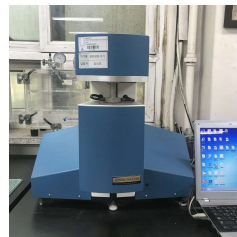
(a) electron microscope



(b) particle size analyzer



(c) Specific surface area measuring instrument



(d) thermogravimetric analyzer



(e) density analyzer

Micropore Co., Ltd. is a technology-specialized venture company established to realize the localization of parts and materials that are the basis of the 4th industrial revolution. Based on the manufacturing technology of porous materials developed in university laboratories for the past 20 years, We manufacture ceramic vacuum chucks, backlight vacuum chucks, non-contact transfer units, semiconductor/display heat treatment equipment insulation materials, gas filters for semiconductors, permeable saggars and catalyst carriers, etc.

**As a mecca of the domestic ceramic parts and materials industry, we intend to realize the dream of becoming The Engine of Korea for innovative growth.**



**(주)마이크로포어**

📍 507 Hyundai Kia-ro, Namyang-eup, Hwaseong-si, Gyeonggi-do

☎ 031-357-9656

☎ 031-357-9657

✉ [sales@micropore.co.kr](mailto:sales@micropore.co.kr)

🏠 [www.micropore.co.kr](http://www.micropore.co.kr)