

Macroporous Silicon FactSheet

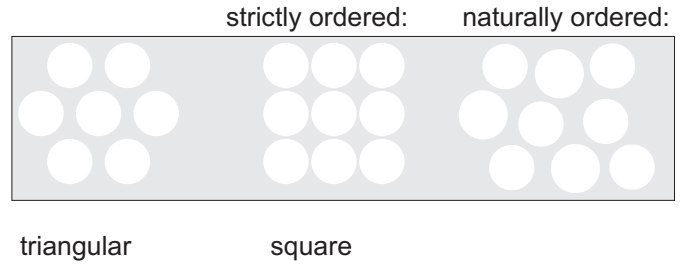
(ultra high aspect ratio porous silicon)

Macroporous silicon can be processed on n-type and p-type doped silicon. Superior to nanoporous and mesoporous silicon, macroporous silicon pores can be etched with a perfectly periodic arrangement which results in a narrow pore size distribution at a fixed pore distance and position.

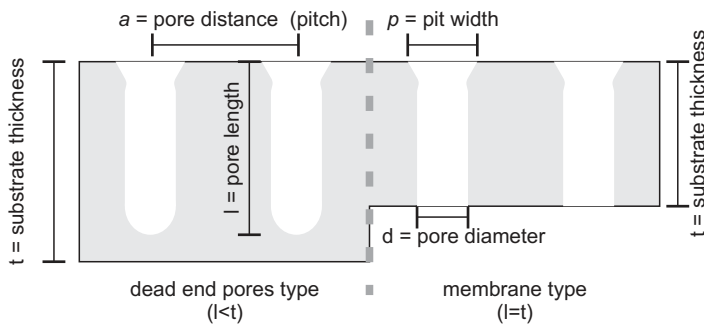
pore geometries

The planar pore geometry can be predefined so that periodic arrangements as well as more complex structures including trenches and cavities can be formed.

Without prestructuring, the pore arrangement is driven by self organization. Due to the fixed pore distance, the size and distance distribution is more precise for the predefined structures.



standard parameters



Our standard lithographies utilize $p = 0.5 a$.

A funnel shaped pore entrance followed by a small bottleneck (length in the range of the pore diameter) will be formed on top of the pore structures.

Two types of structures are available: „Dead end type“ pores inside bulk silicon substrate and „membrane type“

upon request available

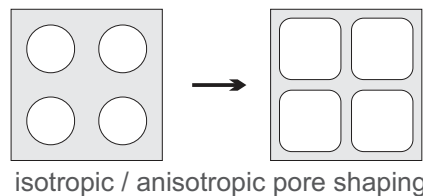
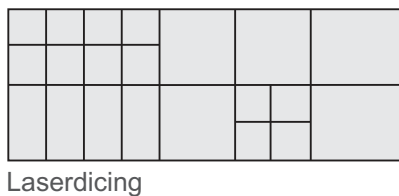


Custom pore profiles (tapered, modulated or arbitrary shaped pore diameter / profiles along the pore length), removal of the bottleneck

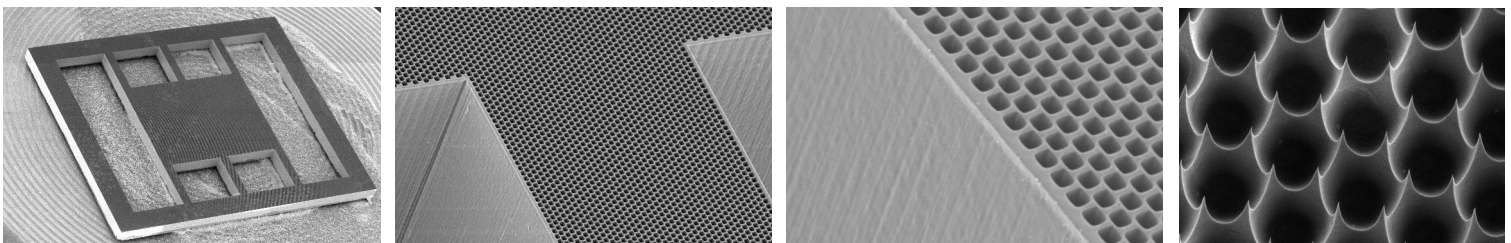
- Custom pore distances (areas with different pore distances / diameters on a single chip are possible)
- Custom pore arrangement (honeycomb structures, individual functional designs...)

... we would be pleased to discuss possible solutions for your individual requirements!

postprocessing



Different optional post processing steps available: substrate lift-off for the generation of both side opened membranes, anisotropic pore shaping, laser dicing.



Macroporous Silicon FactSheet

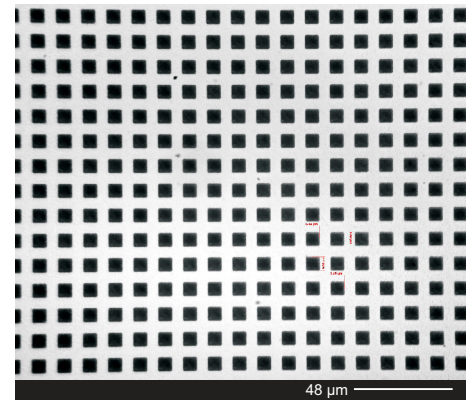
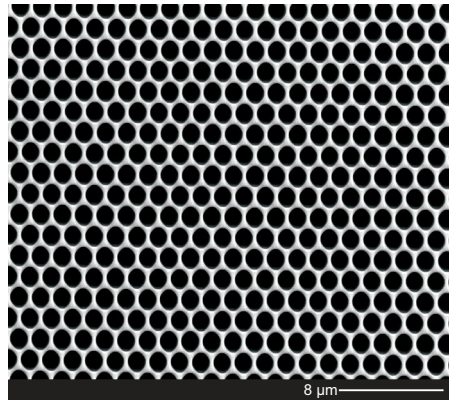
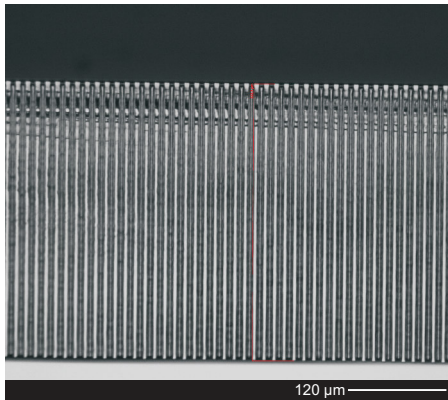
<http://www.silicon-membranes.com/>

macroporous silicon technical data

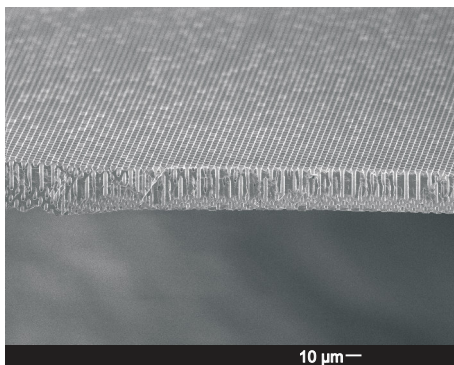
Pore geometry:	trigonal, square, honeycomb - custom defined lithography including trenches, rims, cavities etc.		
Pore distance (a):	standard stock material: a = 1.5 μm , 4.2 μm trigonal lattice, a = 12 μm square lattice		
Pore diameter (d):	0.8 - 10 μm		
Porosity (ρ):	20 - 60 %		
Pore length (l):	1 - 500 μm (depending on substrate thickness)		
Chipsize:	Up to 6" diameter. Custom sizes/shapes via laserdicing. Small scale custom process development possible		

standard stock material - details

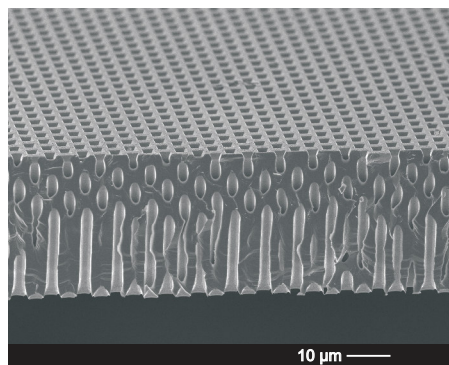
Interpore distance	1.5 μm	4.2 μm	12 μm
Pore diameter (standard)	0.8 - 1 μm for 50 μm , 1 μm for 200 μm	2.0 μm for 30 μm , 2-2.5 μm for 200 μm	4.5 - 5 μm
Standard widening	-	-	8, 10 μm
Available widening	up to 1.2 μm	up to 3.5 μm	up to 10 μm
Pore arrangement	hexagonal	hexagonal	cubic
Porosity	40-60%	20-60%	20-50%
Membrane thickness, standard	50, 200 μm	30, 200 μm	15, 350, 475 μm
Membrane thickness, acceptable	25 μm - 200 μm	25 μm - 500 μm	-
Membrane size	up to 6" wafer with dia.130 mm valid region	up to 6" wafer with dia.130 mm valid region	up to 6" wafer with dia.130 mm valid region
	standard tolerances of $\pm 10\%$	standard tolerances of $\pm 10\%$	standard tolerances of $\pm 10\%$



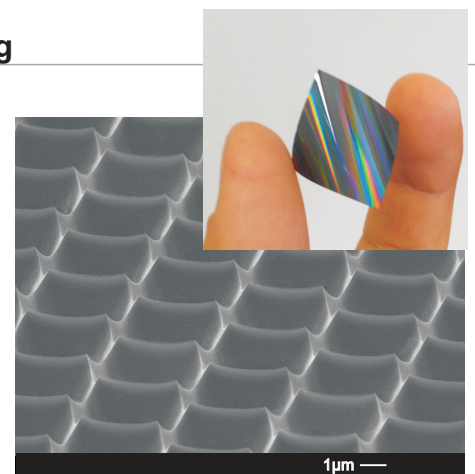
thin free standing membranes by direct lift off during pore etching



front side (shiny)



10 μm



lifted backside (dark)

Lifted backsides are sensitive to mechanical handling. Abrasion of silicon nanotips is visible as brown "scratches" on the surface but have minor effect on the underlying pores.

We suggest using vacuum tweezers on the front side or polymer tweezers on the side faces.