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IFAM

FRAUNHOFER INSTITUTE FOR MANUFACTURING TECHNOLOGY AND ADVANCED MATERIALS IFAM

1 *FOAMINAL® segments in a light-weight gear wheel (co-operation with WZL Aachen).*

METAL FOAMS FOAMINAL®

The Process

At Fraunhofer IFAM the powder metallurgical process for production of foamed metals has been developed and patented. In this process, commercially available metal powders are mixed with small quantities of a foaming agent (metal hydride). This mixture is compacted by applying techniques such as hot extrusion, co-extrusion or hot pressing. The result of the compaction process is a dense, foamable precursor material that can be worked into sheets, pro-files etc. by means of conventional metal forming techniques. The foamable precursor expands and develops its highly porous, closed-cell inner structure as well as the surrounding closed surface skin in a final heat treatment at temperatures around the melting point of the corresponding alloy. Starting from aluminum alloys the Fraunhofer IFAM process has been further developed for expansion of other metals (e. g. zinc, lead, bronze, titanium, steel, etc.).

Properties

For aluminum foams, densities in the range of 0.5 to 1 g/cm3 (up to 85 percent porosity) can be achieved – in individual cases, lower density values are possible. Due to their closed-cell structure, these metal foams float in water. A wide range of property values for aluminum foams can be found in Fraunhofer IFAM "Properties Overview and Design Guidelines" available at www.ifam.fraunhofer.de/foaminal.

In general, the properties of metal foams can be summarized as follows:

- high specific stiffness
- efficient energy absorption
- increased mechanical damping

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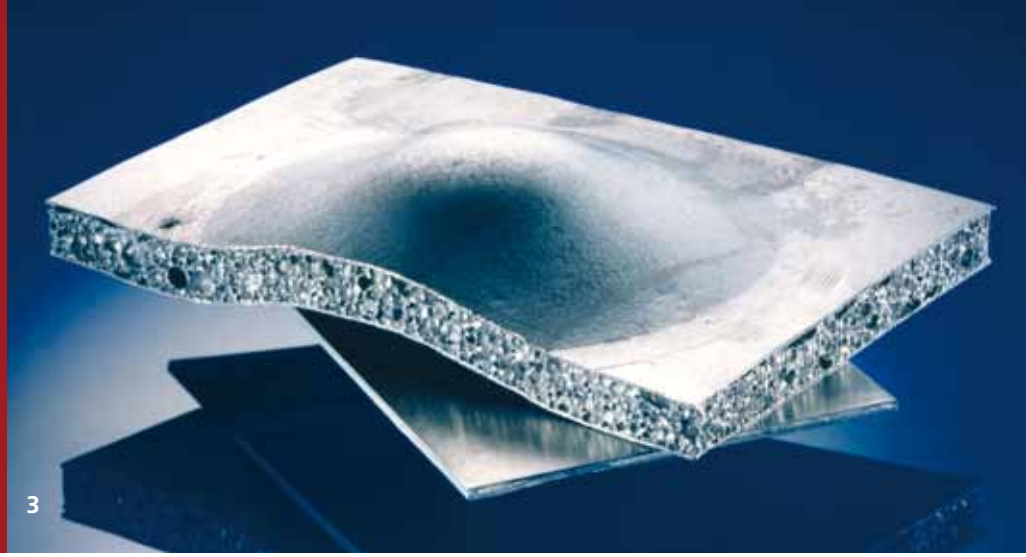
2



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- good sound insulation properties
- reduced thermal conductivity
- reduced electrical conductivity
- wide range of service temperatures
- not flammable
- good machinability (sawing, drilling, turning, milling etc.)
- joining by screwing, adhesive bonding, special welding and soldering techniques
- good recycling ability

The properties of metal foams can be tailored by adjusting the following parameters:

- density (porosity)
- alloy composition
- heat treatment condition of material
- pore morphology

Through variation of these parameters optimised foams for each specific application can be produced.

Areas of Application

- energy absorption
- lightweight construction
- vibration attenuation
- thermal barrier insulation
- flame arresters
- architecture and aesthetic

FOAMINAL® part production

With Fraunhofer IFAM process aluminum foam parts with complex 3D geometries can be produced near net-shape (trademark: FOAMINAL®). This is achieved by placing a piece of pre-cursor material of suitable shape and size inside a hollow mould. When both the mould and the precursor material are heated to foaming temperature, the expanding foam fills the mould and, thus, reproduces the inner shape. After cooling the near net-shape aluminum foam part can be removed from the mould.

Aluminum Foam Sandwich (AFS)

FOAMINAL® can also be employed as core layer between conventional metal face sheets in Aluminum Foam Sandwich (AFS). The foamable precursor material is roll-cladded with face sheets of other metals. The resulting precursor compound can be formed like conventional aluminum panels with standard forming equipment. During a final heat treatment the foamable layer is expanded to form flat or 3D shaped Aluminum Foam Sandwich (AFS) panel.

Our Offer

- Feasibility studies and part development (FOAMINAL®, AFS)
- Supply of foamed parts and sandwich panels
- Training courses, workshops and technology demonstrations
- Licensing and technology transfer of the patented metal foaming technology

2 *FOAMINAL® filled lightweight brake piston (co-operation with TRW automotive).*

3 *AFS Sandwich structure with FOAMINAL® core layer and steel face sheets, precursor composite below.*