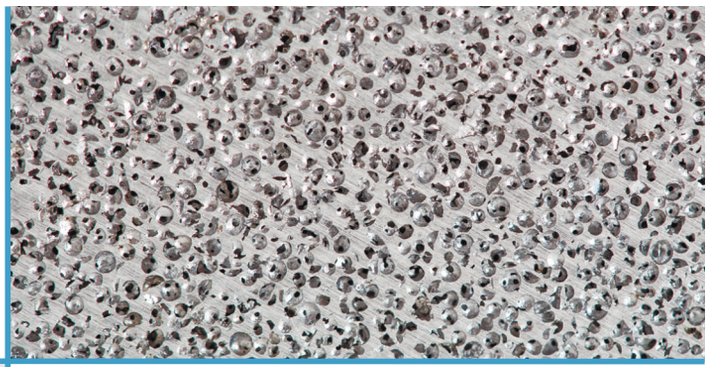
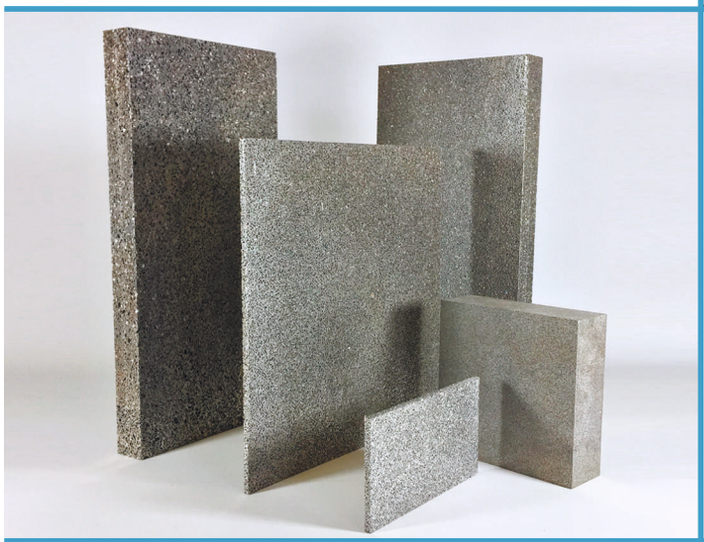
EXXENTIS
POROUS ALUMINUM





open-pore metal foam

unique properties combination for different applications

permeable material with controllable pore sizes

an option for sintered metals

product design according to your requirements

prototypes and small batches to attractive prices

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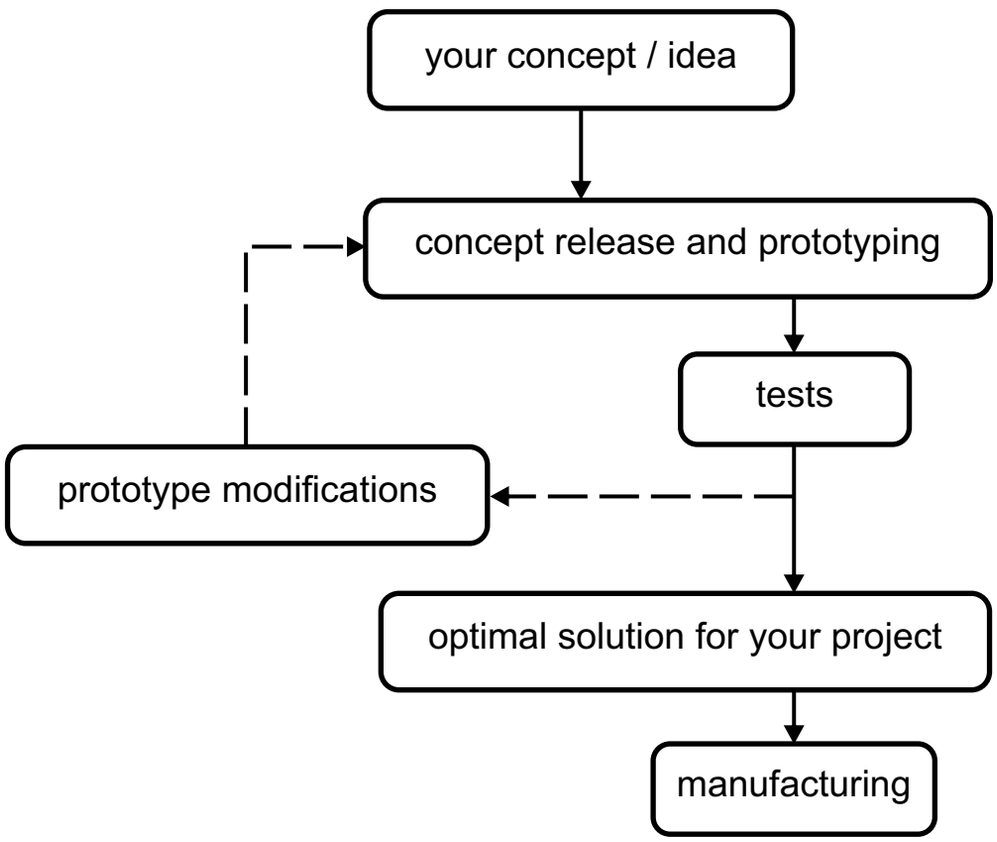
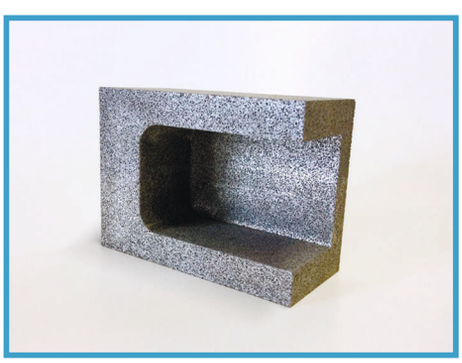
About us

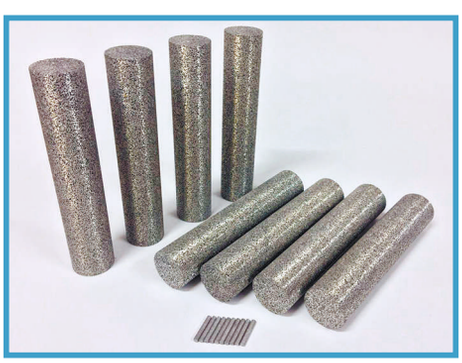
EXXENTIS Ltd was founded in 2011. Based in Switzerland near Zurich EXXENTIS operates successfully in Europe as a manufacturer of porous aluminum and works with clients from various industries. Our products made of porous aluminum are produced in our own production facility to the highest quality standards.

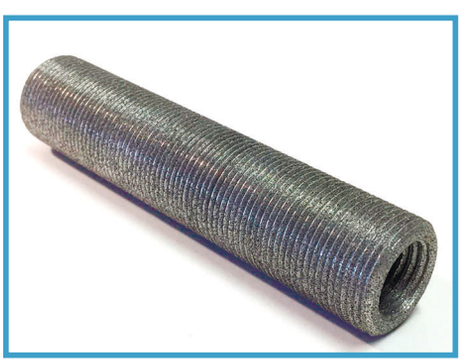
We offer you individual technical advice for every new task. In an active, ongoing dialogue we find the optimal solution for your requirements. When necessary, our experienced and competent team of engineers develops tailor-made solutions and individual parts.

Our core competencies are the development and production of tailor-made, optimal product solutions for complex and unusual tasks in various industrial applications. Our technology makes it possible to produce individual prototypes for testing your ideas - quickly and at attractive prices.









Insight into our production

In the production of high-tech material porous aluminum several factors play the decisive role: innovative thinking and years of experience, high-quality starting and raw materials, advanced and modern production facilities as well as professionalism in every working step. We have combined all these factors under one roof.

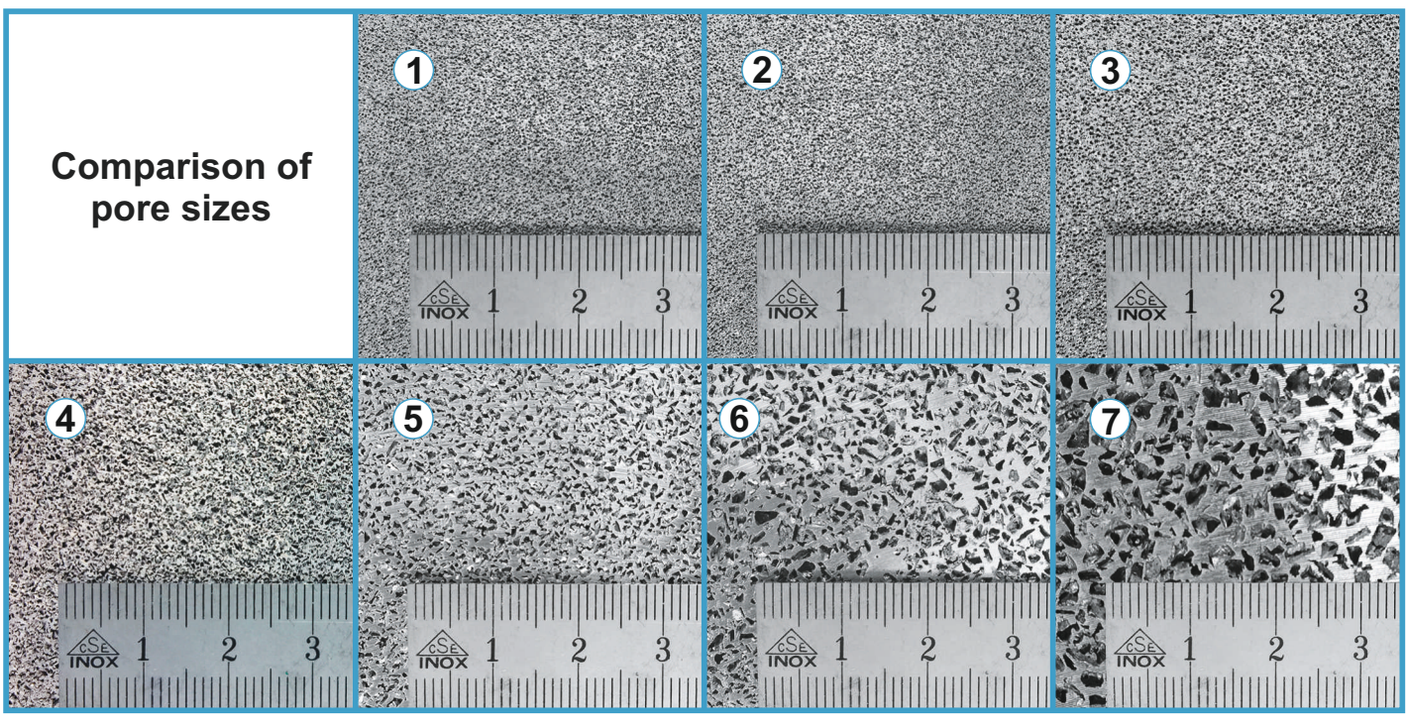
For the manufacturing of our products we have an in-house developed and innovatively equipped production line at the cutting edge of technology. We are only satisfied if our customers are. That's why we do everything we can to ensure the high quality of our products. Among other things to this contribute also the flexibility and individual performance of each our employee. Our team consists of creative thinking, competent professionals who are highly educated, self-dependent and flexible. Constant improvements, efficiency increase and innovations in all processes are the integral part of our corporate philosophy. Our technical sales department communicates directly with the production management. All these allow the rational production of prototypes, single parts and small batches up to large series.

Manufacturing technology

Porous aluminum is a porous material that is permeable over the entire surface. Production technology of porous aluminum differs from production technologies of other porous metals.

Manufacturing of porous aluminum

– Aluminum casting with crystal salt
  Liquid aluminium together with crystal salt will be cast in a conventional casting mould. To obtain products with different pore sizes we use salt crystals of different particle sizes.



– Mechanical treatment
  By mechanical finishing we get products of any shape and complexity according to your request.

– Salt washing out
  The salt will be washed out after the mechanical finishing, thus all the pores are of open structure and the product is permeable over the entire volume.

For the manufacturing of porous aluminium we do not use any cost-intensive pressing moulds as sinter technology needs, but conventional casting moulds. Our products made of porous aluminium have – thanks to innovative and relative simple manufacturing technology – an excellent quality-price ratio.

As a manufacturer of porous aluminum products, we have the necessary knowledge to be able to reduce the mechanical processing and thus to optimize the production costs. This is feasible with the help of certain mold inserts. For series production we develop molds with certain dimensions and special construction. These measures have a direct influence on the final price of the product.

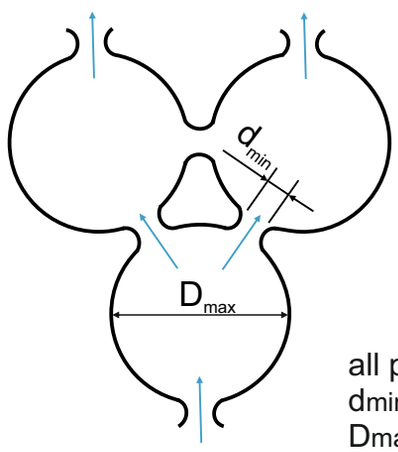
We give you the necessary technical advice, which combines your product requirements and our manufacturing possibilities in order to be able to offer you the best possible solution for your task.

Properties

Structure of porous aluminum

In our production process for porous aluminum the liquid aluminum is casted together with crystal salt and after the mechanical treatment the salt is washed out. The salt grains and their contact points are thus replaced by pores.

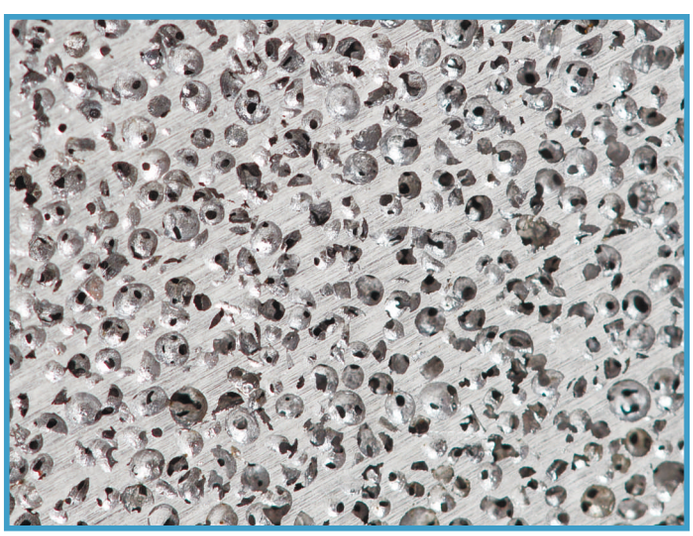
Therefore, there are two types of pores:
Dmax – emptiness instead of salt particles,
dmin – channels between the Dmax pores.
Depending on the application, one or the other type of pores plays the decisive role.

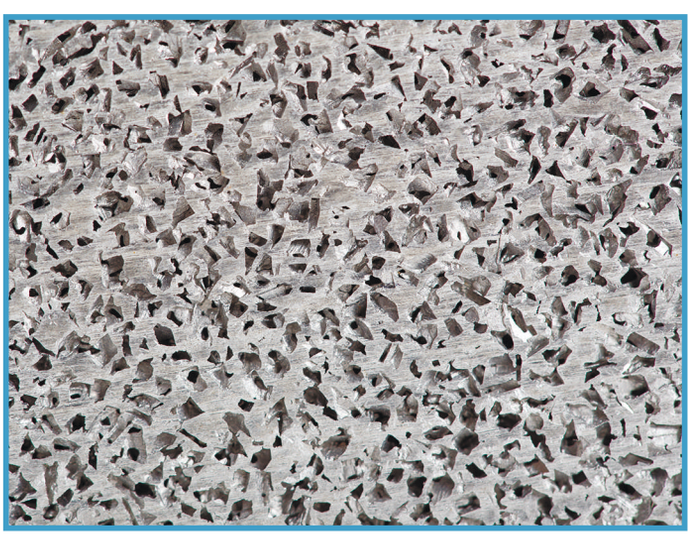


all pores are open
dmin = filter grade
Dmax = pore size

Shape and size of the pores

Two types of salt granules are used for the production of porous aluminum, either spherical salt or break salt:

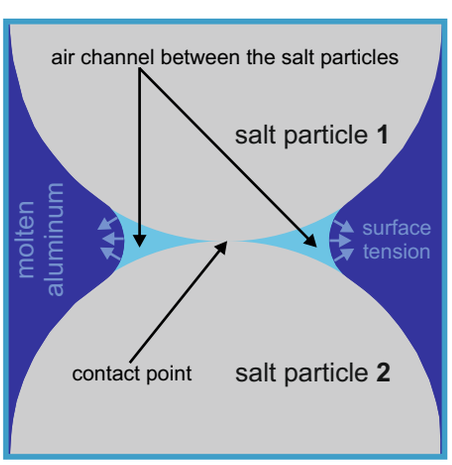




Connection between the pores

In the production of porous aluminum, each salt particle has many contact points with other salt particles. The surface tension prevents molten aluminum to get between two salt particles.

Therefore, all salt particles and then all the pores are connected to each other. All pores are open, so porous aluminum is permeable throughout the whole volume and in all directions.



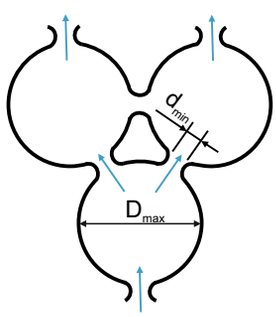
Material properties

	parameter	Nr. 1	Nr. 2	Nr. 3	Nr. 4	Nr. 5	Nr. 6	Nr. 7
1	pore size mm	0,2-0,35	0,3-0,5	0,4-0,63	0,4-1,0	0,63-1,6	0,63-3,0	0,63-4,0
2	filter degree µm	40-50	50-60	70-90	150-200	300-400	500-600	600-700
3	volume porosity %	60±5						
4	surface m^2/m^3	20'000	10'000	6'500	4'000	3'000	2'500	2'200
5	compressive strength N/mm^2	39	35	28	24	21	20	19
6	tensile strength N/mm^2	26,0	21,0	16,4	15,3	8,3	7,6	7,2
7	density g/cm^3	1,1±0,1						
8	working temperature °C	von -200 bis +250…550						
9	melting point °C	+600						
10	hardness HB	67-71						
11	thermal conductivity W/(m*K)	30-50						
12	aluminum alloy	AlSi7Mg						
13	cleaning, maintenance	Backwashing, ultrasonic, mechanical and chemical cleaning						
14	coefficient K* 10^{-12} m^2 ≥	7	8,5	31	75	145	225	260

* - You can use the permiability coefficient K (from the table above) to calculate the flow rate, please apply the Darcy law:

$$Q = \frac{K*\Delta P*S}{\mu*H}$$

Q – flow rate m^3/sec
ΔP – pressure difference on the filter Pa
S – filter surface m^2
µ – dynamic viscosity Pa*sec
H – filter thickness m



pore structure:
all pores are open
dmin = filter degree
Dmax = pore size

alloys

AlSi7Mg (EN AC-42000) – standard
composition %

Fe	Si	Mn	Al	Cu	Pb	Be	Mg	Zn	residues
max 1,5	6-8	max 0,5	89,6-93,8	max 0,2	max 0,05	max 0,1	0,2-0,4	max 0,3	max 2

ENAW-1085 – option
composition %

Fe	Si	Mn	Al	Cu	Ti	Mg	Zn	Ga	residues
max 0,08	max 0,06	max 0,02	min 99,85	max 0,01	max 0,008	max 0,02	max 0,02	max 0,03	jeder 0,02

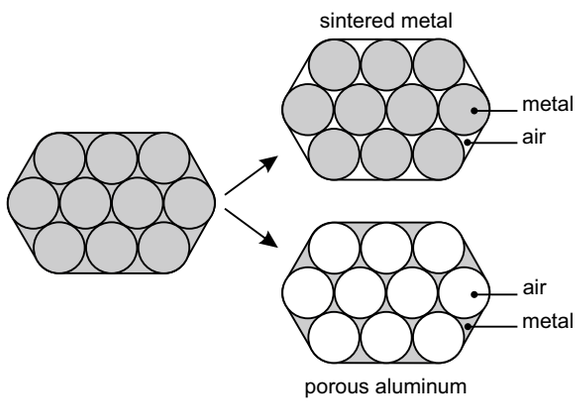
Porous aluminum compared to sintered metal and metal foam

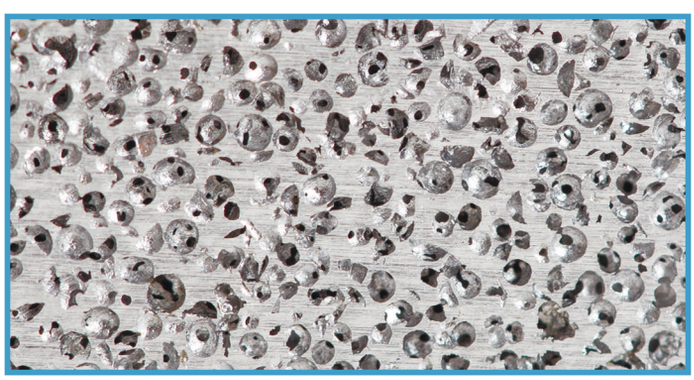
Porous aluminum vs. sintered metal

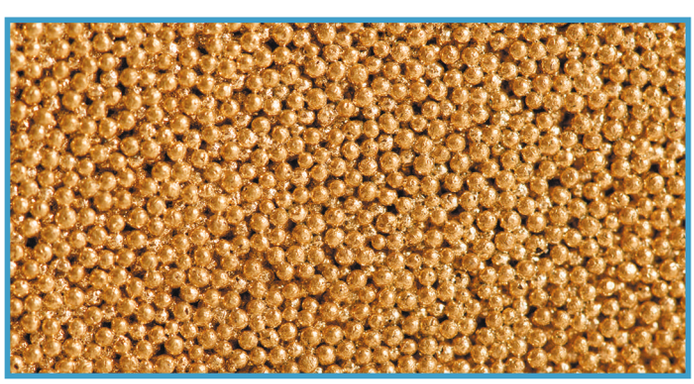
Porous aluminum and sintered metal are both open-celled and therefore permeable, but the manufacturing technologies and thus the structure of the materials are different.

The structure of porous aluminum and the structure of well-known sintered metals are complementary. The pores in the sintered metal correspond to the metal in the porous aluminum and vice versa.

Theoretically, the minimum porosity of the sintered metals is 26% and the maximum porosity of the porous aluminum is 74%. Practically, porous aluminum has 60 ± 5% pores due to the imperfect stacking of the salt particles.







In the production of porous aluminum, liquid aluminum is casted together with crystal salt. After cooling and mechanical treatment, the salt is washed out. The pores appear instead of the salt grains and their contact points.

By sintered metals the metal granules are baked together. The voids between the granules become pores in this case. So it's the other way around. In porous aluminum the pores are formed in place of the salt grains and the voids in the granular salt are filled with metal.

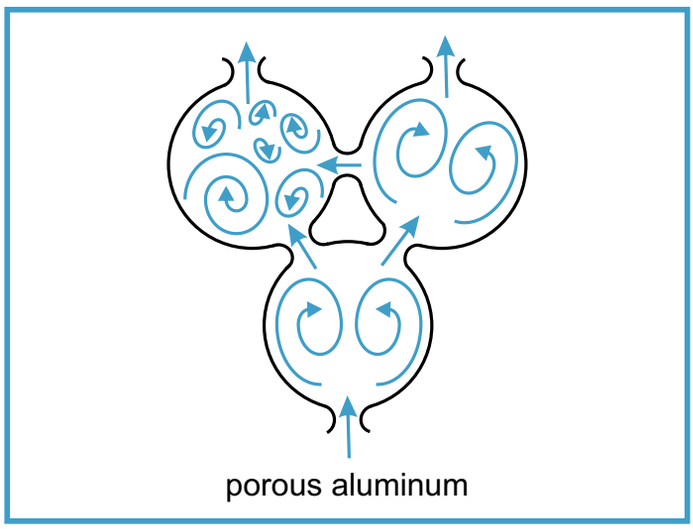
The particular structure of the pores in porous aluminum results in a different flow of liquid or gas than in the pores of the sintered metal. Such flow increases the efficiency of the use of porous aluminum in such applications as heat exchange, filtration and silencing.

Advantages of the pore structure

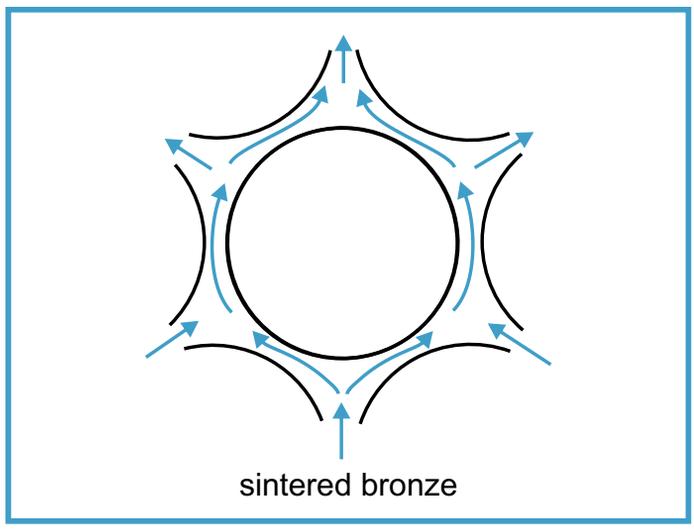
1. Large contact surface between gas and porous aluminum matrix

	Nr. 1	Nr. 2	Nr. 3	Nr. 4	Nr. 5	Nr. 6	Nr. 7
pore size mm	0,2 - 0,35	0,3 - 0,5	0,4 - 0,63	0,4 - 1,0	0,63 - 1,6	0,63 - 3,0	0,63 - 4,0
surface m^2/m^3	ca. 20'000	ca. 10'000	ca. 6'500	ca. 4'000	ca. 3'000	ca. 2'500	ca. 2'200

2. Long contact time of the gas and the matrix of porous aluminum. Gas flows follow complex routes with turbulences.



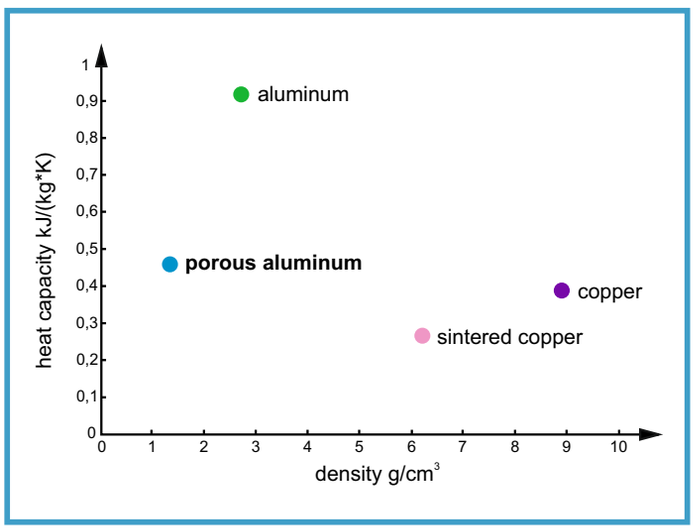
porous aluminum



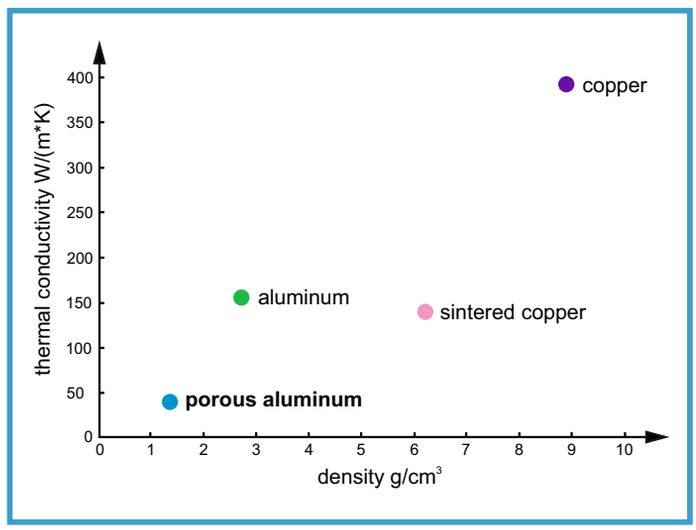
sintered bronze

Comparison table of some properties:

	porous aluminum	sintered metal
volume porosity %	55 - 65	30 - 35
density g/cm^3	1,0 - 1,2	5,0 - 6,3
fragility	not fragile	fragile
up to large dimensions	possible	not possible
in every form	möglich	not possible
controllable pore size	easy	difficult
prototyping	simple, not expensive	difficult, expensive
machining	possible	not possible



heat capacity: (porous) aluminum and (sintered) copper



thermal conductivity: (porous) aluminum and (sintered) copper

Porous aluminum vs. metal foam

Open-cell metal foam and porous aluminum are both permeable to gaseous and liquid media, but differ in their manufacturing technology and properties.

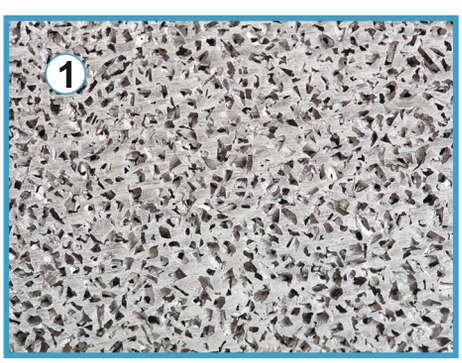
Thanks to their high breaking strength and low weight, foamed metals are becoming increasingly important as industrially relevant materials. Especially as lightweight components in vehicle construction but also in heat engineering, thanks to the large internal surface and the good thermal conductivity.

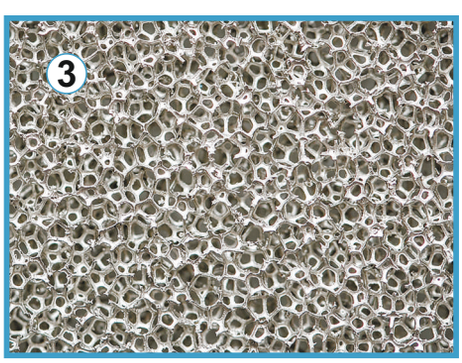
Metal foams are usually made of aluminum or aluminum alloys, although it is possible to foam up copper, zinc or even lead.

Closed-cell metal foam manufacturing technology: metal powder or metal chips are mixed with titanium hydride or other blowing agents and heated above the melting point of the metal. This releases gaseous hydrogen, which foams the mixture.

Difficulties in the production of metal foams are mainly to find the right combination of metal and the blowing agent and to heat them to the correct temperature in the right period of time. The desired result arises only if all factors fit together. The control of the pore shares, pore size and the distribution of the pores in the volume is almost impossible.

For these reasons, porous cast aluminum with its manufacturing technology is a valuable alternative for metal foams. The wide range of precisely defined pore sizes from 0.2 mm to 4.0 mm makes it possible to produce the optimum porosity for the desired application.



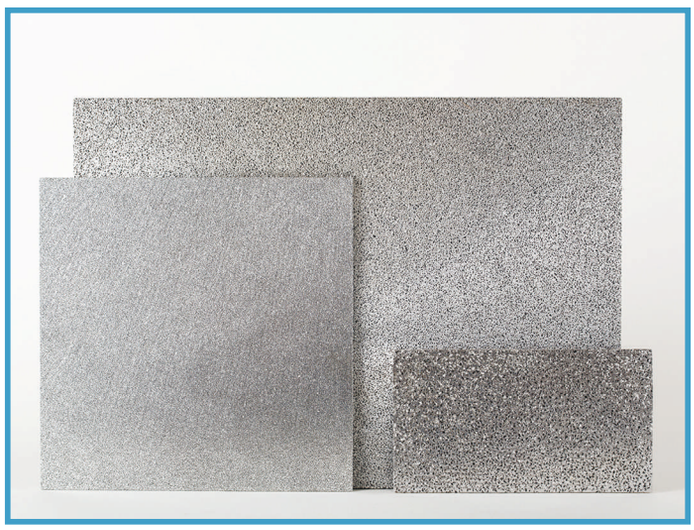


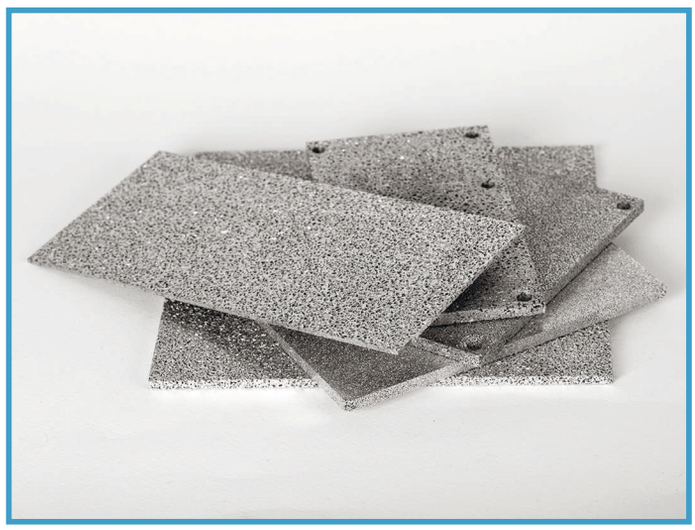
	porous aluminum (1)	**closed-cell metal foam (2)**	**open cell metal foam (3)**
permeable	+	-	+
volume porosity %	55 - 65	80 - 90	85 - 95
density g/cm^3	1,0 - 1,2	0,3 - 0,5	0,14 - 0,4
fragility	not fragile	fragile	+ / -
up to large dimensions	possible	possible	possible
in every form	possible	not possible	not possible
controllable pore size	easy	difficult	+ / -
prototyping	simple, not expensive	difficult, expensive	difficult, expensive
mechanical machining	possible	possible	+ / -

Shapes and sizes

We supply plates, blocks, cylinders and forms according to customer requirements, even with complex geometries. Each product is developed individually in close cooperation with the customer. This allows us to offer you the optimal solution for your project.

Plates



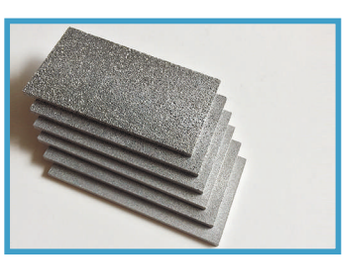


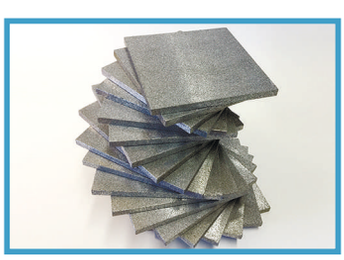
Plates max. dimensions
(wall thickness tolerance ± 0,1 mm)

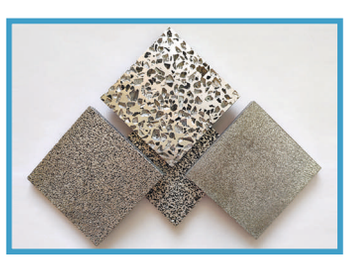
Wall thickness mm	Squaret AxA mm	Rectangle AxB mm
1	20x20	20x15
2	30x30	30x25
3	40x40	40x35
4	100x100	170x100
5	120x120	170x120
6	150x150	200x150
7	160x160	300x160
8	160x160	400x160
9	160x160	400x160
10	160x160	400x160
15	160x160	400x160
20	160x160	400x160

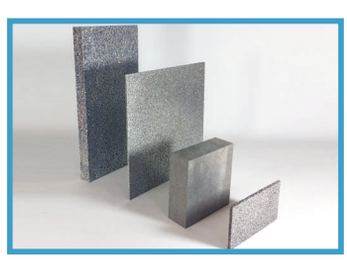
Plates max. dimensions
(wall thickness tolerance ± 0,3 mm)

Wall thickness mm	Square AxA mm	Rectangle AxB mm
1	20x20	20x15
2	30x30	30x25
3	40x40	40x35
4	100x100	170x100
5	120x120	200x120
6	400x400	500x300
7	400x400	500x300
8	400x400	550x320
9	400x400	600x400
10	400x400	600x400
15	400x400	600x400
20	400x400	600x400

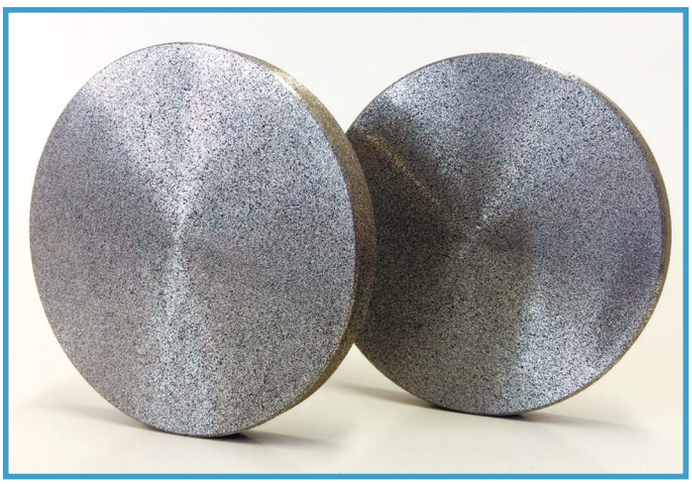


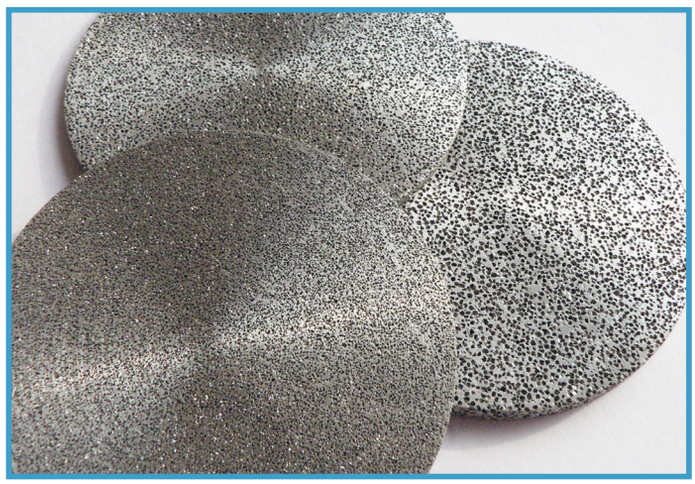






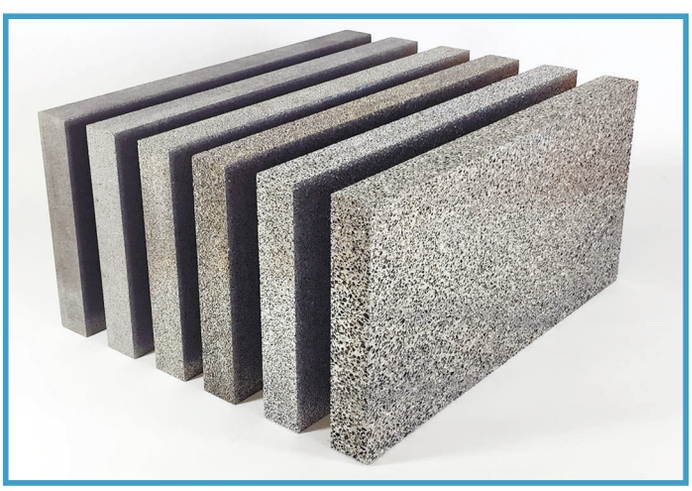
Discs

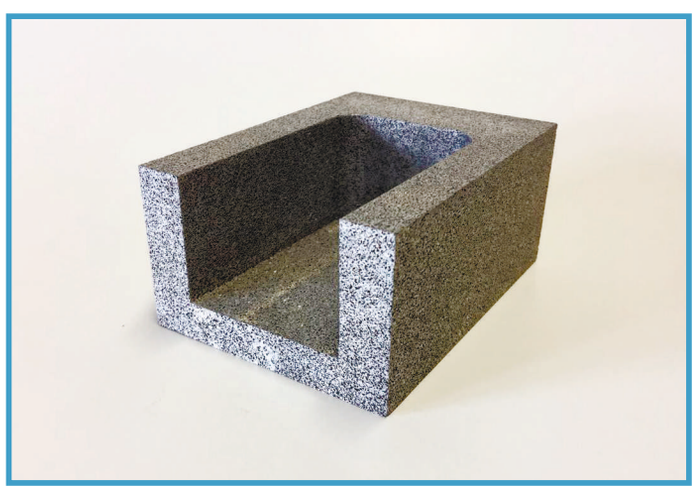




Maximum dimensions (wall thickness tolerance ± 0,1 mm)					
Wall thickness mm	1	2	3	4	5 ... 20
Diameter mm	20	30	40	100	120
Maximum dimensions (wall thickness tolerance ± 0,3 mm)					
Wall thickness mm	1	2	3	4	5 ... 20
Diameter mm	20	30	40	100	250

Blocks





max length mm	max width mm	max wall thickness mm						
		Pore size **Nr. 1**	Pore size Nr. **2**	Pore size Nr. **3**	Pore size Nr. **4**	Pore size Nr. **5**	Pore size Nr. **6**	Pore size **Nr. 7**
150	150	15	30	60	60	60	60	60
300	250	15	30	60	80	100	100	100
500	300	15	30	60	80	100	100	100
600	400	15	30	60	80	100	100	100

Complex forms

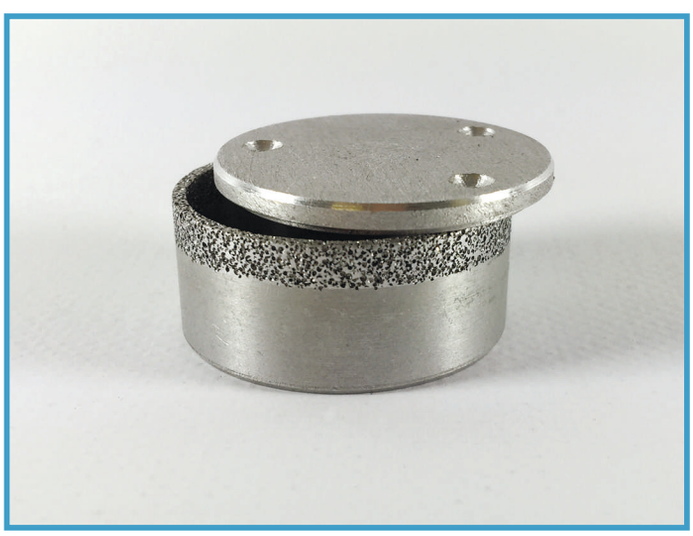
Porous aluminum can be processed on conventional machines into a variety of different and complex shapes.

The combination of porous aluminum and solid aluminum

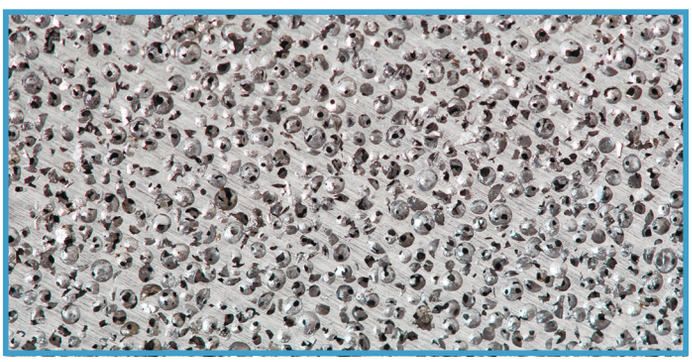
According to customer's specific requirements we manufacture products made of porous aluminum with parts made of solid aluminum. Both elements are casted in one piece and have a fixed monolithic connection.

Normally the solid aluminum part is used to implement the fixing element like thread or flange.

However, parts made of solid aluminum can be used not only like fixing elements, but also for other possible requirements according to your needs.



Advantages of porous aluminum



Thanks to the unique combination of material properties, porous aluminum is used in many industrial applications.

Advantages of porous aluminum:

– permeable over the entire volume, all pores are open
– every shape and size according to customer needs
– 7 standard types of pore sizes
– high strength thanks to cast structure
– low weight thanks to 55-65% volume porosity
– homogeneous distribution of the pores over the entire volume
– high thermal conductivity and heat capacity
– the manufacturing technology is innovative and relatively simple, it is fundamentally different from the manufacturing technologies of sintered metals and metal foams

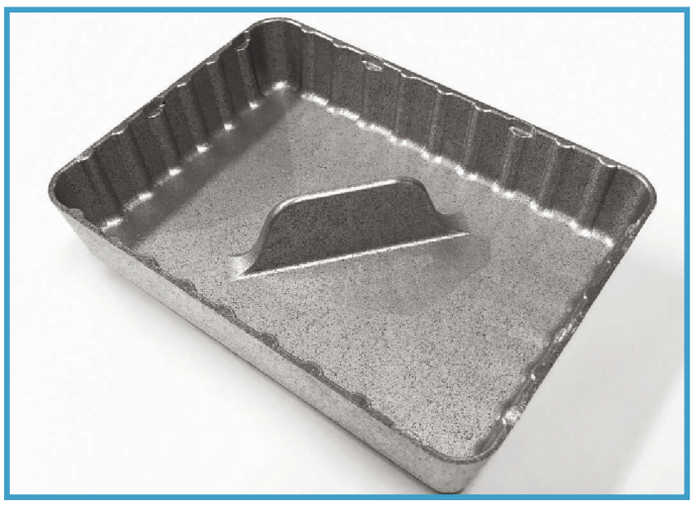
Main applications

	bulk material / powder	liquids	facilities	gas / steam
compressed air	pneumatic transport, aeration (fluidization)	aeration	filtration, silencing, acoustic insulation	
vacuum	bulk material compaction, volume reduction		vacuum tables	
thermal energy	heating, cooling or drying in a fluidized bed	heating, evaporation, cooling	thermoforming, heat exchangers	gas and steam condensation
steam	EPS / EPP foaming tools		filters and filter elements, silencing	
facilities		filtration	lightweight material	filtration, silencing, even gas distribution, cooling and protective housing for sensors

other applications	energy absorption and energy damping, vibration dampers and vibration protection	explosion protection	flame arrestors	weapon sound suppressors	design and decor

Applications

Vacuum and foaming moulds, thermoforming tools



Vacuum forming and thermoforming are processes for forming thermoplastics.

In these processes, special aluminum molds with vacuum holes or steam nozzles are often used. Porous metals are being increasingly used for these purposes.

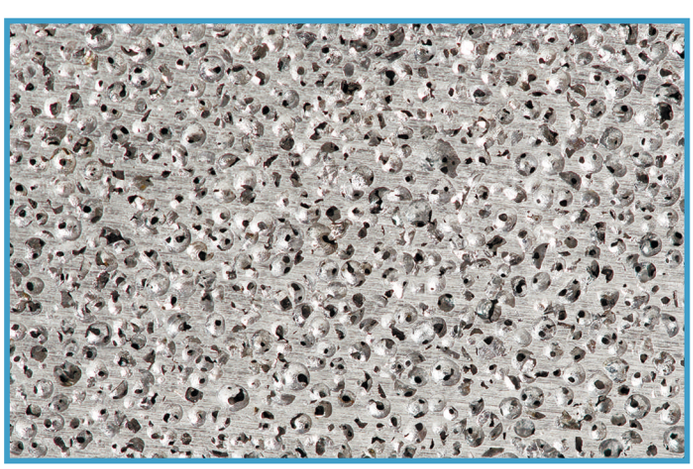
Porous aluminum is excellently suited for the production of foaming and thermoforming moulds:

– completely permeable, eliminates the need to drill vacuum holes or steam nozzles
– Aluminum is a very good heat-conducting metal and thus ensures the rapid cooling of the mould
– High strength thanks to cast structure, thus long life time of the porous aluminum molds

Compared to conventional forms of solid aluminum

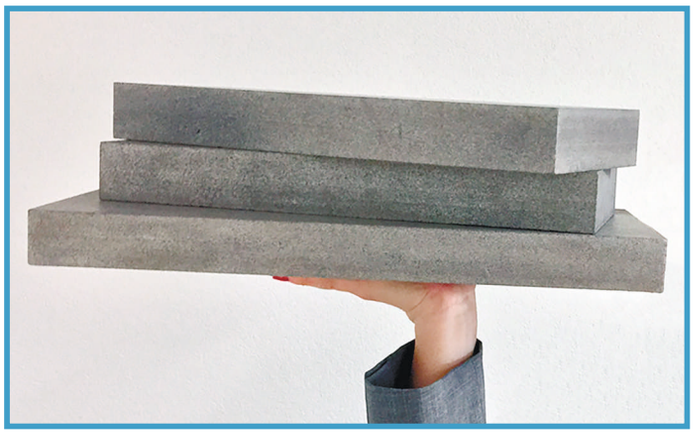
1) complex shapes without vacuum holes or steam nozzles

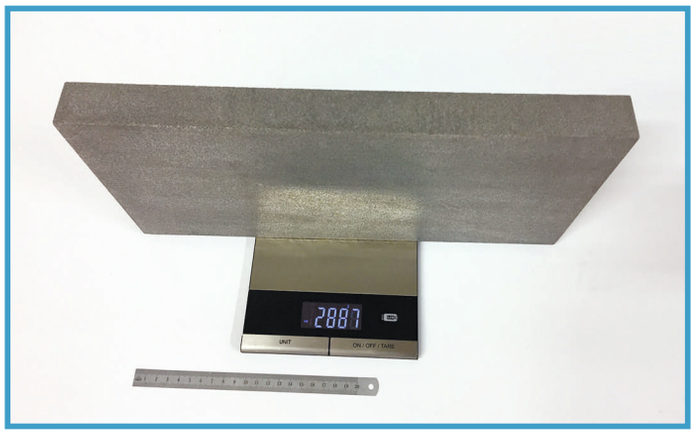
In the production of molds made of solid aluminum quite complex shapes are often not implementable. The reason for this is the inability to create channels for vacuum or steam in such difficult forms. It can also be very difficult to bring vacuum or steam to such channels. Thanks to the uniform distribution of pores in porous aluminum and its permeability in all directions, it is possible to produce the most complex shapes without restrictions.



2) even distribution of vacuum or steam

The surface of the porous aluminum consists to 55-65% of pores. This ensures an absolutely even supply of vacuum or steam at each point. Thus the homogeneity of the properties of the plastic product becomes very high compared to the use of relatively infrequently arranged channels for vacuum and steam.





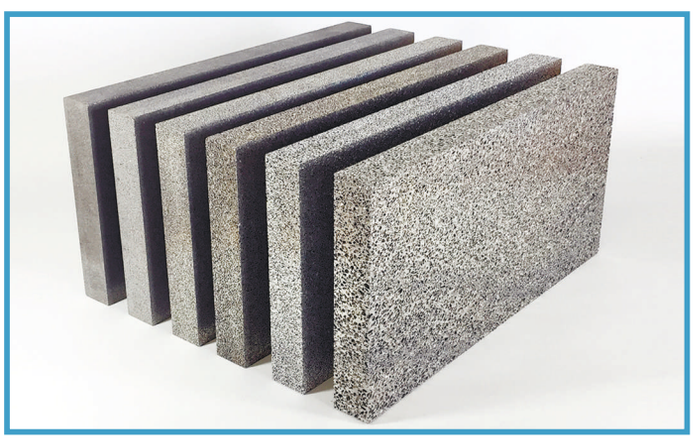
3) half of the weight (density 1,2-1,0 g/cm^3)

The low weight of porous aluminum allows the production of lightweight molds for foaming and thermoforming tools, fiber molds. The entire construction is greatly simplified and the weight is reduced also because there are no tubes/pipes for the supply of vacuum or steam necessary.

4) half of the heat capacity

5) rapid prototype production from prefabricated blocks

You can process porous aluminum under special machining conditions on lathe machines, milling benches and also with the help of other mechanical equipment. This allows you to quickly create complex molds for the production of prototypes or series production.



6) Working temperature up to 250...550 °C

Porous aluminum is a cast material, it contains no bonding agents such as glue or resin and can also be used at high temperatures.
Porous aluminum has a unique combination of material properties:
– all products are complete permeable
– can be made to large formats and in any shape
– high strength thanks to cast structure
– different and controllable pore sizes
– homogeneous distribution of the pores over the entire volume

Vacuum plates for vacuum tables and vacuum clamping systems

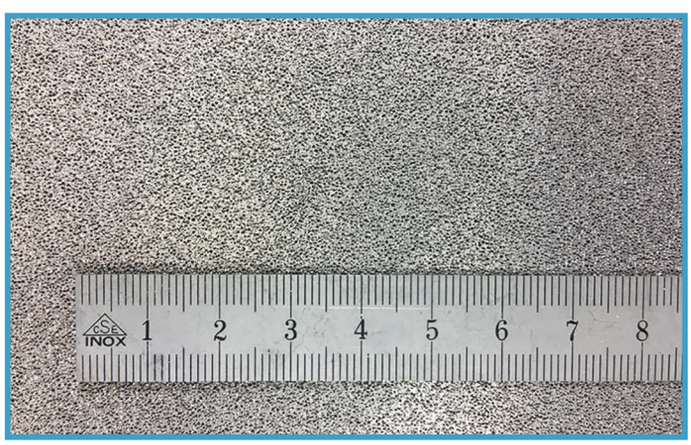
Vacuum tables

Vacuum tables are used for quick clamping and release of the workpieces. They are also used for the processing of thin and flexible materials that are otherwise difficult or impossible to fix.

Main types of vacuum tables:
– with perforated plates
– with grooves
– with porous plates

The vacuum table holds the workpieces due to the difference between atmospheric pressure and pressure in the vacuum chamber of the vacuum table. The clamping force on the vacuum clamping table depends on the sum of the areas of the holes in the vacuum plate below the surface of the workpiece and on the pressure difference that the vacuum pump can generate.

Vacuum plates made of porous aluminum



In porous aluminum plates for vacuum tables, the pores occupy 55-65% of the surface at each point of the vacuum plate.

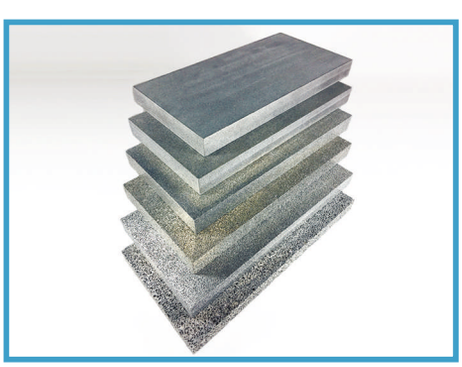
This is achieved because of the small pore size and even distribution of pores on the surface of porous aluminum.

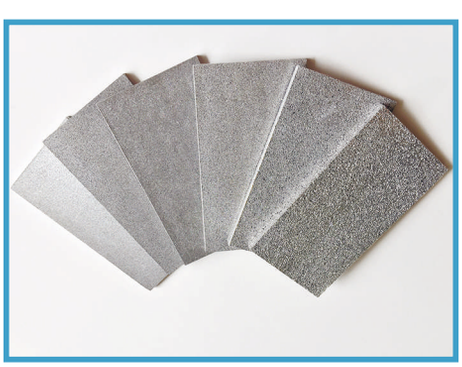
This provides maximum clamping force and allows you to place the workpiece anywhere on the vacuum table in any position.

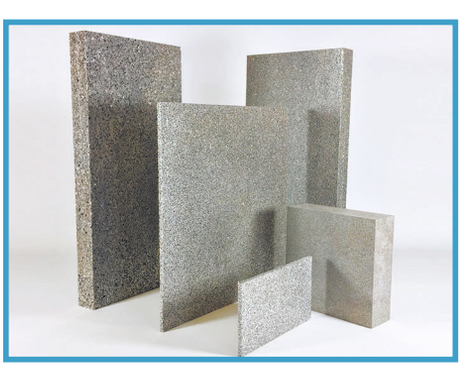
Thanks to the ability to vary the pore sizes and the thickness of the vacuum plate, you can set exactly the necessary time for adjusting the clamping force.

By adjusting the thickness of the vacuum plate, it is also possible to select the permeability that is suitable even for a low-power, low-capacity vacuum pump.

Vacuum tables with vacuum plates made of porous aluminum are suitable for processing of metal, wood, plastics, paper, film and much more.







Pneumatic silencers

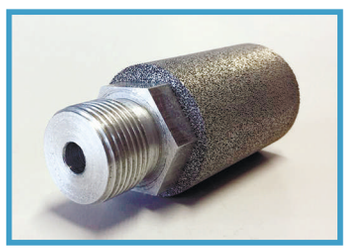
Porous aluminum silencers can be used in pneumatic cylinders, valves, air motors, compressors, pneumatic devices and other pneumatic equipment. Silencers not only reduce the noise level of the exhaust air, but also protect the pneumatic system from dust and dirt that could enter through the valve.

A good silencer should not only provide the desired noise level, but also prevent the speed and performance of the device from being reduced.

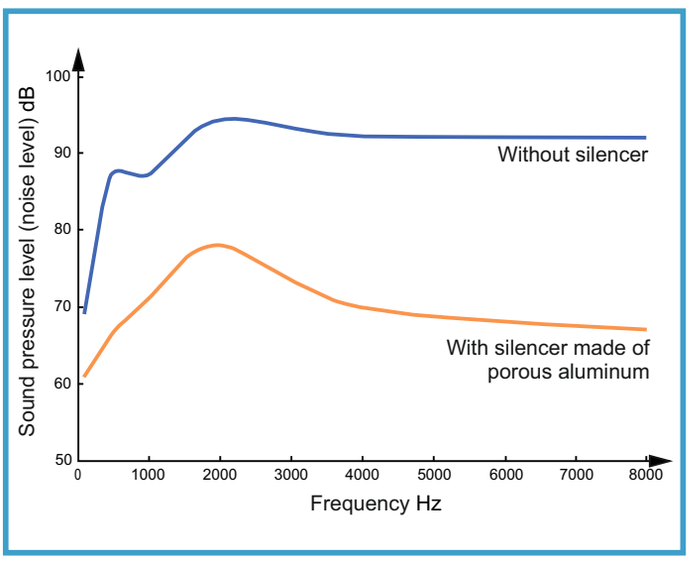
Porous aluminum silencers meet both conditions. Due to the wide flexibility of the technology, porous aluminum offers the best solution for your noise reduction problems.

Dimensions and shape of pneumatic silencers

The advantage of porous aluminum is the possibility to produce silencers in almost any shape and size according to your individual requirements. It is also possible to cast the silencer of porous aluminum and the thread of solid aluminum in one piece, this simplifies the whole construction and increases the durability.



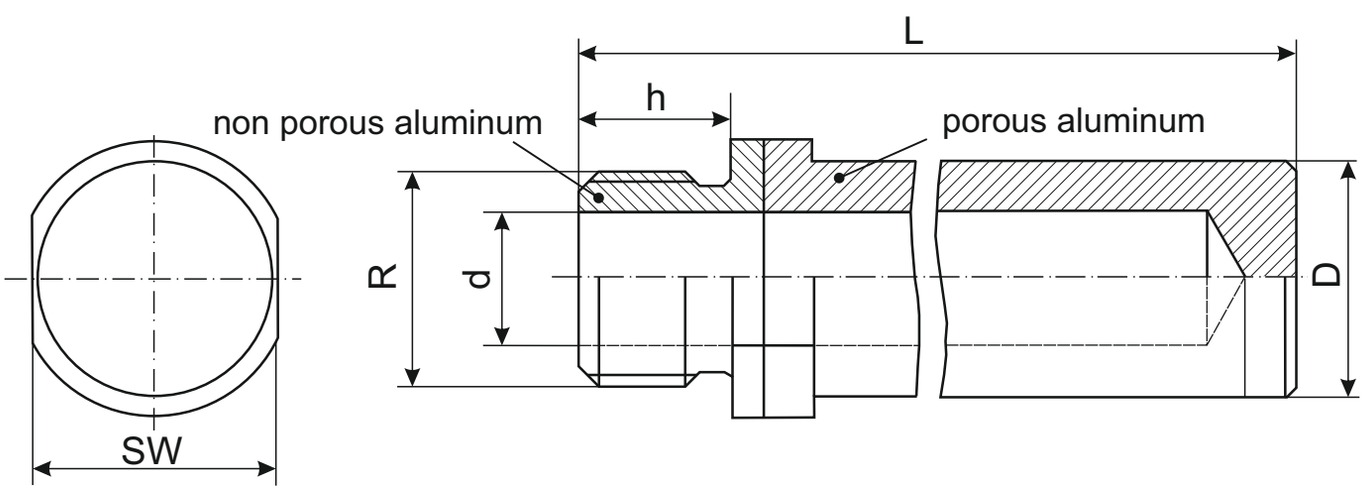
Acoustic properties of silencers



Standard pneumatic silencers made of porous aluminum provide a noise reduction of up to 75-85 dB and are installed on the vent valve of compressed air systems. The sound is damped due to a reduction in airflow velocity, this happens because:

– the air outlet area is increased (the surface of a silencer is bigger than that of a vent valve)
– the discharge time is increased (due to the optimally selected hydraulic resistance of the pneumatic silencer)

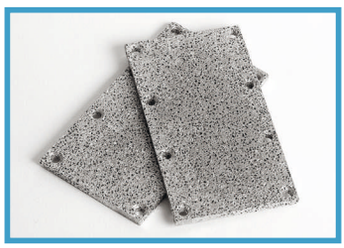
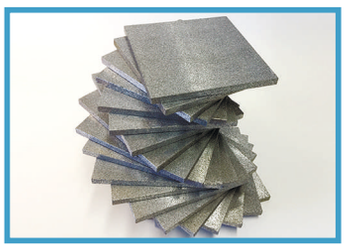
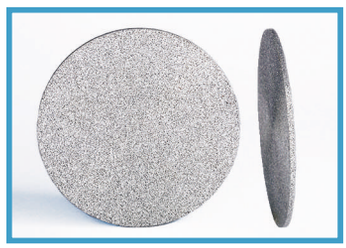
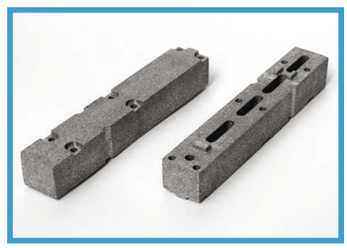
Construction and parameters of pneumatic silencer with thread



silencer type	R	D mm	d mm	L mm	h mm	SW mm	Max ΔP bar	Sound dB	Mass g	kv l/min
PST 18-M	G⅛	10	4	25	4,5	10	10	≤ 85	3	15
PST 18-L	G⅛	10	4	40	4,5	10	10	≤ 82	5	24
PST 14-M	G¼	14	8	30	6	14	10	≤ 85	6	28
PST 14-L	G¼	14	8	55	6	14	10	≤ 82	10	51
PST 38-M	G⅜	17	11	50	8	17	10	≤ 85	12	59
PST 38-L	G⅜	17	11	80	8	17	10	≤ 82	18	95
PST 12-M	G½	21	13	60	9	21	10	≤ 85	23	65
PST 12-L	G½	21	13	100	9	21	10	≤ 82	35	108
PST 34-M	G¾	27	19	65	10	27	10	≤ 85	33	95
PST 34-L	G¾	27	19	125	10	27	10	≤ 82	59	182
PST 1-M	G1	34	26	70	12	36	10	≤ 85	47	133
PST 1-L	G1	34	26	150	12	36	10	≤ 82	92	285

Construction and parameters of flat silencers

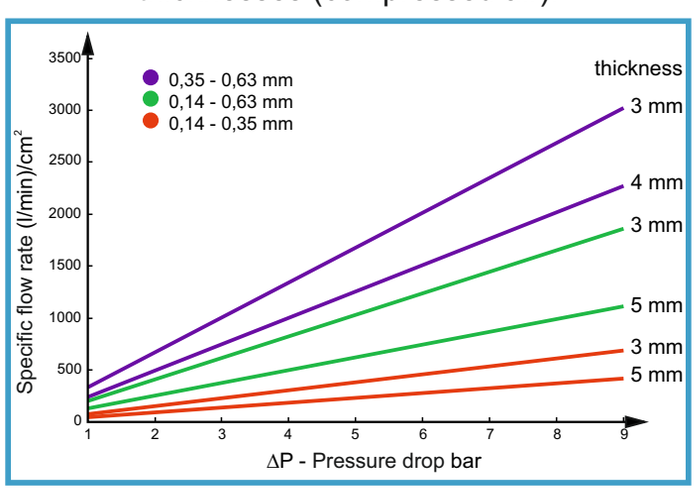
Porous aluminum allows the production of silencers in the form of plates with rectangular, square and complex shapes:

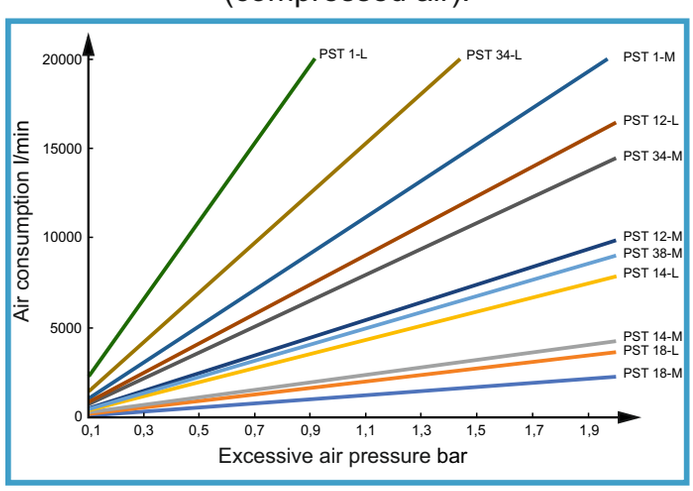
Flow rate of silencers

All pores of porous aluminum are open, the material is permeable over the entire volume. The production process of porous aluminum makes it possible to regulate the flow rate of silencers in a wide range. This results in a low back pressure (pneumatic resistance) of the silencer and a minimal impact on the operation of the pneumatic system.

The calculated specific flow rate of porous aluminum for different pore sizes and material thicknesses (compressed air):

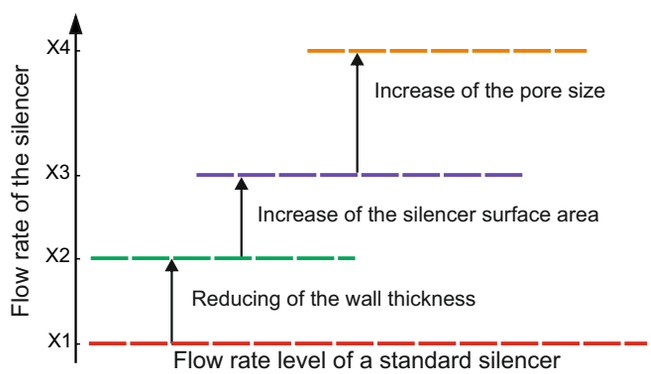


The calculated specific flow rate of pneumatic silencers with thread (compressed air):



Ways to increase the flow rate

If required, we can increase the flow rate of silencers in one of the following ways:

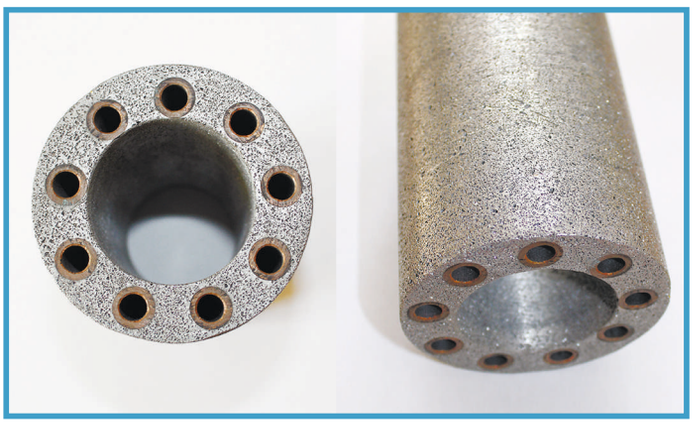


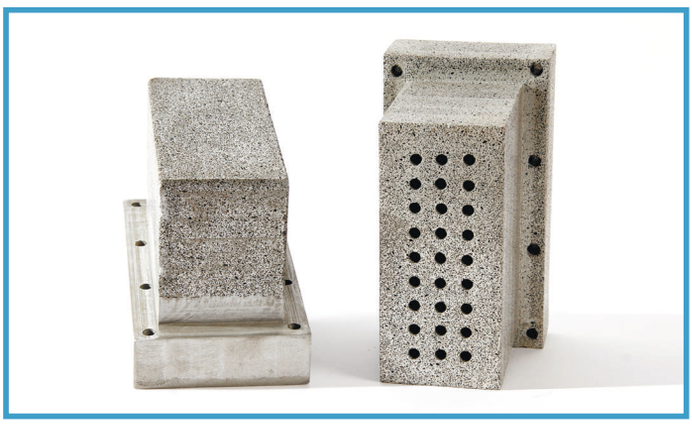
Limitations:

– Reduction of wall thickness leads to a slight increase of noise level and is limited by the requirements of the durability of the silencer
– Increase of the pore size can lead to increased noise levels.

All of these methods can be used either in combination or separately.

Heat exchangers





Heat exchanger made of porous aluminum

Porous aluminum is ideal for use as a heat exchanger.

For heat transfer, aluminum is predominantly used because of its good thermal conductivity. The heat exchange capacity of porous aluminum is higher than that of conventionally processed aluminum, since porous aluminum has a very large internal surface in relation to the volume.

However, large internal surfaces also have other porous materials, e.g. sintered metals. But it is not yet possible to produce aluminum products with high volume porosity and sufficient strength according to the sintering technology. Another advantage of porous aluminum is the cast structure, which also support the thermal conductivity. In the case of sintered metals, thermal resistance is created at the contact points of the pressed metal particles.

In the Technical University Bergakademie Freiberg, the thermal conductivity of the porous aluminum has been tested: depending on the pore size, the thermal conductivity of the material is in the range 30 - 50 W/(m*K). Porous aluminum products can therefore be used very well for heat transfer.

Due to the high volume porosity respectively the large inner surface, they are also suitable as heat exchangers in convective heat transfer. Water or other liquids, air or gas flow through the porous aluminum, which optimally absorbs the temperature through the large inner surface. This temperature can be submitted to a solid body or in a similar manner to a fluid.

Also for cooling porous aluminum is perfectly suitable. The object to be cooled is fastened directly to the porous aluminum and the heat is optimally dissipated to the outside air through the large internal surface, if necessary with ventilation.

Due to its high heat capacity and thermal conductivity, aluminum is often used in various thermal processes. Porous aluminum offers additional benefits to create efficient heat exchangers. Especially in the industries where the low weight of the material is important:

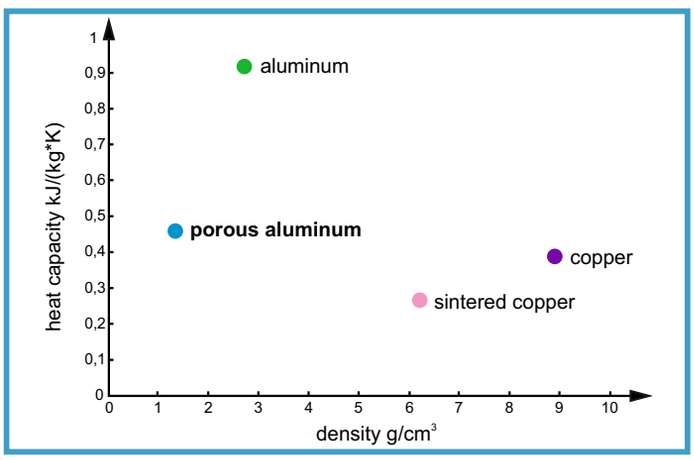
– Automotive industry, including electric vehicles
– Aircraft Industry
– Aerospace industry

Heat capacity and thermal conductivity

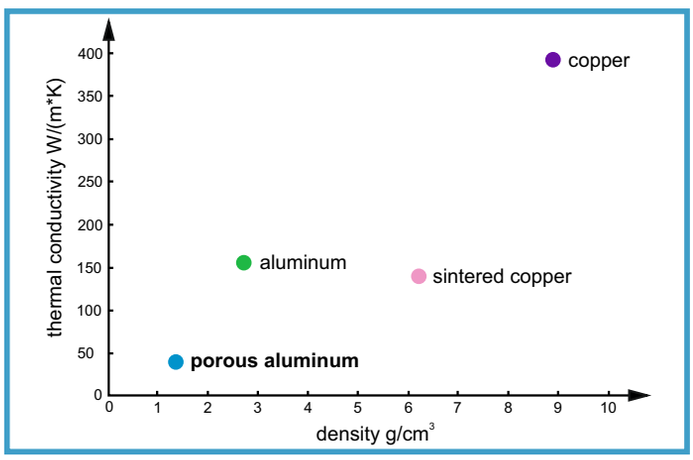
Heat absorption due to the high heat capacity of aluminum: the larger the aluminum mass, the more heat it can absorb by heating.

Heat dissipation thanks to high thermal conductivity: the greater the temperature gradient and the greater the cross section of the product, the more intense the heat flow through the porous aluminum.

Heat transfer due to the high specific surface of the material: the larger the specific surface, the more intense the heat transfer of the liquid or gaseous medium flowing through porous aluminum.



heat capacity: (porous) aluminum and (sintered) copper



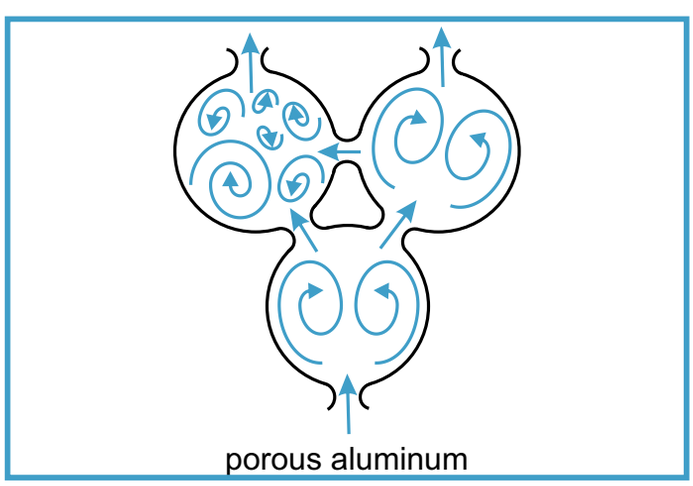
thermal conductivity: (porous) aluminum and (sintered) copper

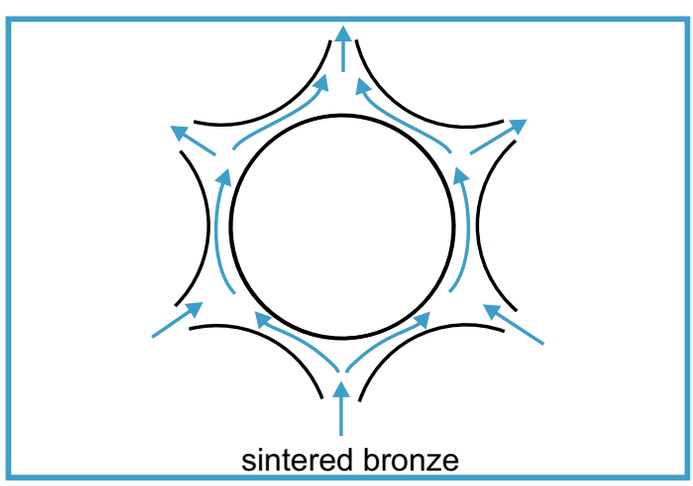
Advantages of the pore structure

1. Large contact surface between gas and porous aluminum matrix.

	Nr. 1	Nr. 2	Nr. 3	Nr. 4	Nr. 5	Nr. 6	Nr. 7
pore size mm	0,2 - 0,35	0,3 - 0,5	0,4 - 0,63	0,4 - 1,0	0,63 - 1,6	0,63 - 3,0	0,63 - 4,0
surface m^2/m^3	ca. 20'000	ca. 10'000	ca. 6'500	ca. 4'000	ca. 3'000	ca. 2'500	ca. 2'200

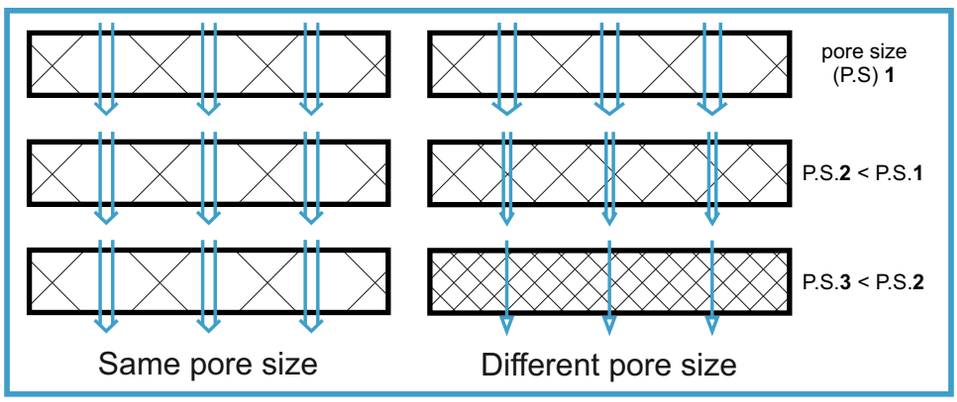
2. Long contact time of the gas and the matrix of porous aluminum.
Gas flows follow complex paths with turbulence.





The great advantage of porous aluminum for the production of efficient heat exchangers is its permeability to liquids and gases. When liquid or gas flows through a block of porous aluminum, it receives or releases heat energy due to a large contact area with the aluminum surface.

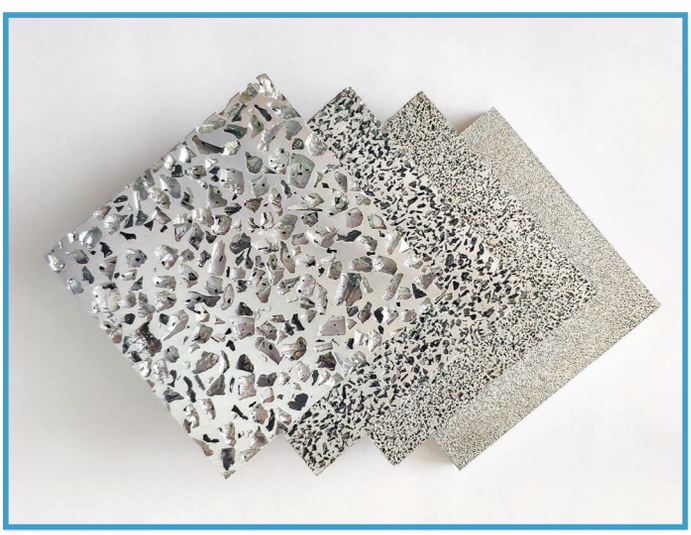
With a wide range of available pore sizes, it is possible to control very precisely heat absorption and heat transfer processes in porous aluminum, including by organizing a multi-step process:

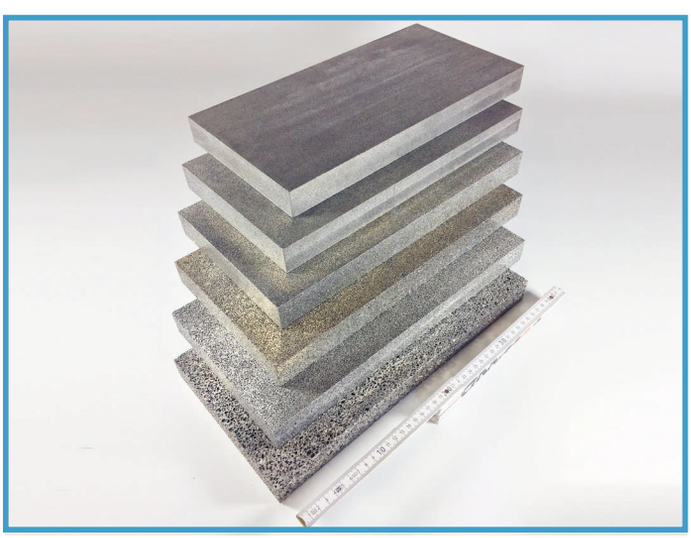


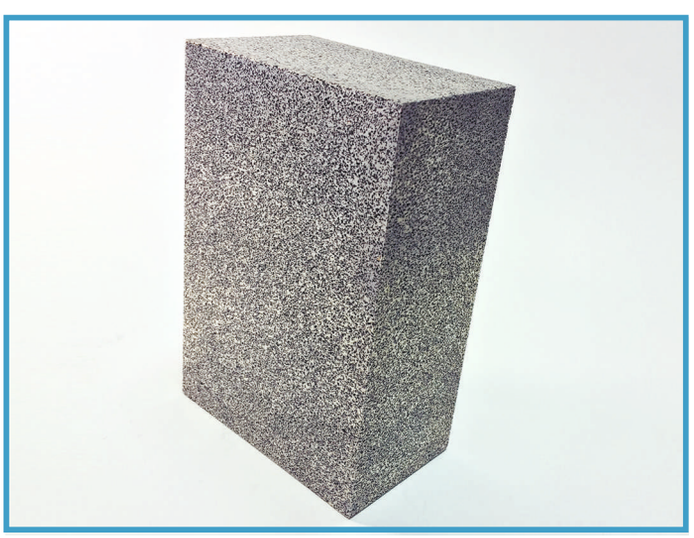
Porous aluminum is an effective material for solving such tasks as:

– Cooling, heating, evaporation of liquids

– Heating, cooling and condensation of gases and steam







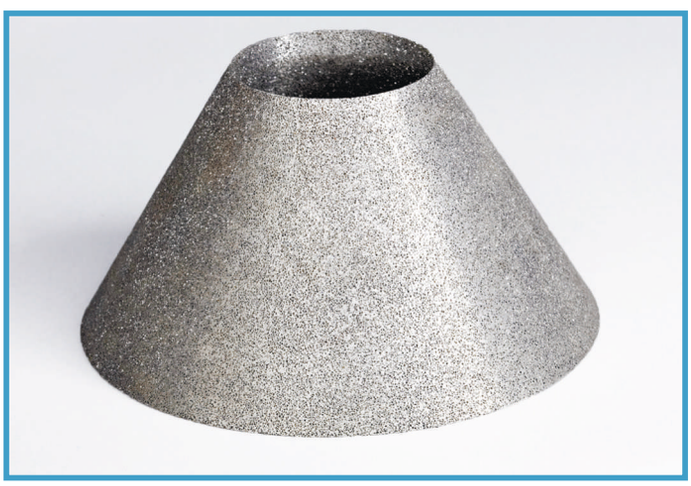
Suppressors

A strong and sharp tone of the shot is caused by the rapid expansion of the hot gases that are formed when the gunpowder is burned. The reduction of the speed and the temperature of these gases leads to a reduction of the shot noise.

Conventional suppressors use special chambers in which gases reduce their speed and temperature. Afterwards, the gases leave the suppressor without occurrence of strong noises.

Porous aluminum is an optimal material for suppressors. This material consists of 60 ± 5% of the pores that are interconnected. Porous aluminum is permeable to gases in all directions. The special shape and structure of the pores give a long contact time of the gas and the matrix of porous aluminum.

Gas flows follow complex paths with turbulence. The combination of different pore sizes makes it possible to control the gas movement very precisely. In addition, porous aluminum products can be made in any shape, no matter how complex.



Porous aluminum has a high internal surface. The turbulence of the gas flow and reduction of the gas flow velocity happens as the gases flow through the porous structure.

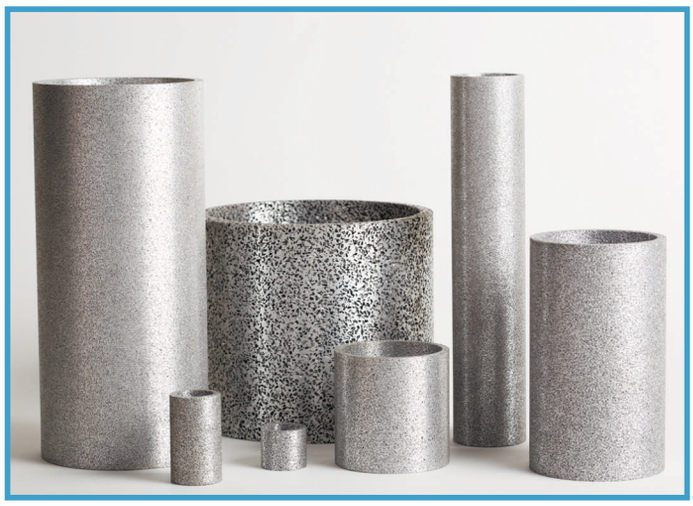
Aluminum is a very good heat-conducting metal and thus the rapid cooling of the gases is ensured.

Thanks to the volume porosity of 55-65%, porous aluminum has a low weight, but at the same time a high strength thanks to the cast structure.

An additional advantage of porous aluminum for supressors is that it is possible to cast porous and non-porous parts together in one piece.

Porous aluminum for suppressors - the perfect combination of insulating performance, weight and durability.

Filters and filter elements



Sinter filters have been known for a long time and are often used. A wider use of sintered filters is prevented by some significant limitations of sintering technology. Porous aluminum filters are an option to sinter filters.

This filter and filter elements are produced in almost unlimited shapes and in almost all dimensions.

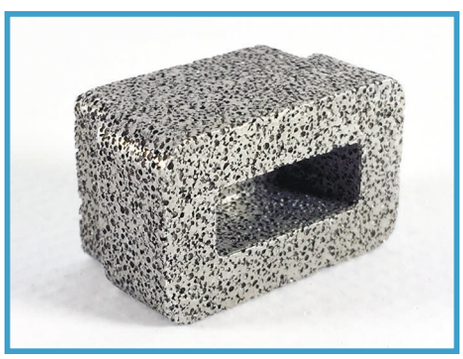
Porous aluminum is produced by casting with salt. This technology provides a unique structure of the porous metal.

The structure of porous aluminum and the structure of known sintered metals are complementary. The pores in the sintered metal correspond to the metal in the porous aluminum and vice versa. Theoretically, the minimum porosity of the sintered metals is 26% and the maximum porosity of the porous aluminum is 74%. In reality, porous aluminum has 60 ± 5% pores due to imperfect stacking of salt particles. Thanks to its high porosity and special pore structure, the porous aluminum filter has a significantly longer durability than the sinter filter.

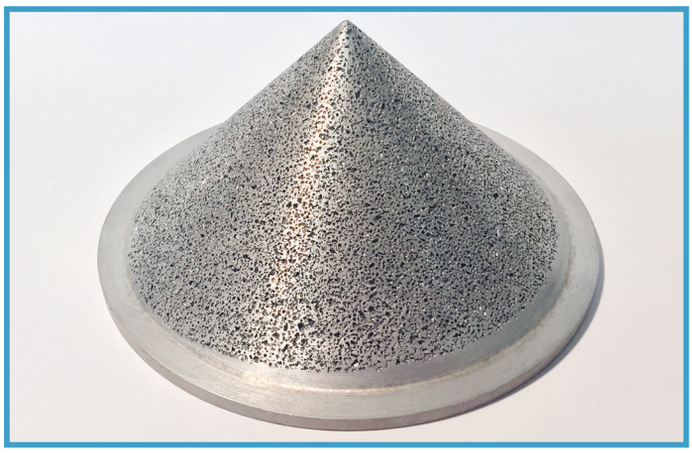
The highly porous material porous aluminum has already found wide range of applications in filtration. Here are just a few examples:
– gas filters
– oil filters
– air filters
– filters for liquids
– filters for hot gases

According to your needs, products with filter degree from 40 µm to 700 µm are produced. This filter and filter elements are produced in almost unlimited shapes and almost all dimensions. Filter cartridges, candle filters, filter plates, filter discs, flat filter elements and flat membranes are known and typical applications, as well as tailor-made types are also often used.

The fastening element is usually solved with a thread or a flange.
The filters are easily cleaned by backwash, which extends the durability of the filter.



Fluidisation



In order to mix, convey, dry or cool etc. powdered materials, they will be brought into a liquid-like state by fluidization - when passed through by air.

Powdered fines can be in the fluidized state (also called fluidized bed) if particles are in a floating state under the influence of rising gas streams (usually compressed air). Gravity and pressure of air jets act on the particles.

To ensure that the particles do not fall down, certain air velocities are required, which depend on the size and mass of the fine particles.

To create a fluidized bed, perforated or porous materials are used. Such materials cause many small air flows over the entire surface on which the powder material lies.

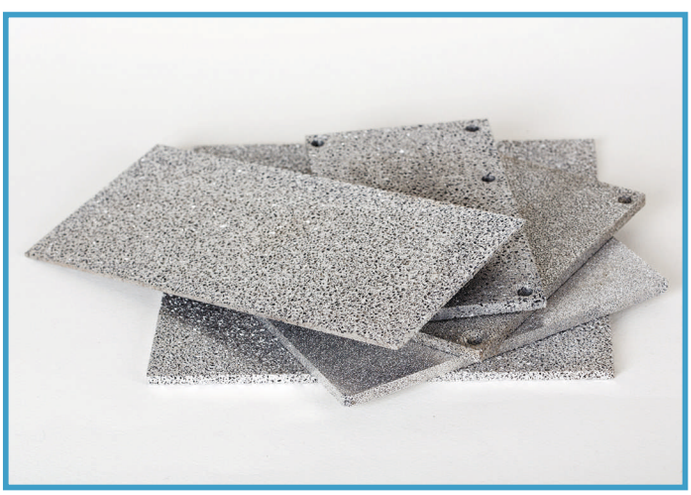
Products made of porous aluminum are very well suited as a fluidized bed for use in fluidized bed systems.

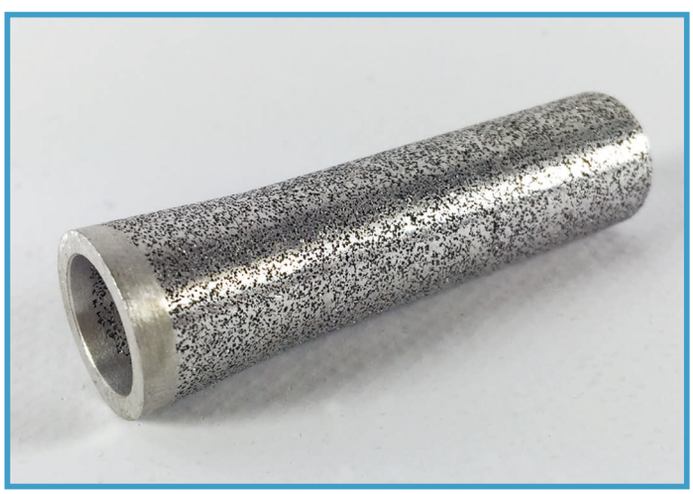
Advantages of porous aluminum for fluidization:
– high volume porosity (60 ± 5%)
– even distribution of the pores over the entire surface
– adjustable pore size
– possibility to produce surfaces of complex shape

Porous aluminum is a permeable material with a homogeneous pore distribution. The smooth surface allows an uniform distribution of the air volume and thus the absolutely uniform leaching of the bulk material.

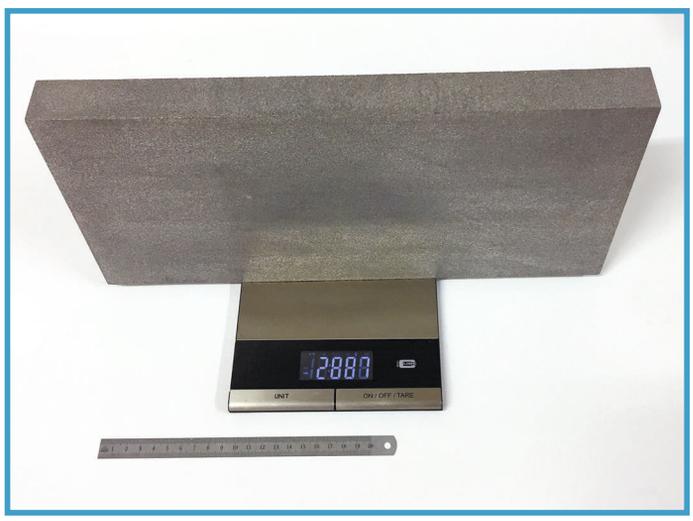
Thanks to the cast structure, our products have high strength and are resistant to permanent load, pressure peaks, shock, cyclic and vibration loads.

Easy cleaning by backwashing, ultrasonic or mechanical and chemical cleaning.





Lightweight material



Semi-finished aluminum foams such as sandwiches are ideal for lightweight constructions. Porous aluminum is lightweight material with volume porosity 60 ± 5% and density 1,1 ± 0,1 g/cm^3.

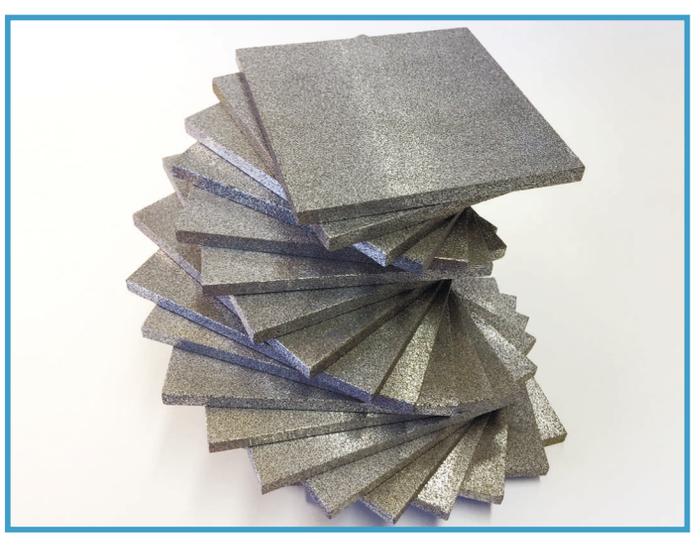
Due to the cellular structure, porous aluminum is very light, has good vibration damping, high energy absorption capacity and is very rigid. The properties of porous aluminum depend very much on the size of the pores. We use 7 different salt fractions to obtain porous material with very different properties.

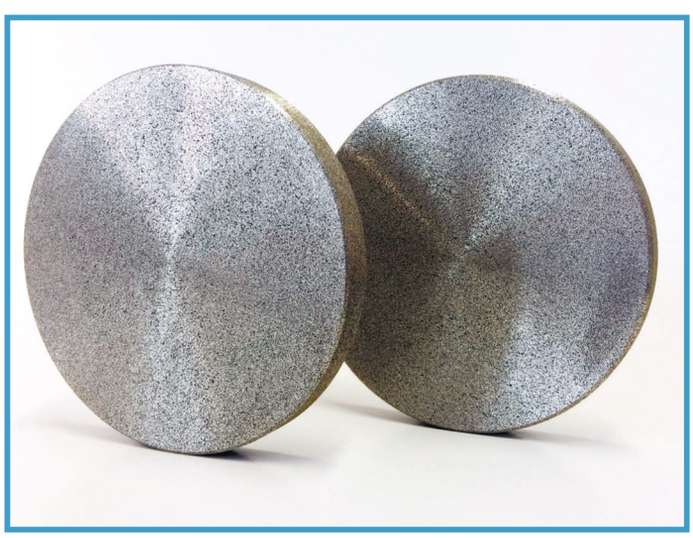
This allows us to produce the optimal product for every individual task.

Energy and resource efficient construction have played an important role in recent years. This trend will intensify in the future. Porous aluminum as a lightweight construction material is more expensive than conventional materials such as concrete and structural steel, but the savings result from an overall cost analysis over the lifetime of a building.

Porous blocks, plates, sheets, discs and products in other forms of porous aluminum are made by machining.

Finished panels made of porous aluminum can optionally be machined as conventional aluminum, taking into account the adapted machining conditions.





Contact

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